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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. Each section starts with a list of operations in alphabetical order.

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 CO₂ 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.

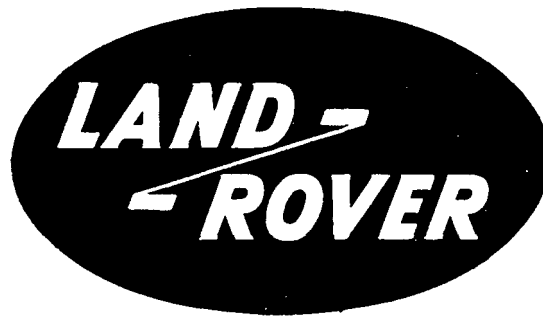
The Manufacturers reserve the right to vary their specifications with or without notice, and at such times and in such manner as they think fit. Major as well as minor changes may be involved in accordance with the Manufacturer's policy of constant product improvement.

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.

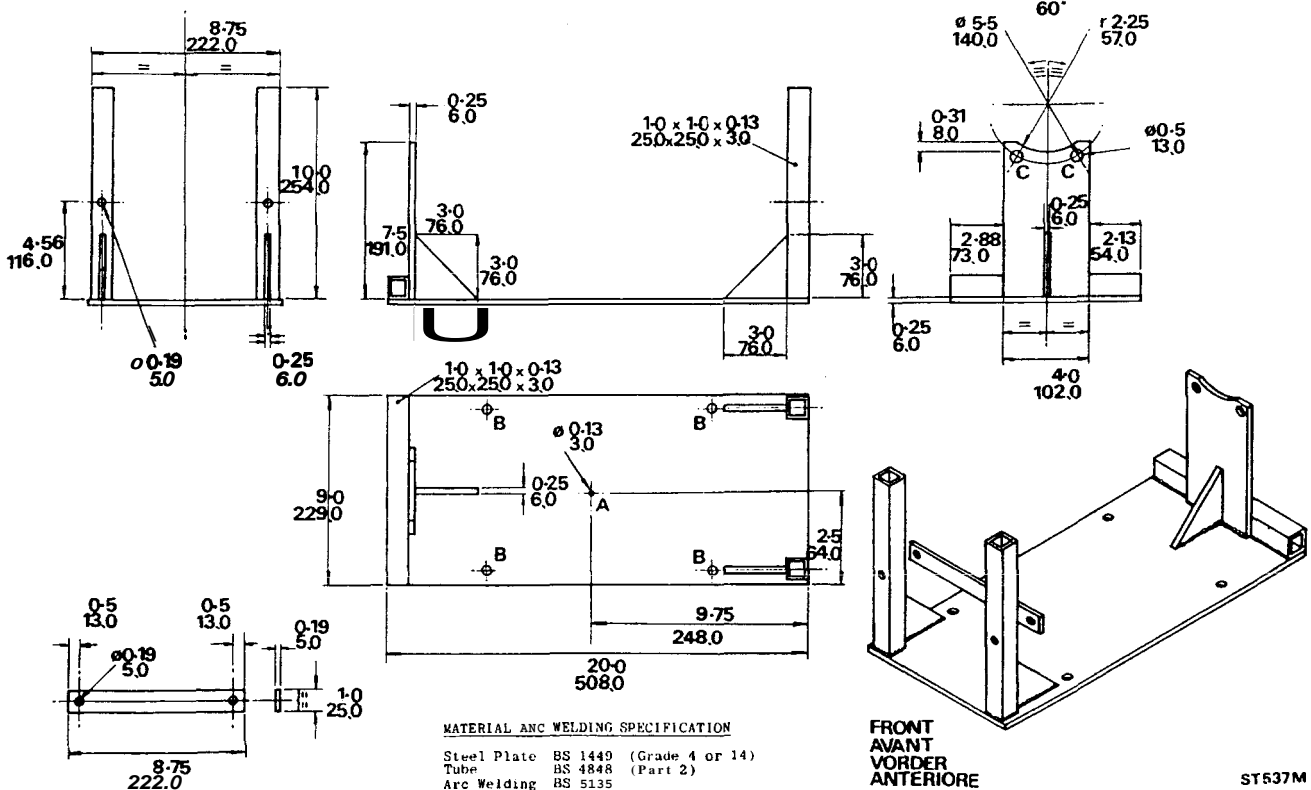
Special tools bulletins will be issued periodically giving details of new tools as they are introduced.

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, PO Box 3, Daventry, Northants, 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 Publication Service, P.O. Box 534, Erdington, Birmingham, B24 0Q5.

REMOVE LT77 FIVE SPEED GEARBOX AND 230R TRANSFER BOX — FOUR CYLINDER MODELS

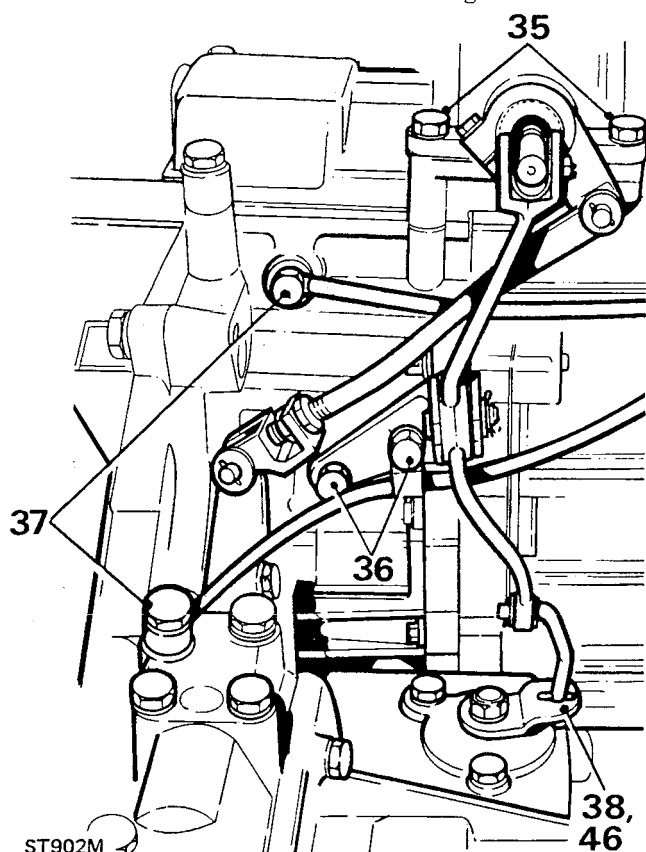
1. Install the vehicle on a ramp.
2. Disconnect the battery.
3. Remove the gear lever knob.
4. Remove the transfer and differential lock knob.
5. Remove the gear lever cover.
6. Remove the 10mm Nyloc nut and plain washer. Mark the gear lever spline setting and detach the gear lever and gaiter from the splined lower gear lever.
7. Select high range to prevent the transfer gearbox selector lever fouling the tunnel when removing the gearbox.
8. Remove the bonnet.
9. Remove the nuts and bolts retaining the fan cowl to the engine and move the cowling forward, clear of the engine.
10. Release the transmission breather pipes, speedometer cable, and starter motor harness from clips at rear of the engine.
11. Release clamp holding heater pipes on top of engine to prevent heater inlet pipe fouling bulkhead.
12. Raise the ramp.
13. Remove the eight nuts and bolts securing the chassis cross member and using a suitable means of spreading the chassis, remove the cross member.
14. Place a suitable container under the transmission, remove the three drain plugs, allow the oil to drain and refit the plugs. Clean filter on the extension housing plug before refitting.
15. Remove the intermediate exhaust pipe and silencer section as follows:
 - (a) Release the connection to the front pipe at the flange.
 - (b) Release the connection to the rear section at the flange immediately behind the silencer.
 - (c) Remove the 'U' bolt retaining the pipe to the bracket attached to the transfer box.
16. Mark the flanges for reassembly and disconnect the front propeller shaft from the transfer box.
17. Similarly, disconnect the rear propeller shaft.
18. Disconnect the speedometer cable from the rear of the transfer box.
19. Disconnect the handbrake inner cable by removing the split pin and clevis pin.
20. Slacken the retaining nuts and release the handbrake outer cable from the bracket.
21. Remove the two bolts and withdraw the clutch slave cylinder from the bell housing.
22. Manufacture a cradle to the dimensions given in the drawing and attach it to a transmission hoist. To achieve balance of the transmission unit when mounted on the transmission hoist, it is essential that point **A** is situated over the centre of the lifting hoist ram. Drill fixing holes **B** to suit hoist table. Secure the transmission unit to the lifting bracket at point **C**, by means of the lower bolts retaining the transfer gearbox rear cover.
23. Remove the bottom two bolts from the transfer box rear cover and use them to attach the rear end of the cradle to the transfer box. Ensure that the tube in the centre of the cradle locates over the extension housing drain plug.
24. Raise the hoist just enough to take the weight of the transmission.



25. Remove the three nuts and bolts securing the transfer box L.H. and R.H. mounting brackets to the chassis.
26. Remove the nuts retaining the brackets to the mounting rubbers and remove the brackets.
27. Lower the hoist sufficiently to allow the transfer lever to clear the transmission tunnel aperture.
28. Disconnect the four-wheel drive indicator electrical lead (bullet connection).
29. Remove the cleat retaining the reverse light switch wires from the R.H. side of the gearbox.
30. Disconnect the wire from the reverse light switch situated at the top rear of the selector housing and move the harness away from the transmission.
31. Support the engine under the sump with a jack, placing timber between the jack pad and sump.
32. Remove the eleven hell housing nuts.
33. Withdraw the transmission whilst ensuring all connections to the engine and chassis are released.

Separating the transfer box from gearbox

34. Remove the transmission assembly from the hoist and cradle and install it safely on a bench.
35. Remove the four bolts securing the transfer gear change housing to the remote gear change housing.
36. Remove the two bolts retaining the cross shaft lever pivot bracket to the extension housing.
37. Remove the breather pipes.
38. Disconnect the cranked lever from the differential lock lever. (A short link was used on early production).
39. Place a sling round the transfer box and attach to a hoist.
40. Remove the two nuts and four bolts retaining the transfer box to the extension housing.



41. Withdraw the transfer box. For LT230 transfer gear box dismantling refer to page 19. Dismantling information on LT77 gearbox, refer to page 3.

Assembling transfer box to main gearbox

42. Hoist the transfer box into position and ensuring that the loose upper dowel is fitted, assemble to main gearbox extension housing and secure with the four bolts and two nuts.
43. Fit the transfer selector housing to the main gearbox remote gear change housing with the four bolts. (The right hand rear bolt is longer).
44. Fit the breather pipes.
45. Fit the differential lock cross shaft lever pivot bracket to the extension housing with the two bolts.
46. Connect the cranked lever to the differential lock lever with a new split pin. (On early production connect the short link with a new 'Nyloc' nut).

Fitting main gearbox and transfer box to engine

47. Fit the cradle to the transmission hoist and the transmission to the cradle as described in instruction 23. Smear Hylomar on bell housing face mating with engine.
48. Locate the gear lever temporarily and select any gear in the main gearbox to facilitate entry of the primary shaft.
49. Position and raise hoist and fit the transmission to the engine whilst keeping wires and pipes clear to prevent trapping.
50. Secure the transmission to the engine with the eleven nuts, noting that the top R.H. nut holds a clip for the speedometer cable.
51. Position the reverse light wires to the R.I. side of the main gearbox and secure with a cleat to the breather pipes.
52. Connect the reverse light wire to the switch at the top rear of the selector housing.
53. Connect the differential lock indicator wires (bullet connection).
54. Raise the transmission to line-up with the engine and ensure that the transfer lever clears the tunnel aperture.
55. Fit the transfer box L.H. and R.H. mounting brackets but only partially tighten the securing nuts and bolts.
56. Loosely fit the rubber mounting nuts and lower the transmission onto the mountings. Fully tighten all the securing nuts and bolts.
57. Remove the supporting jack from under the engine sump.
58. Remove the two bolts securing the cradle to the transfer box and remove the cradle and hoist.
59. Refit the two bolts using Loctite 290 on the threads and note that the L.H. bolt holds a clip for the speedometer cable.
60. Fit the slave cylinder using Hylasil on the gasket and tighten the two bolts evenly to 22 to 28 Nm (16 to 21 lb ft).

61. Fit the handbrake cable using a new split pin to secure the clevis pin. Grease the clevis and tighten the outer cable lock nuts.
62. Connect the speedometer cable.
63. Check that the three drain plugs are tight and remove the main gearbox and transfer box filler level plugs. Fill the main gearbox with approximately 1,76 litres (3 pints) of a recommended oil or until it begins to run out of the filler level hole. Fit and tighten the filler plug. Similarly remove the transfer filler level plug and inject approximately 2,6 litres (4.5 pints) of recommended oil or until it runs out of the filler hole. Apply Hylosil to the threads and fit the plug and wipe away any surplus oil.
64. Line up the marks and fit the front and rear propeller shafts to the transfer box.
65. Fit the exhaust system, and evenly tighten the flange nuts and bolts. Fit the 'U' bolt and secure to the bracket.
66. Expand the chassis side members, fit the cross member and secure with the eight nuts and bolts (four each side).
67. Fit the heater pipe clamp.
68. Clip the breather pipes, speedometer cable and starter motor harness to rear of engine.
69. Fit the fan cowl.
70. Fit the bonnet.
71. Fit main gear lever gaiter and lever, to previously marked spline setting. Secure with the 10mm 'Nyloc' nut (with plain washer) to the correct torque.
72. Fit the cover to both gear levers.
73. Fit the gear lever knobs.
74. Connect the battery.

OVERHAUL LT77 FIVE SPEED GEARBOX

(4 cylinder petrol and diesel)

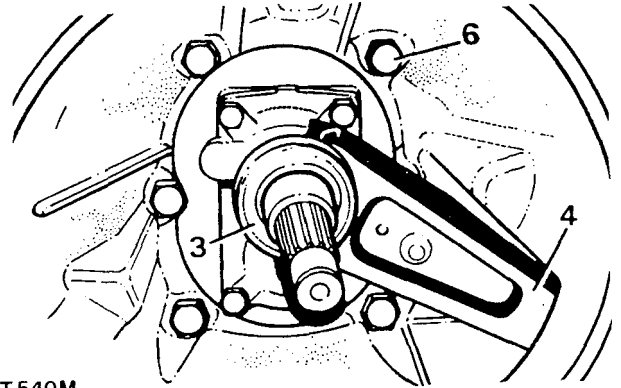
Service Tools:

- 18G705 — Bearing remover
- 18G705-1A — Adaptor for mainshaft
- 18G705-5 — Adaptor for layshaft
- 18G1400 — Remover for synchromesh hub and gear cluster
- 18G1400-1 — Adaptor mainshaft 5th gear
- MS47 — Hand press
- 18G47BA — Adaptor, layshaft bearing remover
- 18G47BAX — Conversion kit
- 186284 — Impulse extractor
- 18G284AAH — Adaptor for input shaft pilot bearing track
- 1861422 — Mainshaft rear oil seal replacer
- 18G1431 — Mainshaft 5th gear and oil seal collar replacer

Dismantle

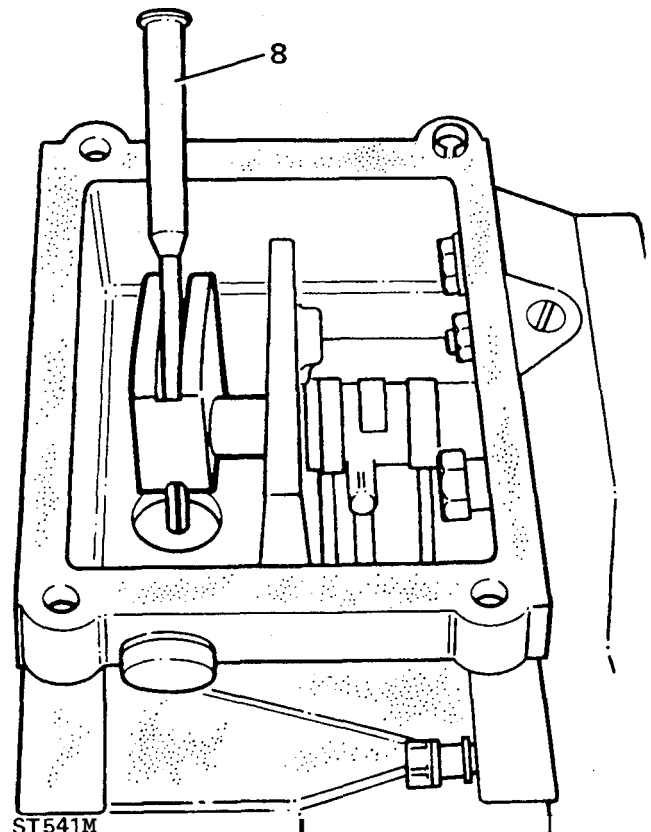
1. Place gearbox on a bench with the transfer gearbox removed, ensuring the oil is first drained.
2. Remove the clutch release bearing carrier clip.
3. Remove the clutch release bearing and carrier.

4. Pull the clutch release lever from the clutch release lever pivot.
5. Remove the bolts and washers securing the clutch release lever pivot.



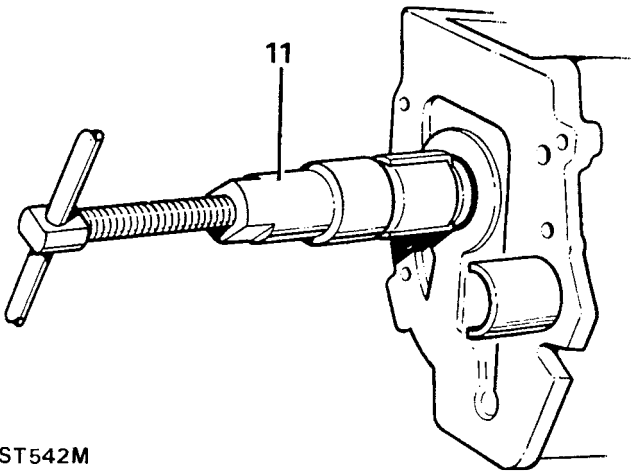
ST 540M

6. Remove the bolts and washers securing the bell housing and remove the bell housing.
7. Remove the three bolts and washers retaining the gear selector housing to the fifth gear extension case. Lift the housing from the case and discard the gasket.



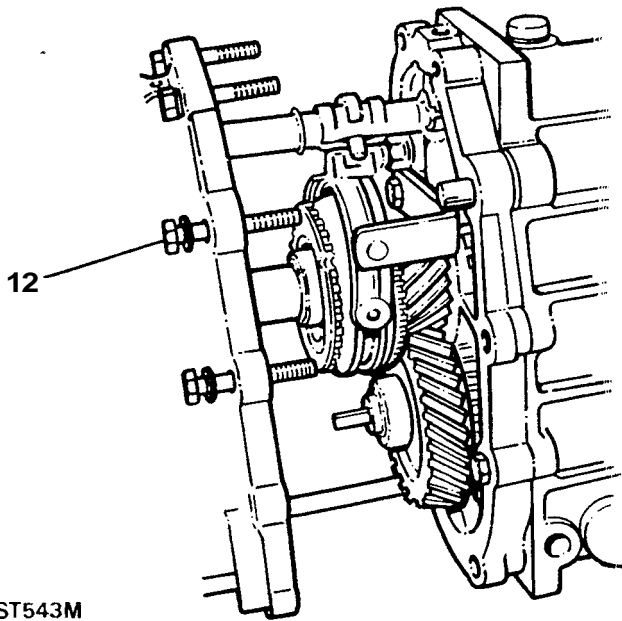
ST 541M

8. Using a suitable pin punch, remove the roll pin retaining the selector yoke.
9. Push the selector shaft forward to engage a gear, and manoeuvre the selector yoke from the shaft. Return the selector shaft to neutral.
10. Remove the circlip which retains the mainshaft oil seal collar located at the rear of the gearbox.



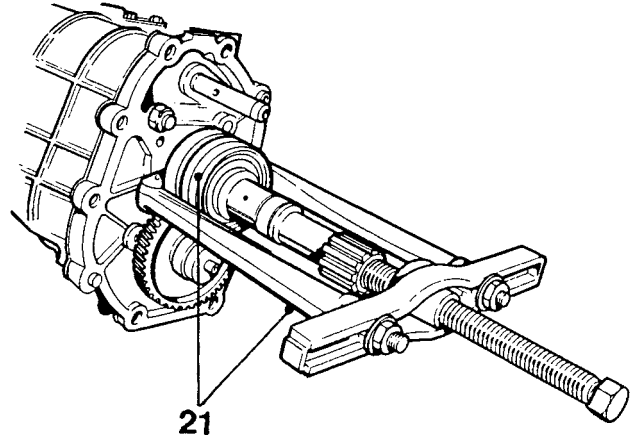
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11. Using tools 186705 and 18G705-1A remove the oil seal collar.



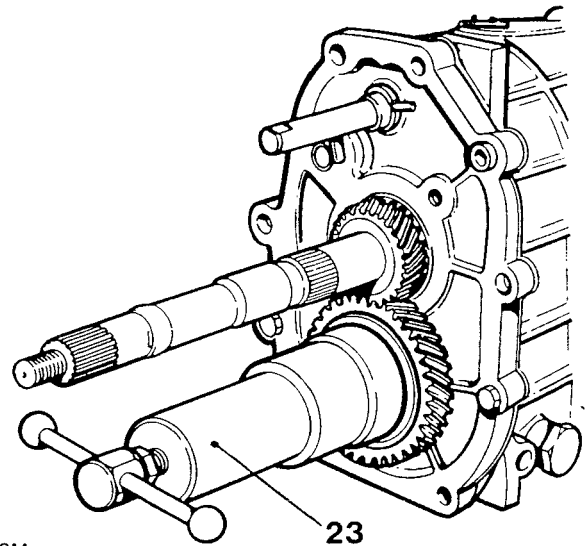
ST543M

12. Remove the ten bolts and spring washers securing the rear cover to the gearcase; withdraw the rear cover and discard the gasket.
13. Fit two dummy bolts (8 x 35 mm) to the casing to retain the centre plate to the main case.
14. Remove the oil seal collar 'O' ring from the mainshaft.
15. Withdraw the oil pump drive shaft.
16. Remove the two bolts and spring washers securing the fifth gear selector fork and bracket.
17. Withdraw the fifth gear selector spool.
18. Withdraw the fifth gear selector fork and bracket.
19. On early models, remove circlip retaining fifth gear (driving) from the layshaft. On later models, engage reverse gear by turning selector rail anti-clockwise and pulling rearwards. Move the fifth speed synchro hub into mesh with the fifth gear. De-stake the retaining nut securing the fifth gear layshaft and remove nut. Select neutral by pushing selector rail inwards and turning clockwise; and return fifth speed synchro hub to its out of mesh position.



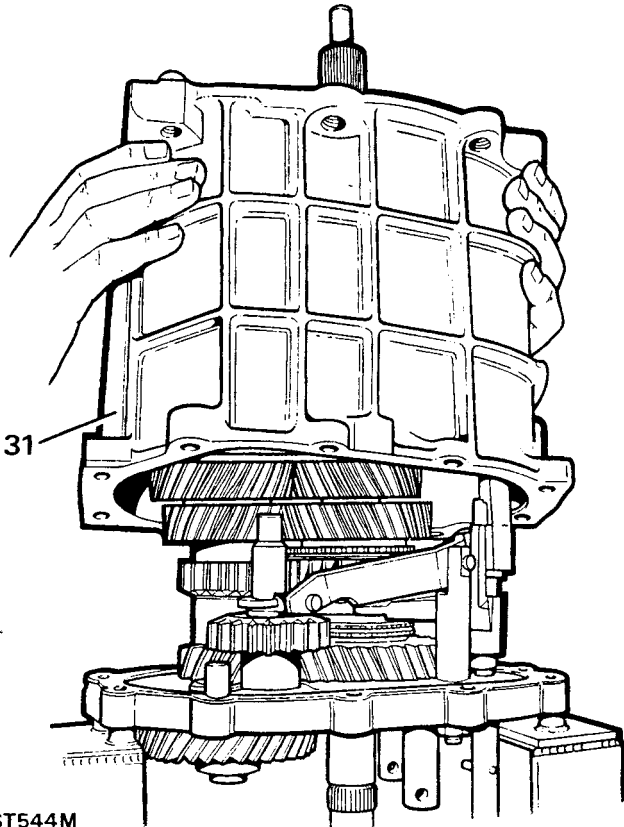
ST908M

20. Release the circlip retaining the fifth gear synchromesh assembly to the mainshaft.
21. Using tools 18G1400-1 and 18G1400 withdraw the selective washer, fifth gear synchromesh hub and cone, fifth gear (driven) and spacer from the mainshaft.
22. Remove the split roller bearing assembly from the mainshaft.
23. Using tools 186705 and 18G705-1A remove the layshaft spacer (if fitted) and layshaft fifth gear.



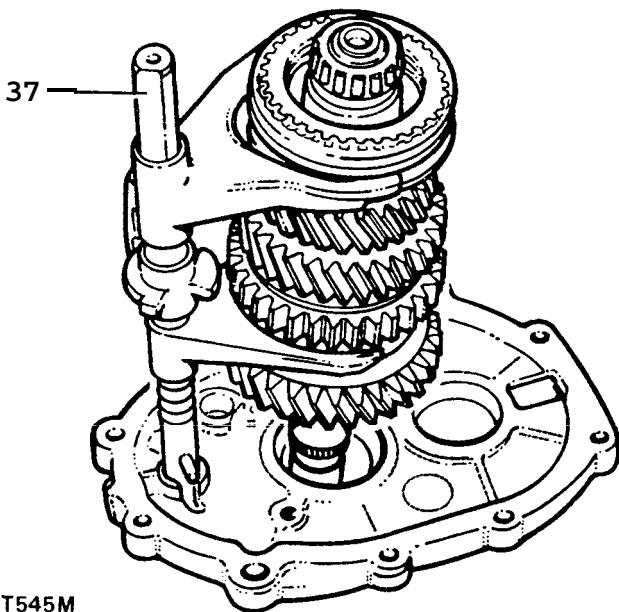
ST909M

24. Remove the selector shaft circlip.
25. Fit suitable guide studs (measuring 8 x 60 mm) to the main gearbox case.
26. Locate the gearbox to a suitable stand.
27. Remove the six bolts and spring washers from the front cover. withdraw the cover and discard the gasket.
28. Remove the input shaft and layshaft selective washers from the gearcase.
29. Remove the two bolts and washers securing the locating boss for the selector shaft front spool, withdraw the locating boss.
30. Withdraw the selector plug, spring and ball from the centre plate.



ST544M

31. Remove the dummy bolts and carefully lift the gearcase, leaving the centre plate and gear assemblies in position. Discard gasket.
32. Insert two slave bolts and nuts to retain the centre plate to the stand; and remove the circlip, pivot pin, reverse lever and slipper pad.
33. Slide the reverse shaft rearwards and lift off the thrust washer, reverse gear and reverse gear spacer.
34. Lift off the layshaft cluster.
35. Remove the input shaft and fourth gear synchromesh cone.



ST545M

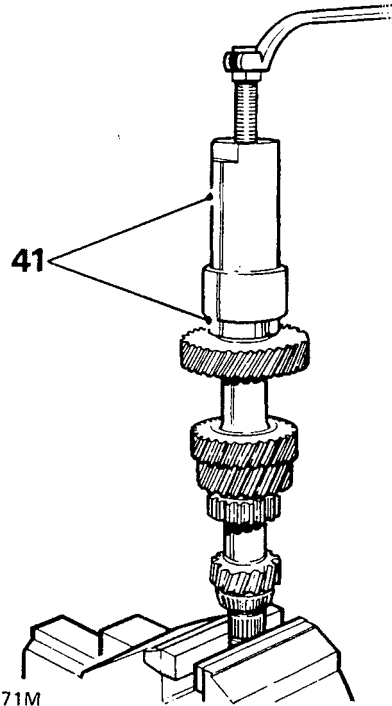
36. Rotate the fifth gear selector shaft clockwise (viewed from above) to align the fifth gear selector pin with the **slot** in the centre plate.
37. Remove the mainshaft and selector fork assemblies from the centre plate.
38. Detach the selector fork assembly from the mainshaft gear cluster.
39. Remove the slave bolts from the centre plate and lift the centre plate clear of the stand.

Front cover

40. Remove and discard the oil seal from the front cover. Do not fit a new oil seal at this stage.

Layshaft

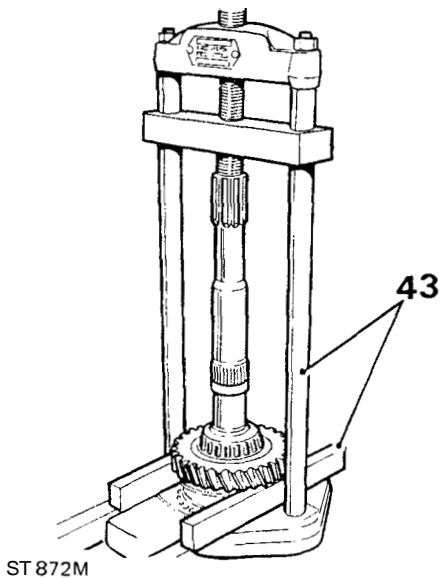
41. Using press 18G705 and tool 18G705-5 remove the layshaft bearings.



ST871M

Mainshaft

42. Remove the centre bearing circlip.
43. Using press MS47 and any suitable metal bar, remove the centre bearing, first gear bush, first gear and needle bearings and first gear synchromesh cone.



44. If a difficulty is experienced in removing the first and second gear synchromesh hub, locate underneath the second gear with a suitable tool; and extract the complete synchromesh hub and second gear assemblies using a suitable press.
45. Using press MS47 and extension, with a support underneath the third speed gear, press the mainshaft through the pilot bearing spacer, third and fourth synchromesh hub, third gear synchromesh cone, third gear and third gear needle roller bearing.

First and second gear synchromesh assemblies

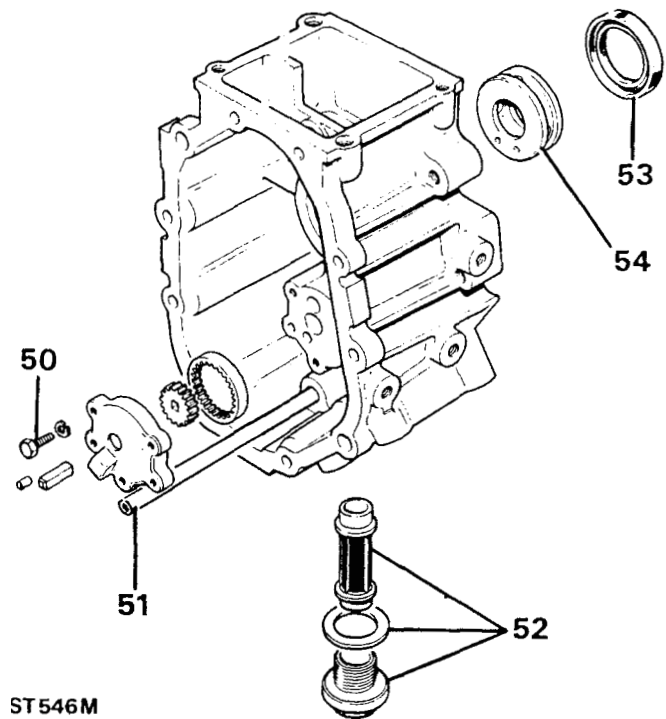
46. Mark the hub and sleeve to aid reassembly and remove the slipper rings from the front and rear of the first and second gear synchromesh assemblies.
47. Withdraw the slippers and hub from the sleeve.

Third and fourth gear synchromesh assemblies

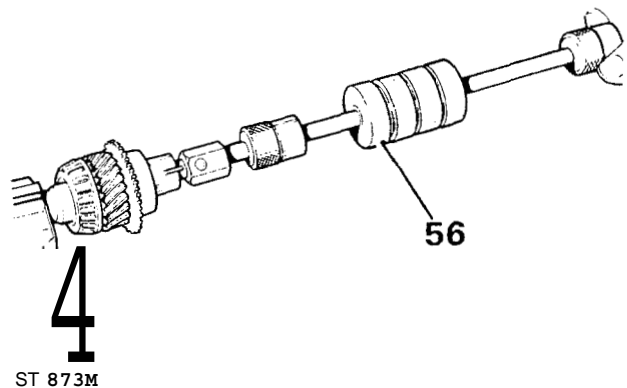
48. Mark the hub and sleeve to aid reassembly and remove the slipper rings from the front and rear of the assembly.
49. Withdraw the slippers and hub from the sleeve.

Extension case

50. Remove the three oil pump housing bolts, spring washers and oil pump gears.
51. Do not withdraw the oil pick-up pipe.
52. Remove the plug, washer and filter.
53. Invert casing and extract the oil seal.
54. Press out the ferrobestos bush from the casing.

**Input shaft**

55. Using tools MS47 and 18G47BA, remove the input shaft bearing.
56. With the aid of tools 18G284AAH and 186284, extract the pilot bearing track.

**Reverse idler gear**

57. Remove the circlip from the reverse idler gear.
58. Having noted their positions, remove both needle roller bearings and remaining circlip from the gear.

Fifth gear synchromesh assembly

59. Lever the backing plate off the fifth gear synchromesh assembly.
60. Remove the slipper rings from the front and rear of the assembly.
61. Release the slippers and slide the hub from the sleeve.

Centre plate

- 62. Remove the layshaft and mainshaft bearing tracks from the centre plate and reverse pivot post.

Main gearbox casing

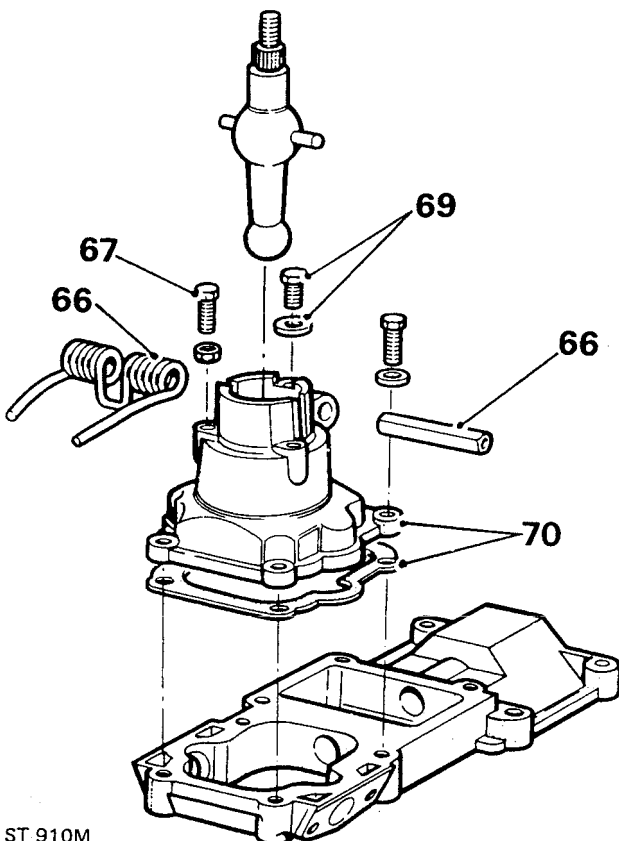
- 63. Remove the mainshaft and layshaft bearing tracks from the main casing.
- 64. Remove the plastic oil trough from the front of the casing.

Selector rail

- 65. The selector rail is supplied complete with first and second selector fork, pin and fifth speed selector pin. If it is required to replace the first and second selector fork on its own, press out the fifth speed gear selector pin and remove the first and second selector fork from the selector rail.

Gear selector housing — Latest models

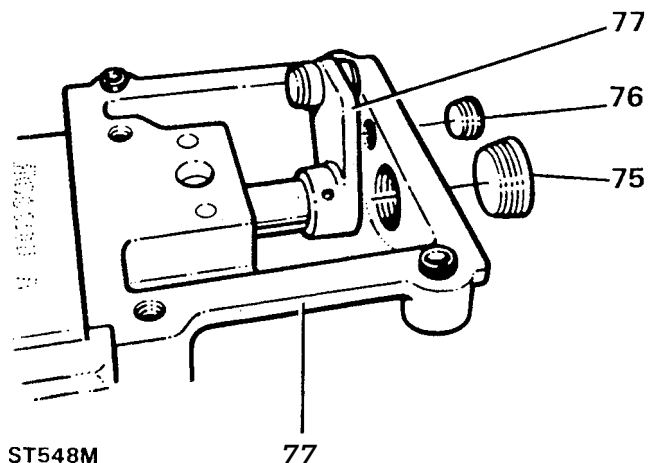
- 66. Remove the roll pin and release the bias spring.
- 67. Remove the two adjusting screws and locknuts.
- 68. Remove the gear lever extension, secured by a nut (with plain washer).
- 69. Remove the bolt and special lock washer to release the gear lever shaft from the trunnion housing.
- 70. Remove the four bolts and spring washers retaining the gear lever housing to the selector housing. Lift off the housing and discard the gasket.



ST 910M

Gear selector housing — Early models (Not illustrated)

- (a) Remove the gear lever gaiter and three bolts holding the gear lever retaining plate and anti-vibration pad.
 - (b) Remove gear lever from the gear lever housing.
 - (c) Remove the four bolts and spring washers retaining the gear lever housing to the selector housing. Lift off the housing and discard the gasket.
 - (d) Remove the bolts and washers retaining the fifth gear plunger assembly. Care must be taken not to lose the shims located on the plunger assembly casting.
 - (e) Withdraw the assembly from the selector housing and label components for identification on reassembly.
- 71. Remove the bolts and washers retaining the reverse gear plunger assembly. Care must be taken not to lose the shims located on the assembly casting. Detach from the selector housing and label components for identification.
 - 72. Remove the locating bolt from the housing for nylon bush. Pull the selector shaft rearwards and remove the trunnion housing.
 - 73. Release the circlip and detach the nylon insert from the trunnion housing.
 - 74. Invert the gear selector housing and remove the fifth gear spool retainer bolts and spring washers. Lift off the fifth gear spool retainer.
 - 75. Remove the large blanking plug at the rear of the housing.
 - 76. Remove the reverse switch blanking plug.
 - 77. Place the gear selector housing into protected vice jaws, using a suitable pin punch, drift out the selector yoke roll pin. Push the selector shaft forwards and remove the selector yoke. Remove housing from vice.

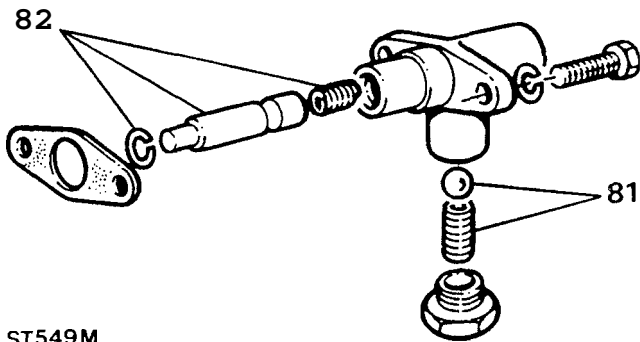


ST548M

- 78. Remove the selector yoke roller circlip and withdraw the pin and rollers.
- 79. Withdraw the gear selector housing shaft out through the large blanking plug orifice.
- 80. Remove and discard the gear selector shaft 'O' ring.

Fifth gear plunger assembly — Early models only

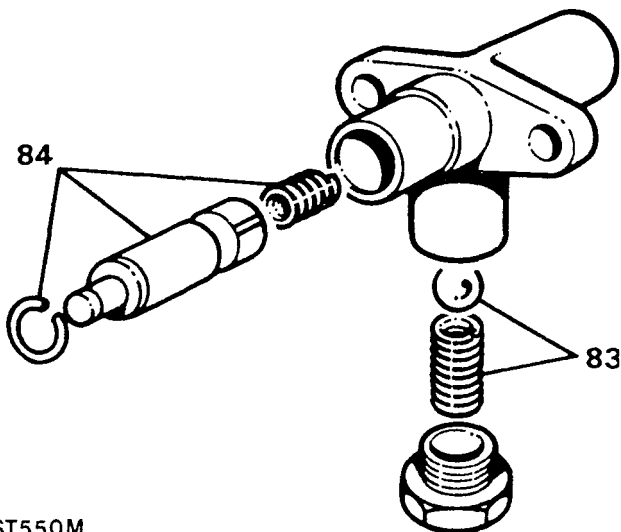
81. Remove the plug, long spring and detent ball from the fifth gear plunger.
82. Remove the circlip which retains the fifth gear plunger, pull out plunger and short spring. Keep all parts labelled and separated from the reverse plunger assembly.



ST549M

Reverse gear plunger assembly

83. Remove the plug, long spring and detent ball from the reverse gear plunger assembly.
84. Detach the circlip which retains the reverse gear plunger, pull out the plunger followed by the short spring. Label all parts and keep separate from the fifth gear plunger assembly.



ST550M

Cleaning and inspection

85. Clean gearcase thoroughly using a suitable solvent. Inspect case for cracks, stripped threads in the various bolt holes, and machined mating surfaces for burrs, nicks or any condition that would render the gearcase unfit for further service. If threads are stripped, install Helicoil, or equivalent inserts.

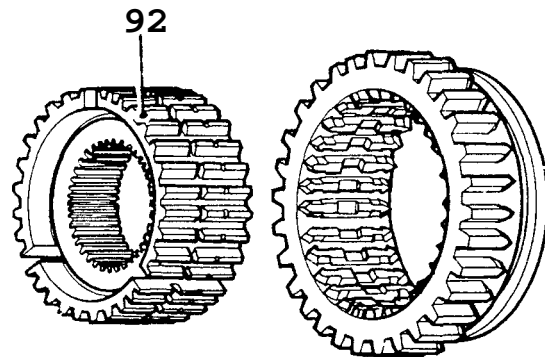
86. Inspect all gear teeth for chipped or broken teeth, or showing signs of excessive wear. Inspect all spline teeth on the synchromesh assemblies. If there is evidence of chipping or excessive wear, install new parts on reassembly. Check all slippers and slipper rings for wear or breakage. Replace with new parts if necessary.
87. Inspect all circlip grooves for burred edges. If rough or burred, remove condition carefully using a fine file.
88. Ensure all oil outlets are clear of sludge or contamination especially the mainshaft oil ways. Clean with compressed air observing the necessary safety requirements.
89. During the rebuild operation, it is recommended that new roller and needle bearings are fitted.

ASSEMBLY**Layshaft**

90. Using tools MS47 and a suitable tube, fit new bearing cones to the layshaft.

Synchromesh assemblies

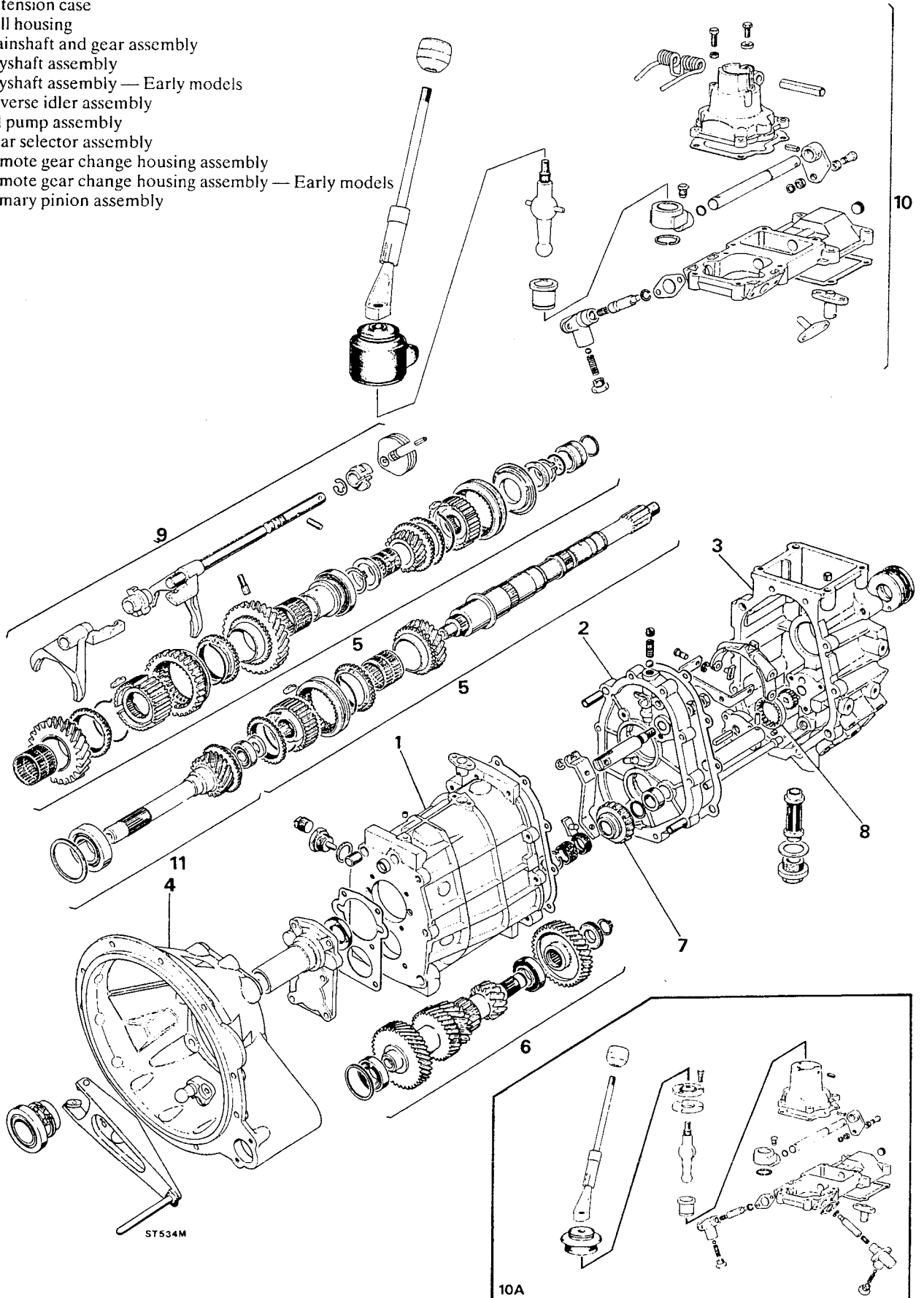
91. With the outer sleeve held, a push-through load applied to the outer face of the synchromesh hub should register 8,2 to 10 kgf m (18 to 22 lbf ft) to overcome the spring detent in either direction.
92. Assemble the first and second synchromesh assembly by locating the shorter splined face towards the second gear.



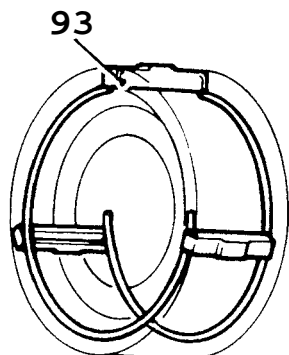
ST551M

KEY TO MAIN GEARBOX

- 1. Main gearcase
- 2. Centre plate
- 3. Extension case
- 4. Bell housing
- 5. Mainshaft and gear assembly
- 6. Layshaft assembly
- 6A. Layshaft assembly — Early models
- 7. Reverse idler assembly
- 8. Oil pump assembly
- 9. Gear selector assembly
- 10. Remote gear change housing assembly
- 10A. Remote gear change housing assembly — Early models
- 11. Primary pinion assembly

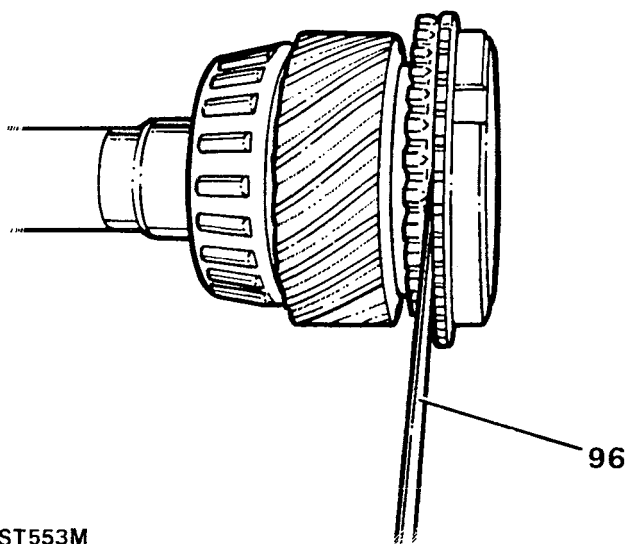


93. Refit the slippers and locate the slipper rings to each side of the assembly, ensuring that the hooked ends of both slipper rings are located in the same slipper; but running in opposite directions and finishing against the other two slippers.



ST552M

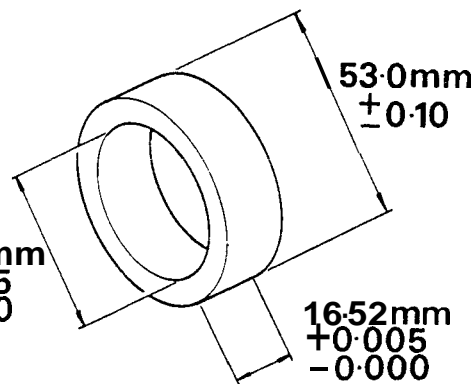
- 94. Assemble the third and fourth synchronesh assembly and ensure the hooked ends are located in the same slipper; and run in opposing directions and finally locate against the other two slippers.
- 95. Refit the fifth synchronesh hub assembly again ensuring the hooked ends of the rings are located in the same slipper, but running in opposite directions. Fit the backplate onto the rear of the synchronesh hub assembly. Ensure the tag on the backplate locates in the slot on the hub.
- 96. Check the wear between all the synchronesh cones and gears by pushing the cone against the gear and measuring the gap between the gear and cone. The minimum clearance is 0,64 mm (0.025 in). If this clearance is not met, fit new synchronesh cones.



ST553M

First gear bush end-float

97. Manufacture a spacer to the dimensions provided in the illustration, this will represent a slave bearing.



ST531M

- 98. Lubricate the second gear needle bearing with a light oil and fit the bearing, second gear and synchronesh cone to the mainshaft. It should be noted that the second gear synchronesh cone has larger slipper slots than the other synchronesh cones.
- 99. Fit the first and second synchronesh hub assembly with the selector fork annulus to the rear of the mainshaft.
- 100. Fit the first gear bush and slave bearing spacer and a new circlip to the mainshaft. When fitting the circlip, care must be taken to ensure it is not opened (stretched) beyond the minimum necessary to pass over the shaft.
- 101. Press the slave bearing spacer back against the circlip to allow the bush maximum end-float. Measure the clearance between the rear of the first gear bush and front face of the slave bearing spacer with a feeler gauge. The clearance should be within 0,005 to 0,055 mm. The first gear bush is available with collars of different thickness. Select a bush with a collar to give the required end-float. The bush must be free to rotate easily with the required end-float.
- 102. Remove the circlip, slave bearing spacer and first gear bush from the mainshaft.
- 103. First gear bushes are available in the following sizes:

Part No.	Thickness (mm)
FRC5243	40,16 - 40,21
FRC5244	40,21 - 40,26
FRC5245	40,26 - 40,31
FRC5246	40,31 - 40,36
FRC5247	40,36 - 40,41

- 104. Having selected a suitable first gear bush, lubricate the needle bearing and fit to the first gear.
- 105. Fit the selected bush to the first gear and place first gear synchronesh cone, followed by the first gear assembly to the mainshaft.
- 106. Using tools MS47, 18G47BA and 18G47BA-X refit the centre bearing and circlip to the mainshaft.
- 107. Invert the mainshaft, lubricate the third gear needle roller bearing with light oil, fit to the front end of the mainshaft.

108. Fit the third gear to the mainshaft; and locate the third gear synchromesh cone to the third gear.
109. Fit the third/fourth synchromesh assembly (with the longer box of the synchromesh hub to the front of the gearbox) to the mainshaft.
110. Fit the spacer and bearing to the front of the mainshaft.

Input shaft

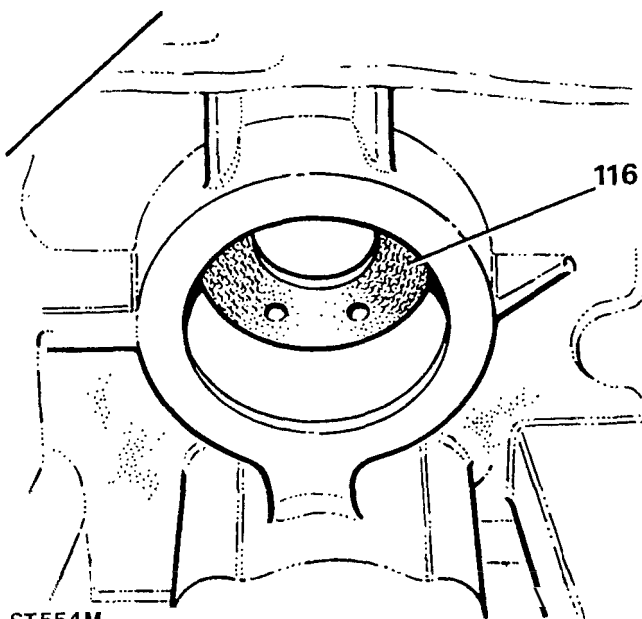
111. Using tool MS47 and any suitable tube, refit a new pilot bearing track to the input shaft.
112. Fit the input shaft bearing using tools MS47, 18G47BA and 18G47BA-X.

Reverse Gear and Shaft

113. Fit a new circlip to the rear of the reverse idler gear, ensuring that the circlip is not stretched beyond the minimum necessary to pass over the shaft.
114. Lubricate with light oil and fit both needle roller bearings. Fit the shorter needle bearing to the rear of the reverse idler gear.
115. Fit a new circlip to the front of the reverse idler gear.

Extension case

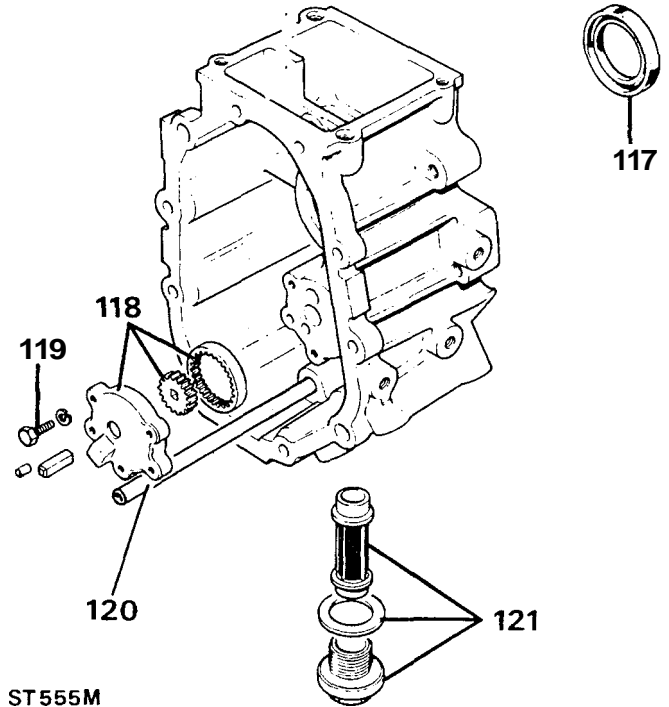
116. Using a suitable press, fit a new ferrobestos bush to the case, ensuring the two drain holes are towards the bottom of the case.



ST554M

117. With the aid of tool 18G1422, fit a new oil seal to the rear of the extension case. Ensure the seal lips are towards the ferrobestos bush. Lubricate the seal lips with a suitable SAE 140 oil.

118. Assemble and fit the fibre oil pump gears to the oil pump cover, whilst ensuring the centre rotor squared drive faces the layshaft.

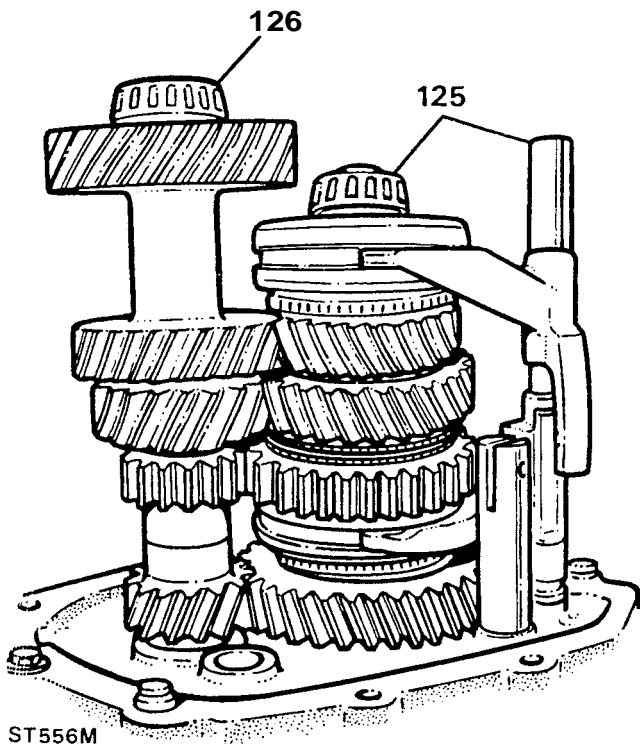


ST555M

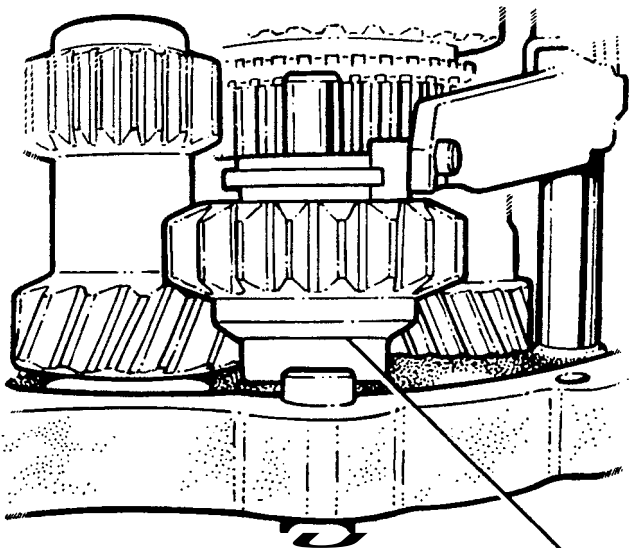
119. Fit the three bolts and spring washers to secure the oil pump cover; and tighten to the specified torque.
120. Ascertain that the oil pick up pipe is free of contamination or blockage.
121. Fit a new oil filter, fibre gasket and tighten plug to the specified torque.

Centre plate

122. Fit the centre plate to a suitable stand and secure with two slave bolts.
123. Place the new mainshaft and layshaft bearing tracks to the centre plate.
124. Lightly lubricate the selector shaft with a light oil.
125. Take the selector shaft complete with the first and second selector fork, front spool and third and fourth selector fork; engage both selector forks in their respective synchromesh sleeves on the mainshaft, simultaneously engaging the selector shaft and mainshaft assemblies in the centre plate, whilst rotating the fifth gear selector pin to align with the slot in the centre plate.
126. Fit the layshaft to the centre plate.
127. Rotate the selector shaft and spool to enable the reverse crossover lever forks to correctly align to the reverse pivot shaft. Reposition the selector shaft and locate the lever between the fork on the reverse gear pivot shaft. Insert pivot pin and fit a new circlip, ensuring that it is not opened beyond the minimum necessary to pass over the shaft.



128. Fit the slipper pad to the reverse lever. If a new reverse lever pivot shaft has been fitted, it will be necessary to ascertain that its radial location is consistent with the reverse pad slipper engagement/clearance. The radial location is determined during initial assembly.



ST557M

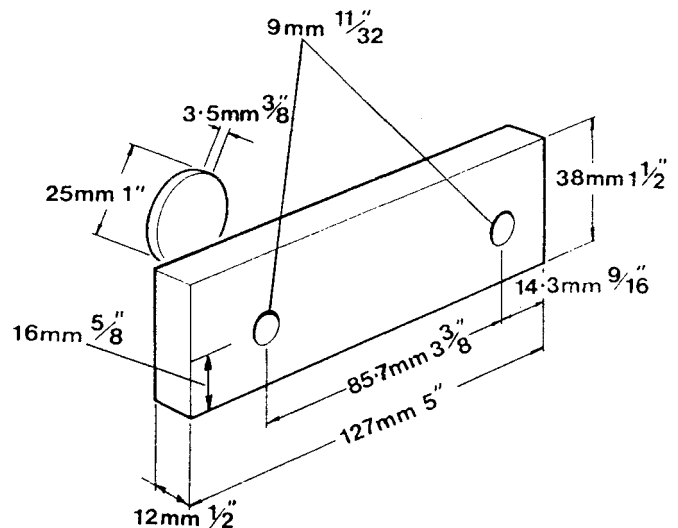
129

129. Fit the reverse gear spacer and reverse gear assembly, locating the slipper pad lip to the reverse gear groove. Engage the reverse gear shaft from the underside of the centre plate, ensuring the roll pin is aligned with the slot in the centre plate casing.

130. Prior to assembly lubricate the detent ball and spring with light oil, and fit to the top of centre plate. Smear Hylomar PL32 or Loctite 290 to the plug threads and screw the plug flush with the case. Stake the plug to prevent rotation using a suitable centre punch. Release the slave bolts.
131. Locate the fourth gear synchromesh cone to the third/fourth synchromesh assembly.
132. Fit the input shaft to the mainshaft.
133. Fit the reverse gear spacer to the reverse gear shaft.
134. Fit a new gasket to the centre plate.

Main gearbox casing

135. Insert a new plastic oil trough to the back of the main gearbox casing, ensuring the open trough faces the top of the case.
136. Carefully lower the gearcase into position over the gear assemblies. **DO NOT USE FORCE.** This operation can be assisted by the use of two 8 x 100 mm guide studs. Ensure the centre plate dowels and selector shaft arc engaged in their respective locations.
137. Fit the layshaft and input shaft bearing outer tracks.
138. Using 8 x 35 mm slave bolts and plain washers to prevent damaging the rear face of the centre plate, evenly draw the gearcase into position on the plate.
139. Fit the locating shaft front spool to the top of the gearcase using Hylomar PL32 to seal between the spool and gearcase. Smear Loctite 290 or Hylomar PL32 to the bolt threads, tighten bolts and spring washers to the specified torque.
140. Manufacture a layshaft support plate and plain washer to the dimensions provided in the illustration.

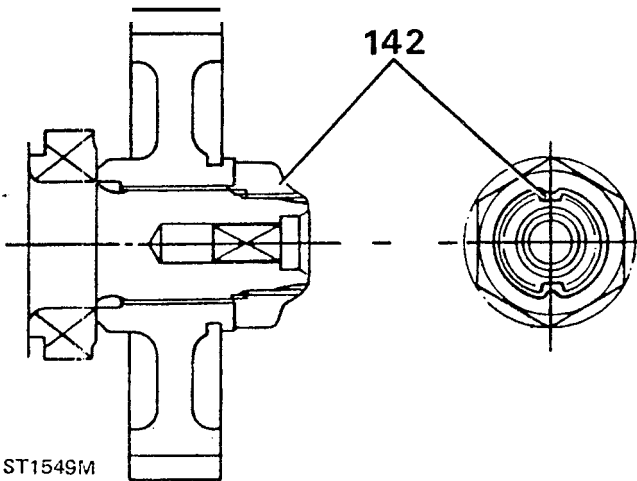


ST1118M

141. The layshaft support plate is fitted using two 8 x 25 mm bolts and washers to the front of the gearbox, with the plain washer situated between the support plate and layshaft. The plate also retains the input shaft bearing outer track.

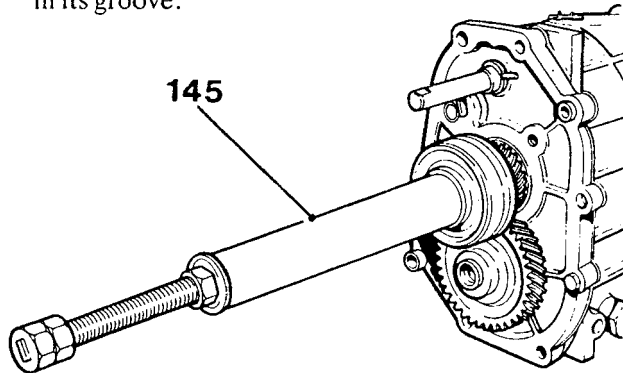
142. On early models: With the aid of a suitable press, fit the fifth gear, collar and new circlip to the layshaft.

Later models: Fit the fifth gear to the layshaft using a suitable press and loosely fit a NEW special nut. To tighten the nut, hold the gearbox firmly in a Vice and if necessary use a flange holding wrench to restrain the gearbox. Tighten the nut to 204 to 231 Nm (150 to 170 lb ft). To prevent damage to the adjacent bearings when deforming the nut locking collar, support the fifth gear with a block of timber. Using a round nose punch carefully form the collar into the layshaft grooves, as illustrated.



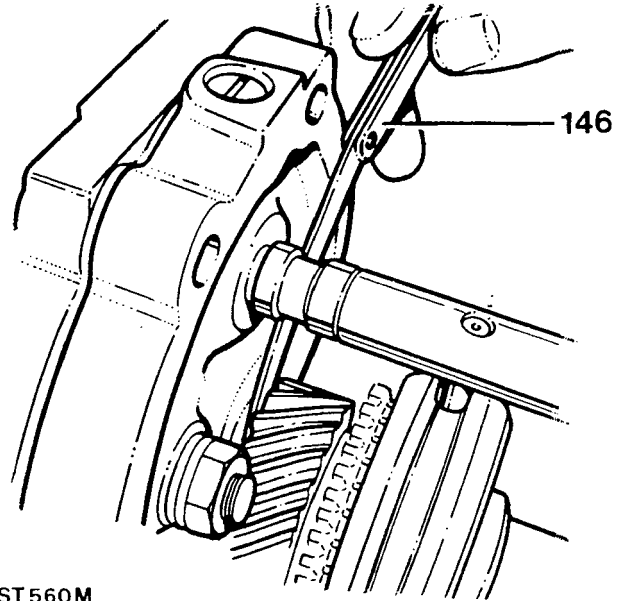
ST1549M

- 143. Locate assembly horizontally in a vice or suitable jig.
- 144. Fit the fifth speed washer, roller bearing, gear and cone to the mainshaft.
- 145. Press fit fifth gear synchromesh hub assembly using tool 18G1431. Fit a dummy spacer with an oversize bore to ascertain the correct spacer to provide the specified clearance on the fifth gear. When fitting, care must be taken to ensure the hub assembly and selective spacer are NOT pushed too far on the mainshaft. Only fit with sufficient clearance to allow the circlip to engage in its groove.



ST 870M

146. Measure the clearance between the front spacer and fifth gear (driven), which should be between 0,005 and 0,055 mm. Select the appropriate spacer to provide the aforementioned clearance.



ST560M

Part No.	Thickness (mm)	Part No.	Thickness (mm)
FRC5284	5,10	FRC5294	5,40
FRC5286	5,16	FRC5296	5,46
FRC5288	5,22	FRC5298	5,52
FRC5290	5,28	FRC5300	5,58
FRC5292	5,34	FRC5302	5,64

147. Fit the correct selective spacer and new circlip.

Mainshaft and layshaft end-float

148. Measure and adjust the mainshaft and layshaft end-float as necessary. Remove the layshaft support plate from the front of the gearbox.

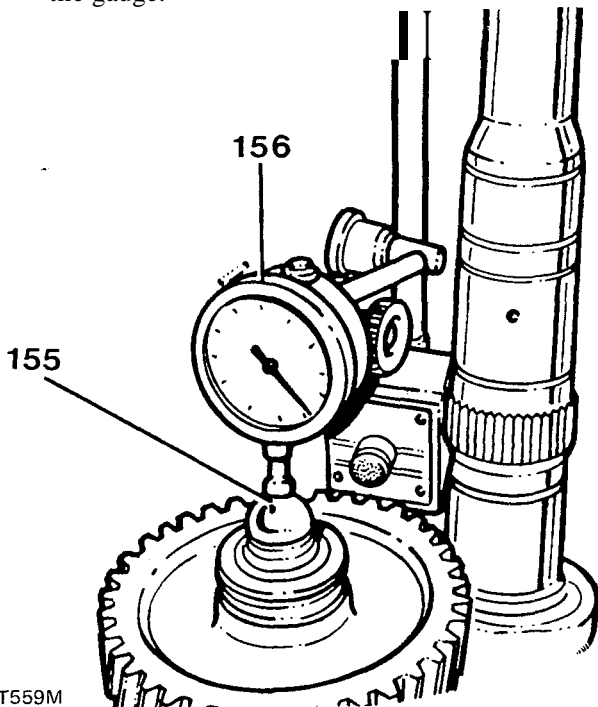
Part No.	Thickness (mm)	Part No.	Thickness (mm)
FRC4327	1,51	FRC4349	2,17
FRC4329	1,57	FRC4351	2,23
FRC4331	1,63	FRC4353	2,29
FRC4333	1,69	FRC4355	2,35
FRC4335	1,75	FRC4357	2,41
FRC4337	1,81	FRC4359	2,47
FRC4339	1,87	FRC4361	2,53
FRC4341	1,93	FRC4363	2,59
FRC4343	1,99	FRC4365	2,65
FRC4345	2,05	FRC4367	2,71
FRC4347	2,11	FRC4369	2,77

149. When ascertaining the mainshaft end-float care must be taken when checking the dial gauge readings to ensure that the end-float only, as distinct from side movement, is recorded. To overcome the difficulty in differentiating between end-float and side movement, wrap approximately ten turns of masking tape around the plain portion of the input shaft below the splines. Ascertain that the rise and fall of the input shaft is not restricted by the tape.

150. Place a mainshaft and layshaft spacer of nominal thickness 1.02mm on the mainshaft and layshaft bearing tracks, fit the front cover and gasket tighten bolts and spring washers to the specified torque.

151. Invert the gearbox on the stand. Rotate the mainshaft to correctly seat the bearing.

- 152. Place a suitable ball bearing in the mainshaft centre and mount the dial gauge on the gearcase with the stylus resting on the ball bearing centre. Zero the gauge.
- 153. Check the end-float by a 'push-pull' action to the mainshaft. The required mainshaft end-float measurement should be between 0,06 to 0,01 mm with no pre-load.
- 154. Spacer thickness required equals; Nominal thickness of spacer, plus end-float obtained. Remove the dial gauge and ball bearing.
- 155 Rotate the layshaft to correctly seat the bearing. Place a suitable ball bearing in the layshaft centre and mount the dial gauge on the gearcase, with the stylus resting on the ball bearing centre. Zero the gauge.



ST559M

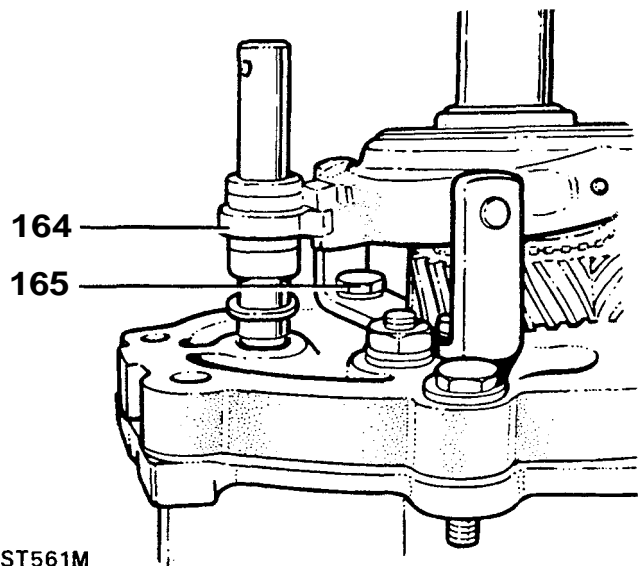
- 156. With the aid of levers approximately 23 cm long; to prevent component damage, check the end-float by a gentle 'push-lift' action to the layshaft. The required layshaft setting is:
 0,025 mm end-float
 0,025 mm preload.
 Spacer thickness required equals; nominal thickness of spacer, plus end-float obtained. Remove the gauge and ball bearing.
- 157. Remove the front cover. Having ascertained the mainshaft and layshaft end-float, fit the mainshaft and layshaft spacers of the appropriate thickness to the mainshaft and layshaft bearing tracks. Selective spacers are available in a range of sizes to meet the aforementioned clearance limits.

Part No.	Thickness (mm)	Part No.	Thickness (mm)
TKC4633	1,69	TKC4649	2,17
TKC4635	1,75	TKC4651	2,23
TKC4637	1,81	TKC4653	2,29
TKC4639	1,87	TKC4655	2,35
TKC4641	1,93	TKC4657	2,41
TKC4643	1,99	TKC4659	2,47
TKC4645	2,05	TKC4661	2,53
TKC4647	2,11	TKC4663	2,59

- 158. Fit a new oil seal to the front cover, ensuring the seal lips face towards the gearbox. Lubricate the seal lips with SAE 140gear oil.
- 159. Mask the splines with masking tape to protect the oil seal. refit the front cover and remove the spline masking tape.
- 160. Refit the bolts and spring washers having used Hylomar PL32 or Loctite 290 on the bolt threads. Tighten to the specified torque.
- 161. Remove gearbox from the stand and place suitably supported on the bench. Remove the guide studs fitted to the centre plate.
- 162. Select reverse gear by turning the selector rail anti-clockwise and pulling rearwards. Move the fifth speed synchromesh hub into mesh with the fifth gear. Tighten the staked nut onto the fifth gear layshaft to the specified torque. Stake the nut with a suitable punch to secure. Select neutral by pushing selector rail inwards and turning clockwise, thereby returning the fifth speed synchromesh hub to its out of mesh position.

Fifth gear selector fork assembly

- 163. Fit the fifth speed selector fork and bracket to the fifth gear synchromesh hub assembly, ensuring that the largest groove lip is facing the rear of the gearbox.
- 164. Fit the fifth gear spool to the selector shaft, rotate and engage the selector fork into the groove. It should be noted that the longer shoulder of the spool is fitted towards the front of the gearbox.
- 165. Fit the fifth speed selector fork bracket bolts and spring washers. Tighten to specified torque.



ST561M

- 166. Fit a new circlip to the selector shaft ensuring that it is not expanded beyond the minimum necessary to obtain entry.
- 167. Remove the six dummy bolts securing the centre plate to the main casing.
- 168. Position the gearbox assembly horizontally and fit the oil pump shaft to the pump.

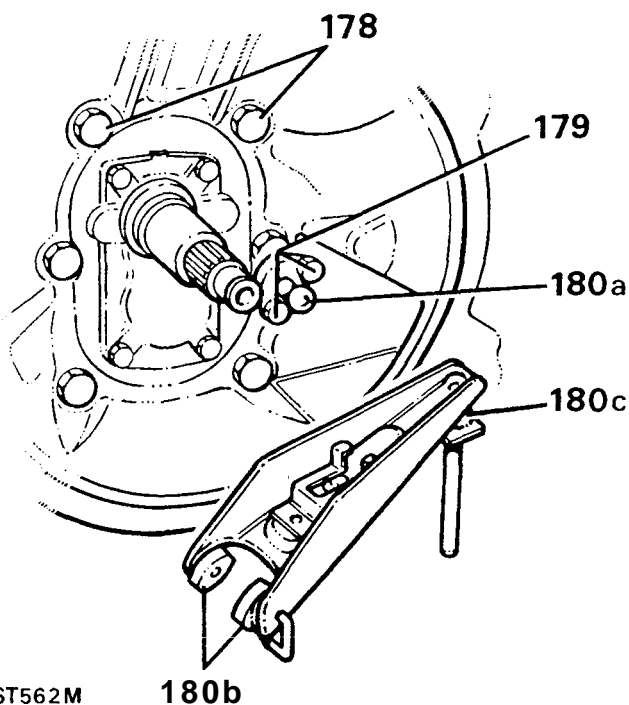
Extension case

- 169. Fit a new gasket to the centre plate.
- 170. Rotate the oil pump to align with the oil pump drive shaft.

171. Carefully fit the extension case ensuring that the oil pump shaft engages the layshaft.
172. Fit the extension case bolts and spring washers; tighten to specified torque.
173. Using a large screwdriver, ease the selector shaft forwards to select a gear. It may be found necessary to rotate the mainshaft to ease gear selection.
174. Fit the selector yoke to the selector shaft and secure with a new roll pin. Pull selector shaft rearwards to select a neutral position.
175. Cover the mainshaft splines with masking tape and fit a new oil seal collar 'O' ring. Remove the masking tape.
176. Using tool 1861431 fit the oil seal collar to the mainshaft, ensuring the collar is NOT pushed too far on the shaft, fit only with sufficient clearance to allow the circlip to engage in its groove.
177. Fit a new gasket to the top of the fifth gear extension case and fit the gear change housing by engaging male selector yoke with the female yoke. Align the housing locating dowels and refit the housing. Secure with the three bolts and washers; and tighten to the specified torque.

Bell housing

178. Locate the bell housing to the dowels and fit the two long bolts (12 x 45 mm) with spring and plain washers to the dowel positions. The remaining four bolts (12 x 30 mm) are fitted with spring washers only. Tighten to the specified torque.



ST562M

180b

179. Fit the clutch release lever pivot and secure with the bolts and spring washers. Tighten to the specified torque.

180. Prior to reassembly, lubricate the following with a thin film of molybdenum disulphide grease:
 - (a) Clutch release lever fulcrum pivot socket.
 - (b) The clutch release lever slipper pad pins and the faces of each slipper pad.
 - (c) Ball ends of the clutch operating push rod.
181. Refit the slipper pads to the clutch release lever and locate the lever socket to the clutch release lever pivot.
182. Lubricate the inner face of the clutch release bearing carrier with molybdenum disulphide grease and fit to the front cover spigot, locating the clutch release lever slipper pads to the carrier recesses.
183. Fit a new nylon clutch release carrier clip.
184. Refit the gearbox oil level plug, and tighten to the specified torque.
185. Refit the gearbox oil drain plug and fit new fibre washer. Tighten plug to specified torque.

Reverse gear plunger assembly

186. Lubricate the short spring and plunger with BP Energrease L2 or similar prior to assembly.
187. Fit the short spring into the plunger base and slide the assembly into the reverse gear plunger housing. Fit a new circlip to retain the plunger. Ensure the spring is not trapped, the detent groove should be fully visible down the detent hole.
188. Lubricate the detent ball with light oil and fit into its bore.
189. Refit the long spring and plug, coat the plug threads with Loctite 290 or Hylomar PL32, and tighten to the specified torque.

The following instructions (190 to 211) relate to the early model gearbox with a spring-loaded plunger for fifth gear selection.

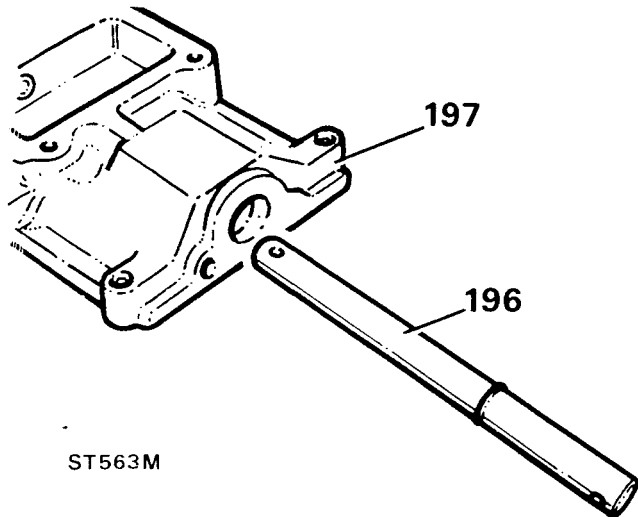
Fifth gear plunger assembly — Early models only

190. Lubricate the short spring and plunger with BP Energrease L2 or similar, prior to assembly.
191. Fit the short spring in the plunger base and slide the assembly into the fifth gear plunger housing. Fit a new circlip to retain the plunger. Ensure the spring is not trapped, the detent groove should be fully visible down the detent hole.
192. Lubricate the detent ball with light oil and fit into its bore.
193. Refit the long spring and plug, coat the plug threads with Loctite 290 or Hylomar PL32, tighten to the specified torque.

Gear selector housing — Early models

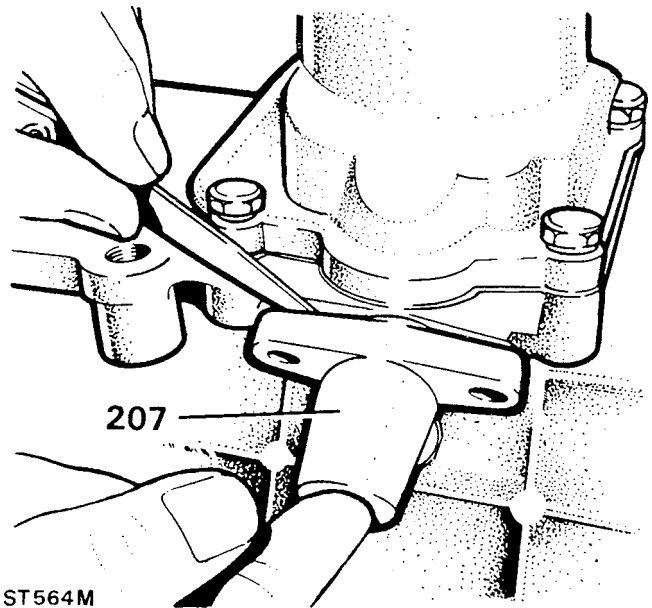
194. Refit the gear selector rollers, pin and new circlip ensuring circlip is not expanded beyond minimum necessary to obtain entry.
195. Lubricate the gear selector housing shaft with light oil and fit a new 'O' ring.

196. Insert shaft through the large blanking plug orifice, ensuring the shaft indent is uppermost.
197. Place the gear selector housing into protected vice jaws and fit the selector yoke to the shaft, using a suitable pin punch and new roll pin. Remove the housing assembly from the vice on completion.



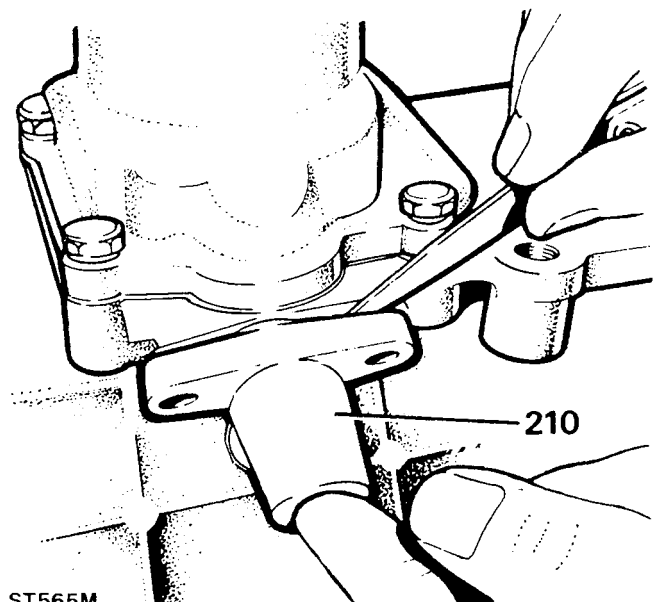
ST563M

198. Fit the reverse switch and large blanking plugs. Coat plug threads with Loctite 290 and tighten to the specified torque.
199. Refit the fifth gear spool retainer, coat the bolt threads with Loctite 290, and tighten the bolts and washers to the specified torque.
200. Fit a new nylon insert into the trunnion housing and secure with a new circlip.
201. Invert the gear selector housing and fit the trunnion housing to the selector shaft, ensuring the locating bolt aligns with the shaft indent. Coat the bolt threads with Loctite 290. Tighten bolt to the specified torque.
202. Fit a new gear lever housing gasket and fit the gear lever housing, spring washers and bolts. Tighten bolts to the specified torque.
203. Coat the upper and lower balls of the gear lever shaft with BP Energrease L2 or similar. Push lever into the trunnion nylon bush.
204. Place new vibration pad over the gear lever and fit the gear lever retaining plate. Refit the three shouldered bolts and tighten to the specified torque.
205. Refit the gear lever gaiter and attach the gear lever extension. Then carry out the following procedure to ensure a clearance of 0,3 to 0,9 mm between the gear lever yoke and stops.
206. Select first or second gear. It may be necessary to rotate the mainshaft whilst manipulating the gear lever.
207. Locate the reverse gear plunger on the right hand side viewed from the rear, giving sufficient load on the trunnion to eliminate side play. Whilst maintaining a light finger pressure, measure the clearance between the plunger assembly casting and gear selector casting. Add 0,6 mm to the measured figure and select suitable thickness shims to equal the total.



ST564M

208. Remove the reverse plunger assembly, fit the required thickness shim(s) refit the plunger assembly, spring washers and bolts. Tighten bolts to the specified torque.
209. Select third or fourth gear.
210. Locate the fifth gear plunger on the left hand side viewed from the rear, giving Sufficient load on the trunnion to eliminate sideplay. Whilst maintaining a light finger pressure, measure the clearance between the plunger assembly casting and gear selector casting. Add 0,6 mm to the measured figure and select suitable thickness shims to equal the total.



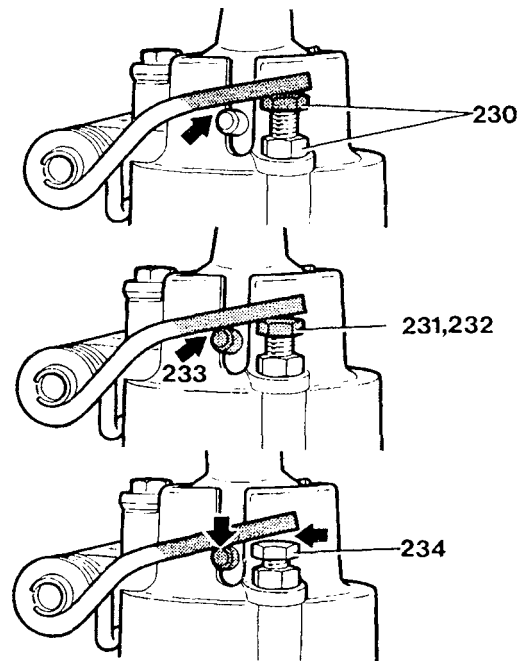
ST565M

211. Remove the fifth gear plunger assembly and fit the required shim(s), refit the plunger assembly, spring washers and bolts. Tighten bolts to the specified torque.

The latest model gearbox employs a spring-loaded biased gear change lever assembly and the following instructions (212 to 236) include the fitting and adjustment of this arrangement.

Gear selector housing

212. Refit the gear selector rollers, pin and new circlip ensuring circlip is not expanded beyond minimum necessary to obtain entry.
213. Lubricate the gear selector housing shaft with light oil and fit a new 'O' ring.
214. Insert shaft through the large blanking plug orifice, ensuring the shaft indent is uppermost.
215. Place the gear selector housing into protected vice jaws and fit the selector yoke to the shaft, using a suitable pin punch and new roll pin. Remove the housing assembly from the vice on completion.
216. Fit the reverse switch and large blanking plugs. Coat plug threads with Loctite 290 and tighten to the specified torque.
217. Refit the fifth gear spool retainer and tighten the bolts and washer 7 Nm (5 lbf ft) and fit a new nylon insert into the trunnion housing and secure with a new circlip.
218. Invert the gear selector housing and fit the trunnion housing to the selector shaft, ensuring the locating bolt aligns with the shaft indent. Coat the bolt threads with Loctite 290. Tighten bolt to the specified torque.
219. Fit a new gear lever gasket and locate the gear lever housing, spring washers and bolts. Tighten bolts to the specified torque.
220. Fit the two bias spring adjustment screws and lock nuts.
221. Place the bias spring in position with the spring legs either side of the gear lever housing and retain with a roll-pin.
222. Coat the upper and lower spheres of the gear lever shaft with Duckhams Q.5848 or Shell Alvania RI and locate the lever in the gearbox and retain with the bolt and special lock washer.
223. Using a screw driver lift the bias spring legs over the gear lever crosspins. Do not overstress the spring legs. Refit the main gear lever with the gaiter. Align the marks made when dismantling. Tighten the 10 mm 'Nyloc' nut.
224. Select first or second gear. It may be necessary to rotate the mainshaft whilst manipulating the gear lever.
225. Locate the reverse gear plunger assembly on the right hand side viewed from rear, giving sufficient load on the trunnion to eliminate side play. Whilst maintaining a light finger pressure, measure the clearance between the plunger assembly casting and gear selector casting. Add 0,6 mm to the measured figure and select suitable thickness shims to equal the total.
226. Remove the reverse plunger assembly, fit the required thickness shim(s) and refit the plunger assembly, spring washers and bolts. Tighten to the specified torque.
227. Fit the fifth gear stop on the left hand side viewed from the rear, giving sufficient load on the trunnion to eliminate side play. Whilst maintaining a light finger pressure, measure the clearance between the plunger assembly casting and gear selector casting. Add 0,6 mm to the measured figure and select suitable thickness shims to equal the total.
228. Remove the fifth gear stop, fit the required thickness shim(s). Refit the gear stop assembly, spring washers and bolts. Tighten bolts to the specified torque.
229. To adjust the bias springs with the unit completely assembled, engage either third or fourth gear.



230. Adjust the two adjusting screws until both legs of the spring are approximately 0,5 mm clear of the cross-pin in the gear lever. This should allow a certain amount of radial movement of the gear lever without the cross-pin contacting either of the spring legs.
231. Apply a slight load to the gear lever knob in a left hand direction to position the gear lever at one extreme of the radial play. Adjust the right hand adjusting screw downwards until the right hand spring leg just makes contact with the cross-pin on the right hand side.
232. Repeat instruction 229 in the opposite direction.
233. At this stage, radial play will still be present, but at the other extreme the cross-pin should just make contact with the spring leg on the other side.
234. Lower both adjusting screws equal amounts until the radial play is just eliminated. Tighten locknuts.
235. Return gear lever to neutral position and rock across the gate several times. The gear lever should return to the third and fourth gate. If not, repeat the aforementioned procedure.
236. Fit the rubber gaiter and secure with a strap.

LT 230 R TRANSFER BOX

The following operations can be carried out with the gearbox in the vehicle. For ease of working, the vehicle should be raised on a ramp or placed over a pit. Also, the battery should be disconnected for safety.

RENEW SPEEDOMETER DRIVE PINION

1. Raise the vehicle on a ramp.
2. Remove the speedometer drive clamp and nut and withdraw the cable.
3. Prise out the drive pinion assembly.
4. Push in a new assembly and fit the speedometer cable and secure with the clamp and nut.

RENEW REAR OUTPUT SHAFT OIL SEAL

Special tool:
18G1422

1. Disconnect the battery for safety.
2. Disconnect the rear propshaft from the output flange.
3. Remove the brake drum retaining screws and withdraw the drum.
4. Remove the two back plate bolts that also retain the oil catcher and remove the catcher.

NOTE: An hexagonal type socket should be used for these bolts.

5. Remove the output shaft nut and washer and withdraw the flange.
6. Using the slot provided, lever off the dust cover.
7. Prise out the output shaft oil seal(s).
8. Using special tool 18G1422 fit the double-lipped oil seal, open side inwards, with the seal in contact with the bearing circlip, taking care not to touch the seal lips.

NOTE: The double-lipped oil seal supersedes the two oil seals used on early production.

9. Fit the dust cover.
10. Lubricate the surface of the flange which runs in the seal and carefully fit the flange.

NOTE: To renew the flange bolts first remove the circlip before fitting the flange.

11. Secure the flange with the nut and washer and tighten to 146 to 179 Nm (108 to 132 lb ft).
12. Fit the oil catcher to the back plate using silicone rubber sealant and secure with the two back plate bolts (with plain washers).
13. Fit the brake drum and retain with the two screws.
14. Reconnect the propeller shaft.

RENEW FRONT OUTPUT SHAFT OIL SEAL

Special tool:
18G1422

1. Disconnect the front propeller shaft from the flange and move to one side.
2. Remove the output shaft nut and washer and withdraw the flange.
3. Remove the oil seal shield.
4. Prise out the oil seal(s).

NOTE: The double-lipped oil seal supersedes the two oil seals used on early production.

5. Using special oil seal replacer tool 18G1422 fit the double-lipped oil seal, open side inwards, with the seal in contact with the bearing circlip, taking care not to touch the seal lip.
6. Lubricate the running surface of the flange and fit it together with the oil seal shield.
7. Secure the flange with the nut and washer and tighten to 146 to 179 Nm (108 to 132 lb ft).
8. Refit the propeller shaft.

REMOVE INTERMEDIATE SHAFT AND GEARS

Service tool:
RO605862

1. Drain the transfer gearbox oil.
2. Disconnect the rear propshaft from the output flange.
3. Remove the two screws and withdraw the brake drum.
4. Remove the four bolts securing the brake back plate and withdraw the back plate and oil catcher.

NOTE: An hexagonal type socket should be used for these bolts.

5. Remove the intermediate shaft keeper plate, retained by a single bolt.
6. Remove the ten bolts and remove the bottom cover plate.
7. Using service tool RO605862 withdraw the intermediate shaft whilst holding the gear cluster. Collect the bearings and thrust washers from both ends of the cluster.
8. Remove the two 'O' rings, one from the shaft, the other from the casing.

Fit intermediate shaft gears

9. Fit the 'O' ring to the intermediate shaft.
10. Fit the 'O' ring into the front of the transfer case.
11. Lubricate thrust washers, bearings, shaft and spacer.
12. Fit needle bearings with spacer interposed.
13. Fit front thrust washer to slot in transfer case (plain side to case).
14. Locate gear assembly partially into the transfer case so that it rests on the front thrust washer.

15. Locate rear thrust washer (plain side uppermost) into slot in transfer case.
16. Gently push gear assembly into mesh.
17. Using a screwdriver through the intermediate shaft hole guide the locating tab on the rear thrust washer into the slot provided in the transfer case.
18. Align gear and thrust assembly and slide the intermediate shaft into the transfer box from the rear.
19. Align the shaft so that the lock plate in the end is on top.
20. Apply Loctite 290 to the lock plate bolt threads. Locate lock plate into position and fit securing bolt (with spring washer).
21. Lever the gear assembly to one side and measure the end-float with feeler gauges. This should be between 0,08 and 0,35 mm (0.003 and 0.014 in).
22. Grease and fit the bottom cover joint washer.
23. Apply Loctite 290 to the ten bolts and evenly tighten to 22 to 28 Nm (16 to 21 lbf ft).
24. Fit the oil catcher to the brake plate, using silicone rubber sealant and secure the backplate with the four bolts. The two bolts securing the oil catcher are fitted with plain washers.
25. Fit the brake drum and retain with the two screws.
26. Connect the rear prop shaft.
27. Refill the transfer box with the correct oil.

OVERHAUL LT230R TRANSFER GEARBOX

Service tools:

RO 605862 — Intermediate shaft removal

18G1271 — Seal remover

18G1205 — Flange wrench

18G257 — Circlip pliers

18G1422 — Oil seal replacer

18G1423 — Stakenut remover

MS47 — Hand press

18G47BB/1 — Collars

18G47BB/3 — Button

18G47BB/2 — Collars

1801424 — Differential centre bearing drift

18G47-7 — Collars and buttons

LST 47-1 — Collars

REMOVE ASSEMBLIES FOR OVERHAUL

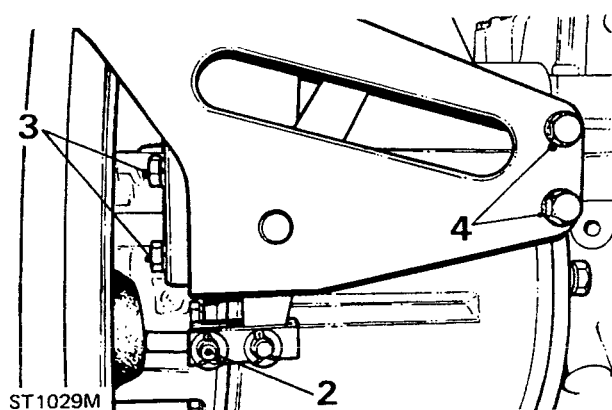
(Instructions 1 to 33)

1. Having removed the complete gearbox and transfer box assembly. The transfer box is separated from the gearbox on the work bench.

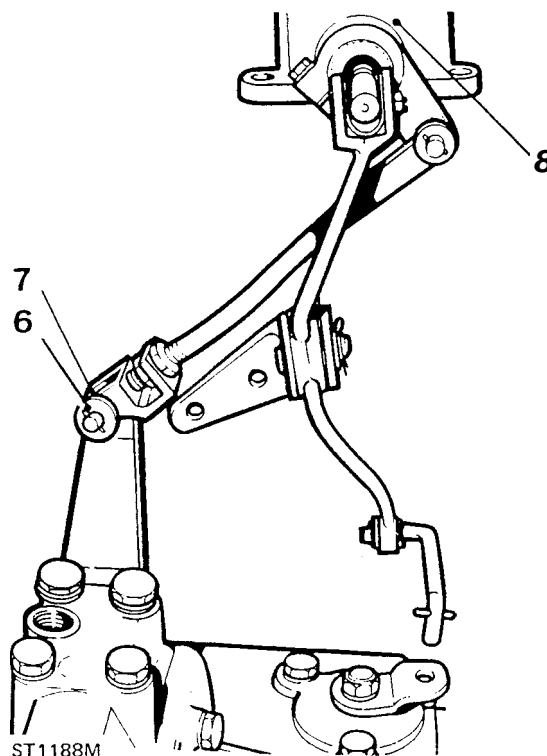
NOTE: To facilitate removal of various items on the work bench, obtain suitable wooden blocks to enable the transfer box to be turned and propped up as required.

Hand brake linkage removal

2. Remove the split pin and clevis pin to release the handbrake linkage from the brake operating lever.
3. Remove the two bolts (with spring washers) securing the rear end of the handbrake mounting bracket to the casing, the lower bolt is shorter.
4. Remove the two bolts (with spring washers and distance pieces) securing the front side of the handbrake mounting bracket and remove from the transfer box.



6. Disconnect the bottom of the high/low connecting rod from the high/low operating arm by removing the split pin and clevis pin.
7. Remove the plastic bushes from the operating arm.
8. Remove the gearchange housing complete with linkage.

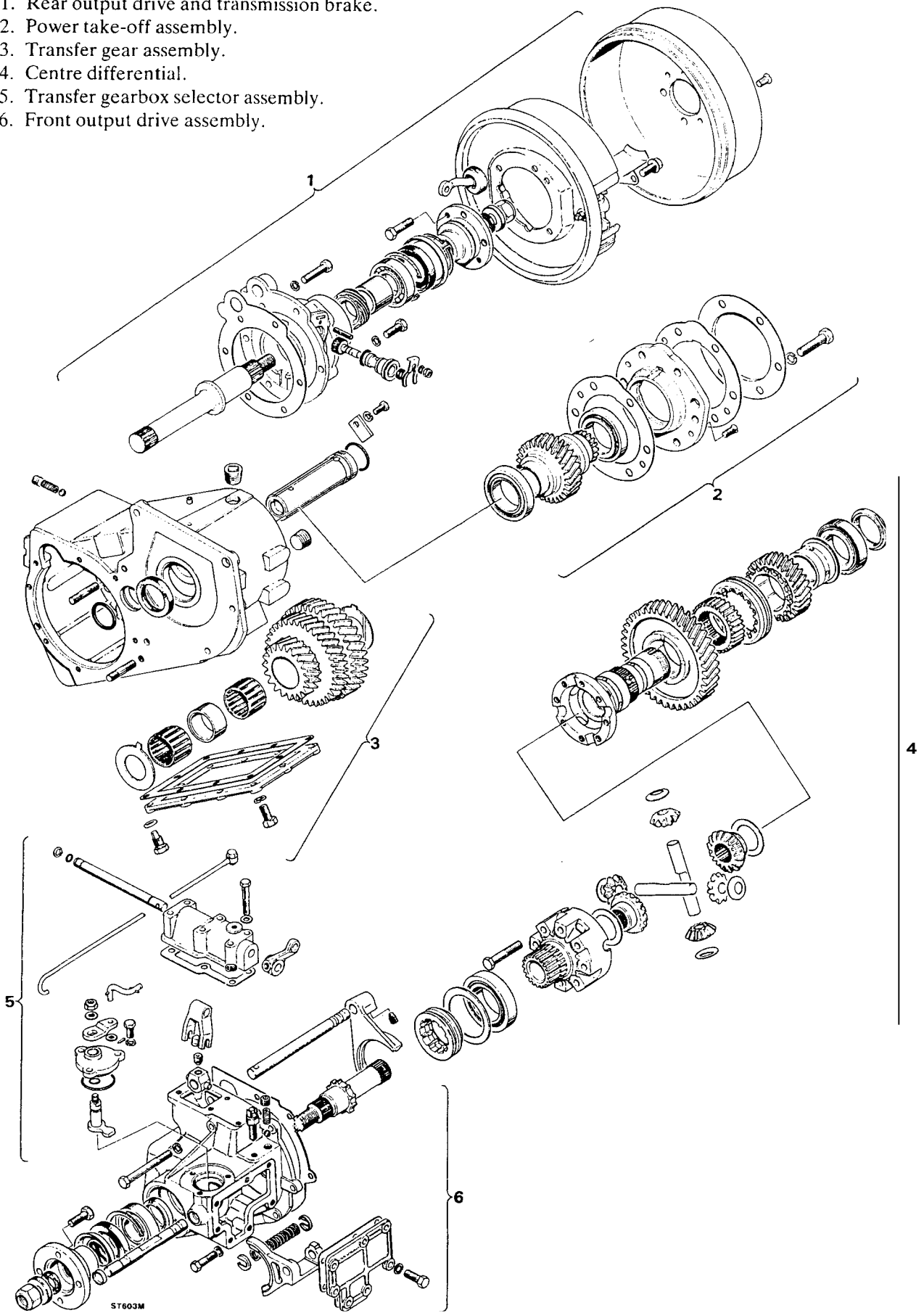


Transfer box mounting removal

5. Remove the bolts retaining the right hand rubber mounting plate.

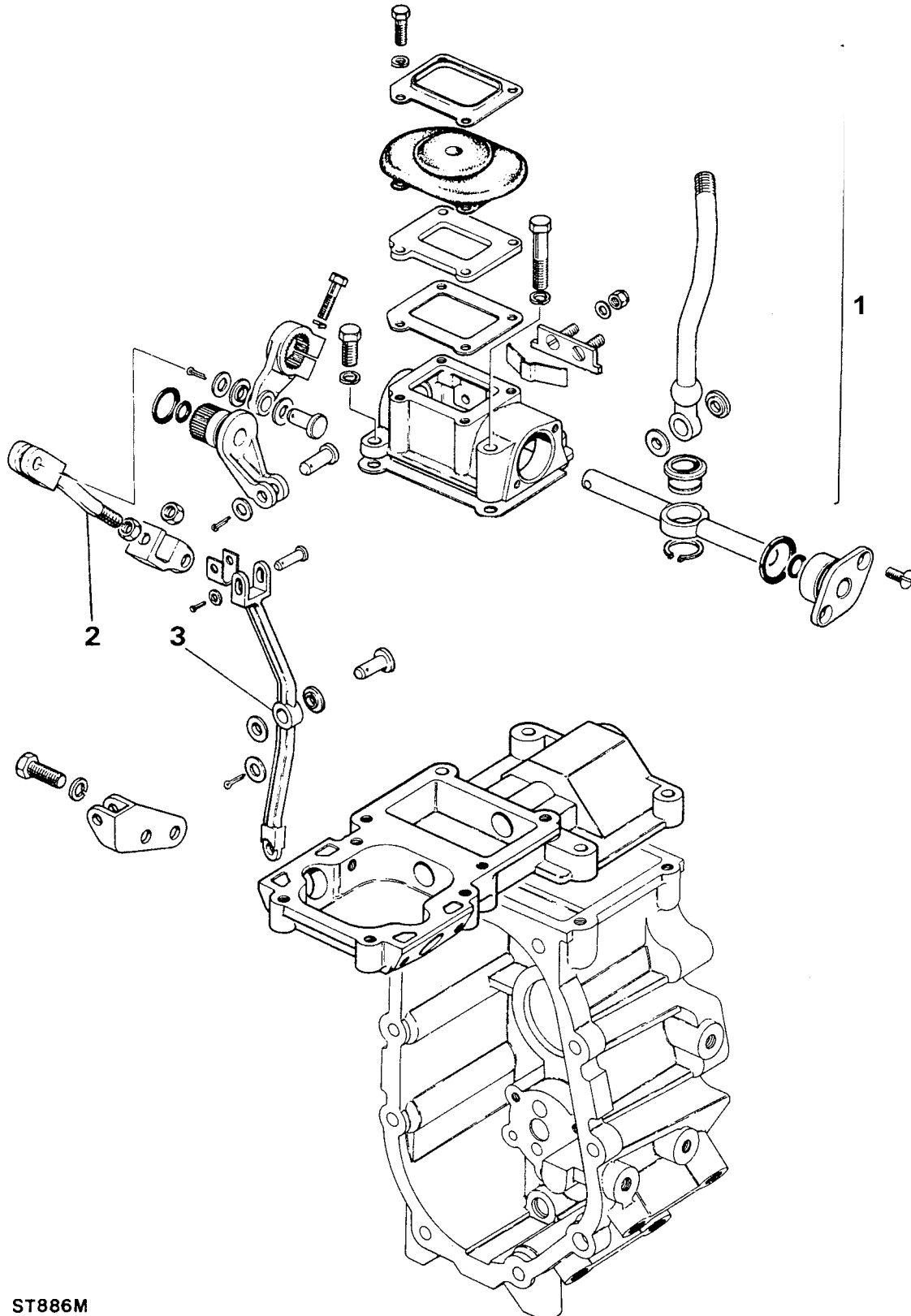
GENERAL ARRANGEMENT OF LT230R TRANSFER GEARBOX

1. Rear output drive and transmission brake.
2. Power take-off assembly.
3. Transfer gear assembly.
4. Centre differential.
5. Transfer gearbox selector assembly.
6. Front output drive assembly.



GENERAL ARRANGEMENT OF TRANSFER GEARCHANGE HOUSING

1. Main selector lever.
2. Transfer gear selector assembly.
3. Differential **lock** selector assembly.



ST886M

Transmission brake removal

9. Remove the two countersunk brake drum retaining screws and **pull** off the drum.
10. Remove the four bolts securing the brake backplate, two of these also retain the oil catcher.

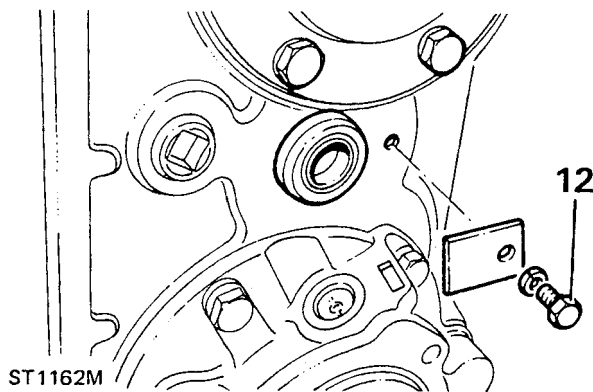
NOTE: An hexagonal type socket should be used for these bolts.

Bottom cover removal

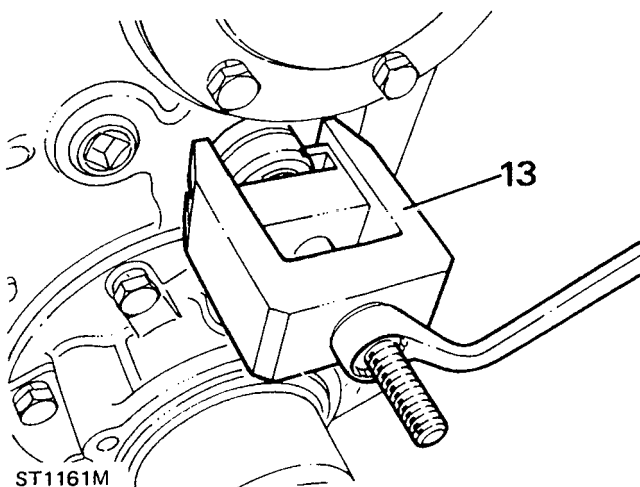
11. Remove the ten bolts retaining the bottom cover.

Intermediate shaft removal

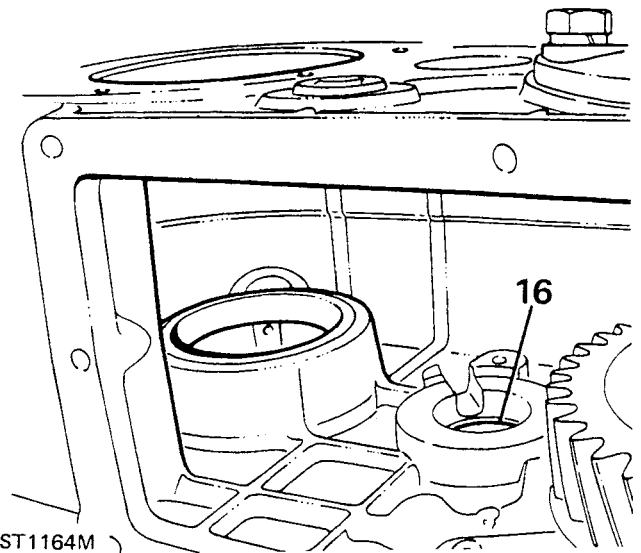
12. Remove the shaft lock plate retained by a single bolt at the rear face of the transfer box.



13. Withdraw the intermediate shaft, using a screw driver in the slotted end. Where the shaft cannot be easily withdrawn use extractor RO605862.



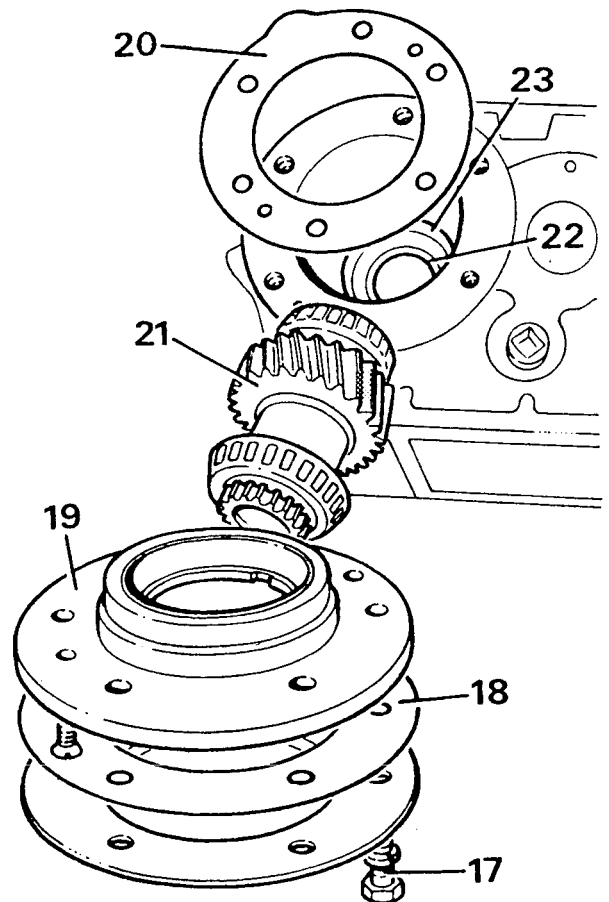
14. Lift out the intermediate gear cluster, roller bearings and spacer.
15. Remove the thrust washers.
16. Remove the 'O' ring from the intermediate shaft and the transfer box case.



Power take off cover removal

17. Remove the four bolts retaining the circular P.T.O. cover and the speedometer cable clip plate.
18. Remove the gasket.

NOTE: The other two bolts were removed with the gearbox assembly cradle.

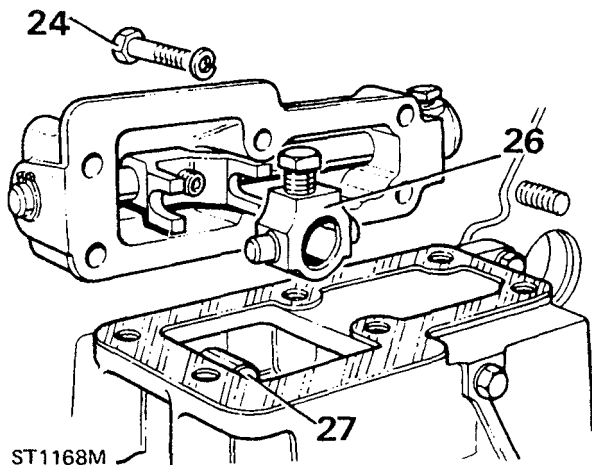


Input gear removal

19. Remove the two countersunk screws and release the mainshaft bearing housing.
20. Remove the gasket.
21. Remove the input gear assembly.
22. Prise out and discard the oil seal at the front of the transfer case using service tool 1861271.
23. Drift out the input gear front bearing track.

High/low selector housing removal

24. Remove the six bolts to release the selector housing.
25. Remove the gasket.



Front output shaft housing removal

26. Slacken the square headed set screw securing the yoke to the high/low selector shaft inside the high/low selector housing aperture.
27. If necessary use a screw driver to move the selector shaft rearwards and allow the yoke to be lifted out.
28. Remove the eight bolts to release the front output shaft housing assembly. The upper middle bolt is longer.

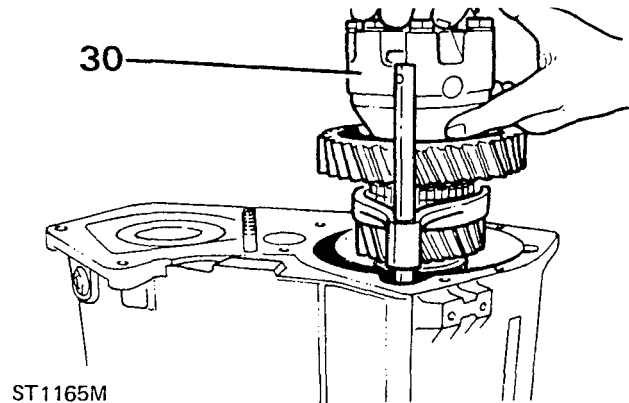
NOTE: The 'radial' dowel in the transfer box face should not be disturbed.

Centre differential removal

29. Remove the high/low selector shaft detent plug, spring and ball.

NOTE: The ball may be more easily retrieved from inside the transfer case after the selector shaft is taken out.

30. Remove the centre differential unit with the selector shaft/fork assembly.



Rear output shaft housing assembly removal

31. Remove the six screws to release the housing. The upper screw is longer.
32. Remove the gasket.

NOTE: Removal of the above housing will reveal the centre differential rear bearing track in the transfer box casing. Before drifting out, either unscrew the two studs and radial dowel projecting from the transfer box front face or use suitable wooden blocks to support the box to avoid damage to these items.

33. Drift out the differential rear bearing track.

NOTE: If it is required to completely strip down the transfer box to the basic casting, remove the level, filler and drain plugs.

IMPORTANT: Clean all parts ensuring any traces of Loctite are removed from faces and threads. Ensure that the magnetic drain plug is thoroughly cleaned. Renew oil seals and examine all other parts for wear or damage, renew as necessary.

Reassembling

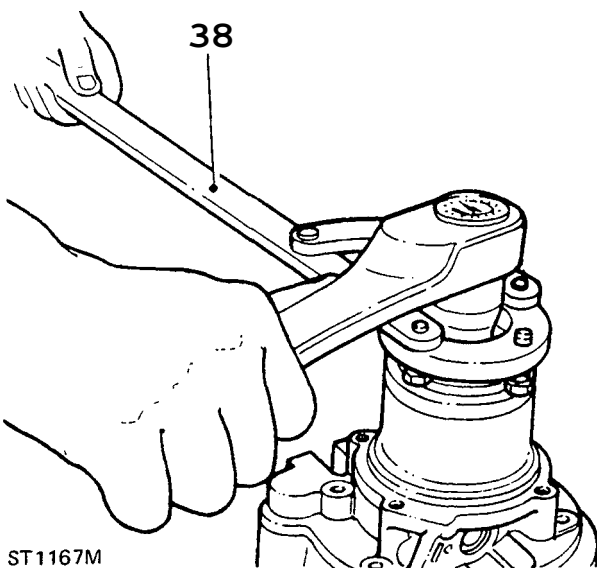
- 34. Ensure that all faces of the transfer box are clean.
- 35. Check that level/filler and drain plugs are in position.
- 36. Fit the two studs which are used for part retention of the extension housing.
- 37. Screw in the 'radial' dowel. It is important that its projecting blade is set radially in line with the tapped fixing hole centres in the transfer box casing.

Rear output shaft housing — Overhaul (Instructions 47 to 73)

Dismantling

- 38. Using flange wrench 1861205 remove the flange nut, steel and felt washers.

NOTE: Ensure flange bolts are fully engaged in the wrench.



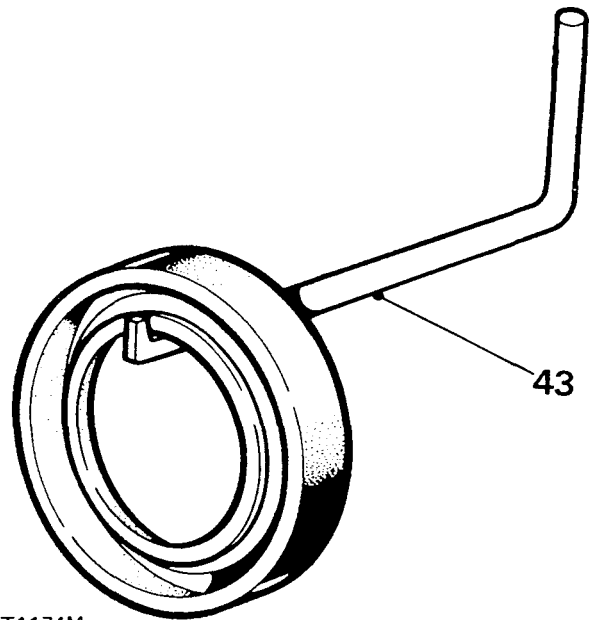
ST1167M

- 39. Remove the output shaft flange with circlip attached. If necessary, use a two-legged puller.

NOTE: The circlip need only be released if the flange bolts are to be renewed.

- 40. Remove the speedometer spindle housing. This can be prised out with a screw driver.
- 41. Remove assembly from vice and support the housing to allow removal of the shaft, drifting it out by striking the flange end of the shaft.
- 42. Carefully prise off the oil catch ring using a screw driver in the slot provided.
- 43. Prise out and discard the seal(s) using tool 18G 1271.
- 44. Using circlip pliers 18G257 remove the circlip retaining the bearing.
- 45. Drift out the bearing from the back of the housing.

- 46. Remove the speedometer driven gear and spindle from the spindle housing.
- 47. Remove the 'O' ring and oil seal.



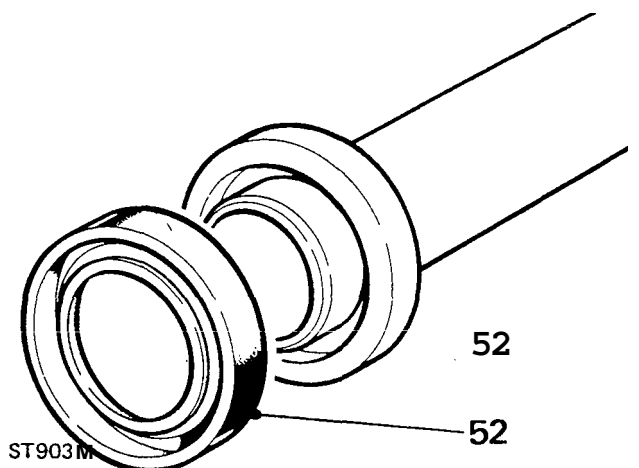
ST1174M

- 48. Slide off the spacer and speedometer drive gear from the output shaft.
- 49. Clean all parts, renew oil seals and Nyloc flange nut and examine all other parts for wear or damage, renew as necessary.

Reassembling

- 50. Press the output bearing into the housing. Do not use excessive force. If necessary warm the housing and case.
- 51. Fit the bearing retaining circlip using circlip pliers 186257.
- 52. Fit a new dual lip oil seal (open side inward), with the seal in contact with the bearing circlip it is essential to use replacer tool 1861422.

NOTE: On early production two separate seals were used, these should be replaced with the new dual lip seal.



ST903M

53. Carefully charge the lips of the seal with grease.
54. Fit oil catch ring on to housing.
55. Fit oil seal into speedometer spindle housing (open side inwards) with a suitable tube.
56. Fit 'O' ring to speedometer spindle housing.
57. Lubricate seal and 'O' ring with oil.
58. Locate speedometer driven gear and spindle in spindle housing and push into position.
59. Slide speedometer drive gear and spacer onto output shaft.
60. Fit output shaft to the bearing in the rear output shaft housing.
61. Examine the flange seal track to check for any damage that may harm the seal. Retain for fitting later.
62. Locate speedometer spindle housing assembly in the output shaft housing and push in flush with housing face.

NOTE: Before fitting the rear output shaft housing to the transfer box casing the centre differential rear bearing track must be fitted.

63. Drift the centre differential rear bearing track into the transfer box casing 1,5 mm ($\frac{1}{16}$ in) below the outer face of the casing. Check the depth before proceeding.

Fitting rear output shaft housing to transfer box

64. Grease and fit housing gasket and locate the housing in position on the transfer box.

NOTE: If the differential rear main bearing track has been correctly fitted there will be a gap between the housing face and the gasket at this stage.

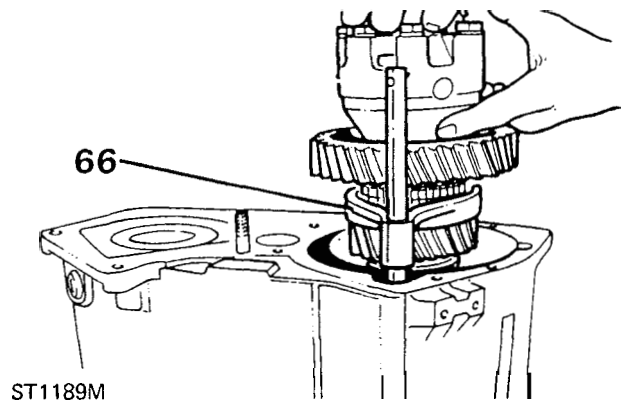
65. Apply Loctite 290 to the threads of the six housing securing screws, noting that the upper screw is longer. Fit the screws (with spring washers) evenly tightening them to the specified torque. This will press in the rear main bearing track to the correct position and seat the housing.

Centre differential Unit — Overhaul

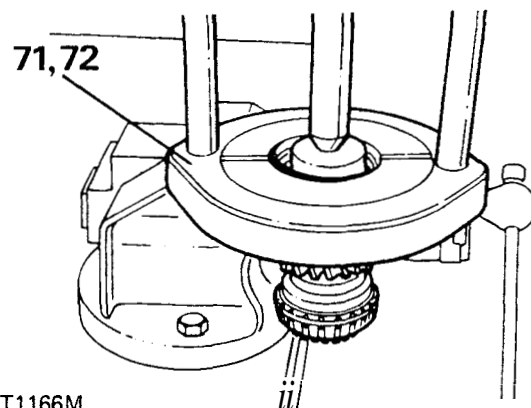
(Instructions 66 to 119)

Dismantling

66. Detach the high/low selector shaft and fork.

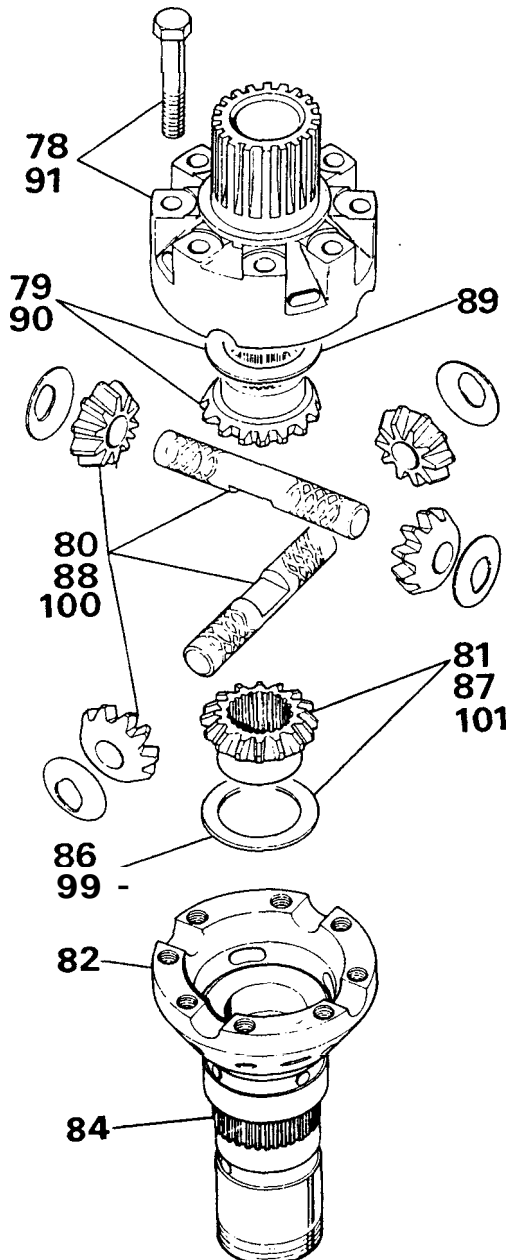


67. Using soft jaws secure the differential unit in a vice with the 'stake' nut uppermost.
68. Remove the peened-over metal to facilitate removal of the nut.
69. Remove the 'stake' nut using tool 18G1423.
70. **Remove the differential unit from the vice.**
71. **Secure hand press MS47 in vice** with collars 18G47BB/1 and using button 18G47BB/3 remove rear taper (twenty-four) roller bearing and collars LST 47-1 for latest (twenty-three) roller bearing.
72. Substituting collars 18G47BB/2 remove front taper roller bearing.
73. **Remove the hand press from the vice.**



74. Remove the high range (smallest) differential gear and its bush.
75. Mark the relationship of the high/low selector sleeve to the hub and remove the sleeve.

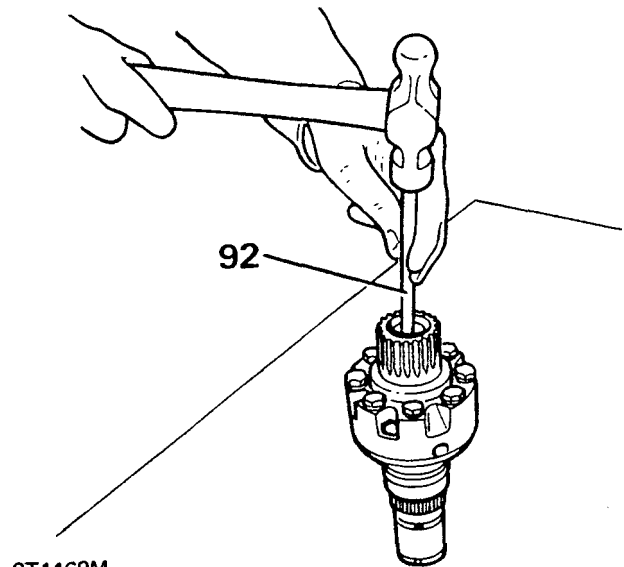
76. Using a suitable press behind the low range (largest) gear carefully remove both high/low hub and low range gear together. Alternatively, the rear carrier bearing, high output gear and bush, high/low hub and sleeve and low output gear can be pressed off in one operation by supporting the differential side of the low gear.
77. **Using soft jaws secure the differential unit in the vice by gripping the inner hub splines.**
78. Remove the eight retaining bolts and lift off the front differential case.
79. Lift off the front (upper) bevel gear and thrust washer.
80. Remove both pairs of side gears with their respective shafts and dished washers together.
81. Lift out the remaining rear (lower) bevel gear and thrust washer.
82. **Remove the rear differential case from the vice.**
83. Clean all parts, examine for wear or damage, renew as necessary.



ST1171M

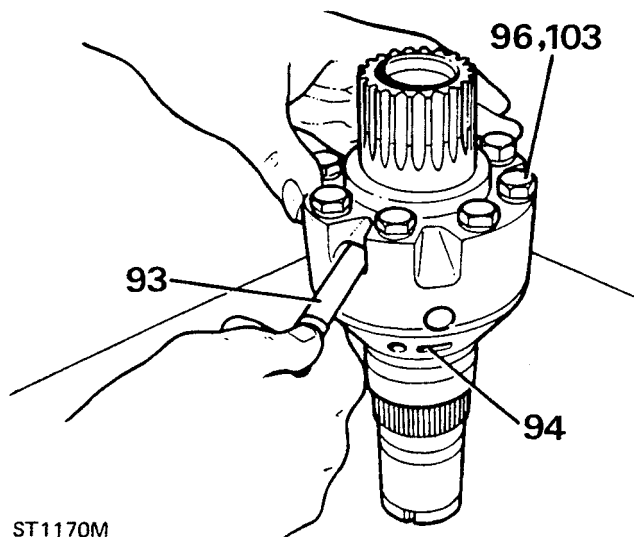
Obtaining differential backlash by checking bevel gear end-float

84. **Using soft jaws secure the rear differential case in the vice by gripping the inner hub splines.**
85. Ensure that all differential components are dry to assist in checking end-float.
86. Using a micrometer measure one of the bevel gear thrust washers and note thickness.
87. Fit the thrust washer and bevel gear to the rear (lower) differential case.
88. Assemble the side gears and dished washers on their respective shafts and fit to the rear case.
89. Measure the remaining bevel gear thrust washer, noting its thickness.
90. Fit the thrust washer and bevel gear to the front case.
91. Fit and align the front differential case tightening the eight securing bolts to the specified torque.
92. Ensure that the front bevel gear is fully in mesh by tapping it down, using a punch through the front differential case.



ST1169M

93. Measure the front bevel gear end-float with feeler gauges through the slots provided in the front differential case. This must be between 0,25 and 0,75 mm (0.001 and 0.003 in) maximum.
94. **Invert differential unit in vice** and repeat the above procedure (items 92 and 93) for the rear bevel gear in the rear differential case.
95. **Return the differential unit to its former position in the vice** i.e. with the front differential case uppermost.



ST1170M

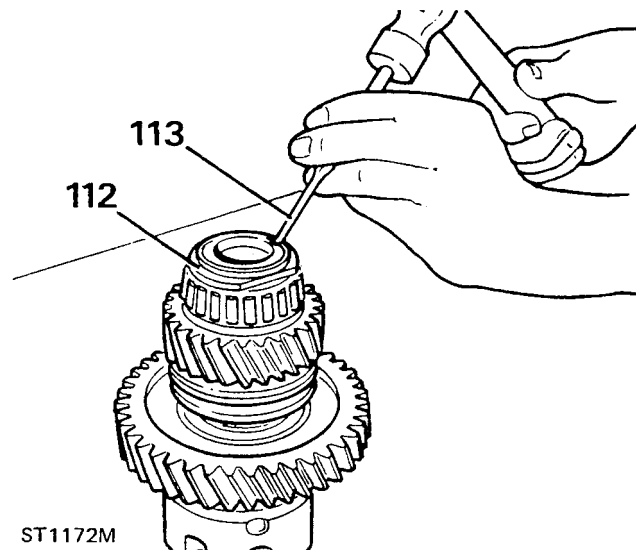
96. Remove the eight securing bolts and lift off the front differential case.
97. Remove the bevel gears and thrust washers, and side gear assemblies.
98. Select correct thrust washers required for final reassembly.

Reassembling

99. Fit the selected thrust washer and bevel gear to the rear (lower) differential case.
100. Assemble the side gears and dished washers on their respective shafts and fit to the rear case.
101. Fit the other selected thrust washer and bevel gear to the rear case.
102. Lubricate all parts with oil.
103. Fit and align the front differential case, locate the eight securing bolts and tighten to the specified torque.
104. Finally check that the differential gears revolve freely.
105. Place the front (outer) differential bearing on the front differential case and press into position using larger end of tool 18G1424.
106. **Invert the differential unit in the vice.**
107. Fit the low range gear (largest) to the rear differential case (with its 'dog' teeth uppermost).
108. Press the high/low hub onto the splined area of the case. Check end-float of low range gear. See Data at end of section.
109. Slide the high/low selector sleeve onto the hub outer splines, observing the alignment marks.
110. Fit the bush into the high range (smallest) gear and slide the bushed gear onto the rear differential case. Check end-float of high range gear and running clearance of gear on bush. See data at end of section.

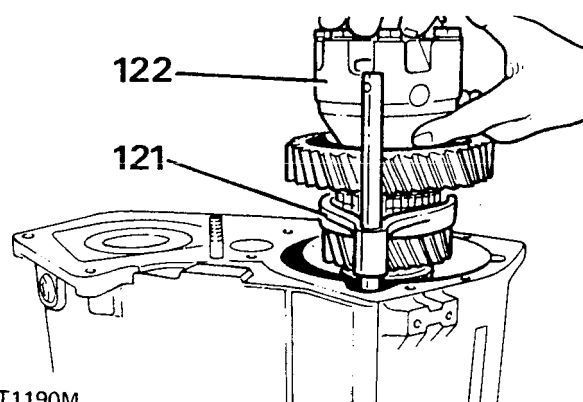
NOTE: If the clearances vary considerably from those specified in the data the assembly must be rebuilt.

111. Place the rear differential bearing on the rear differential case and press into position using the smaller end of tool 1861424.



ST1172M

112. Fit the 'stake' nut using tool 18G1423 and tighten to the specified torque.
113. Peen the nut flange into the slot provided.
114. **Remove the differential unit from the vice.**
115. Lubricate gears, bearings, sleeve and bush with oil.
116. Clean and check the high/low selector fork assembly for wear and renew if necessary.
117. To renew the selector fork remove the square set screw retaining it to the selector shaft and ensure any traces of Loctite are removed from the threads.
118. Refit the selector fork with the fork boss towards the three detent grooves. Align the hole in the fork boss with the indent in the shaft nearest to the detent grooves.
119. Apply Loctite 290 to the set screw threads and fit the set screw to the correct torque.
120. **Prop up the transfer box so that its front side is uppermost.**
121. Fit the selector fork to the high/low selector sleeve in the differential assembly.
122. Locate the differential assembly and high/low selector fork assembly into the transfer case. It may be necessary to rotate the output shaft to ease fitment.
123. Fit the selector shaft detent ball and spring, apply Loctite 290 to the detent plug threads, screw in the detent plug until the spring is just coil bound, then back off two complete turns.



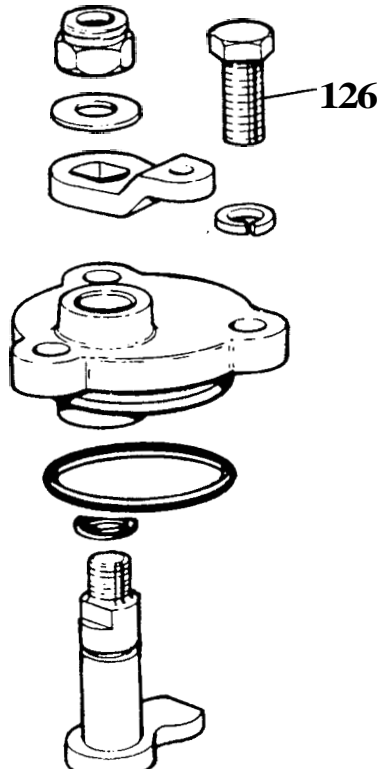
ST1190M

Front output shaft housing — Overhaul

(Instructions 125 to 175)

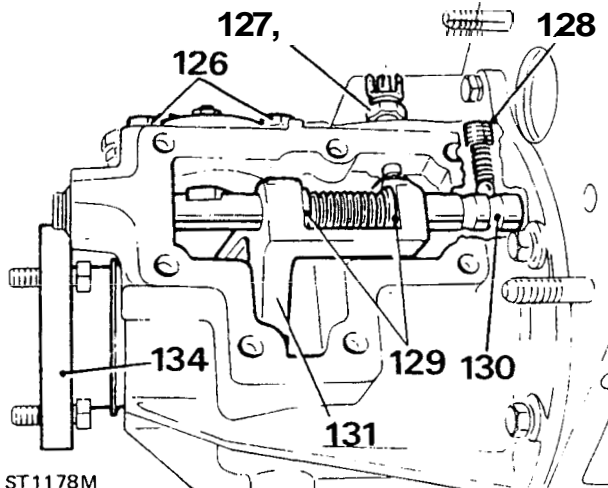
Dismantling

- 124. Secure the housing in the vice, using soft jaws.
- 125. Remove the seven screws securing the differential lock selector side cover and release the side cover and gasket.
- 126. Remove the three screws securing the differential lock finger housing and lift out the complete assembly.



ST1173M

- 127. Slacken the lock nut retaining the differential lock switch and unscrew the switch.



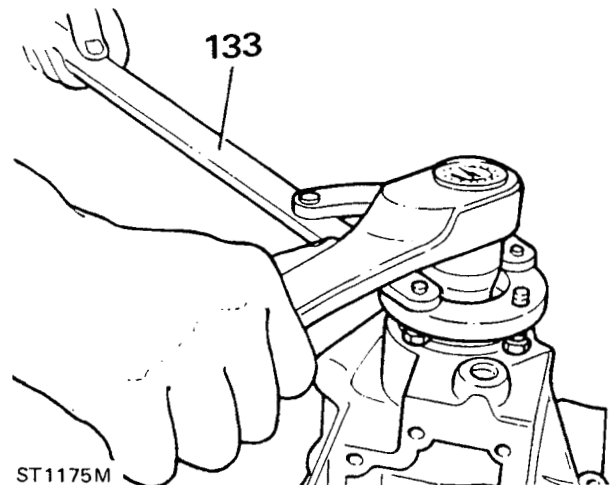
ST1178M

- 128. Remove the detent plug from the top of the housing and lift out the spring and ball using a magnet.
- 129. Compress the selector fork spring inside the housing and slide out the spring locating 'C' caps.
- 130. Slide the selector shaft out of the rear of the housing.
- 131. Remove the selector fork and spring through the side cover aperture.
- 132. Lift out dog sleeve from the back of the output shaft housing.
- 133. Using the flange wrench 18G1205 remove the flange nut, steel and felt washers. A two-legged puller may be necessary.

NOTE: Ensure that flange bolts are fully engaged in the wrench.

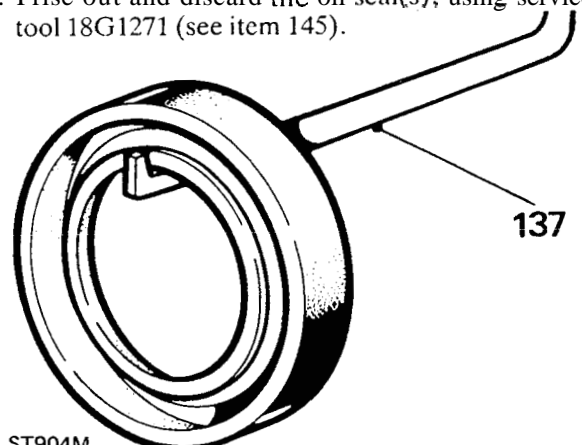
- 134. Remove the output shaft flange with oil seal shield.

NOTE: These parts need not be separated unless the flange bolts are to be renewed.



ST1175M

- 135. Drift the front output shaft rearwards out of the housing.
- 136. Slide off the collar from the output shaft.
- 137. Prise out and discard the oil seal(s), using service tool 18G1271 (see item 145).



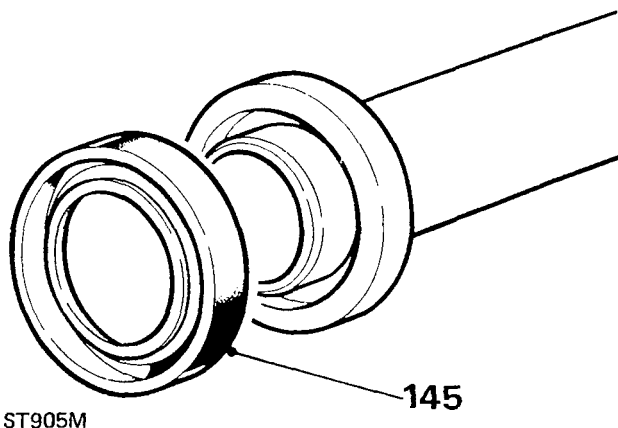
ST904M

138. Using circlip pliers 18G257 remove the circlip.
139. **Remove the housing from the vice** and drift out the bearing from inside.
140. Press out the differential front bearing cup and remove the shim behind it.
141. Clean all parts ensuring that any traces of Loctite are removed from faces and threads.
142. Renew oil seals and examine all parts for wear or damage, renew as necessary.

Reassembling

143. Press the front bearing into the housing. Do not use excessive force, if necessary, warm the housing assembly and case.
144. Fit the bearing retaining circlip, using circlip pliers 186257.
145. Fit a new dual lip oil seal (open side inward) until the seal is in contact with the bearing circlip. It is essential to use replacer tool 1861422.

NOTE: On early production two separate seals were used, these should be replaced with the new dual lip seal.



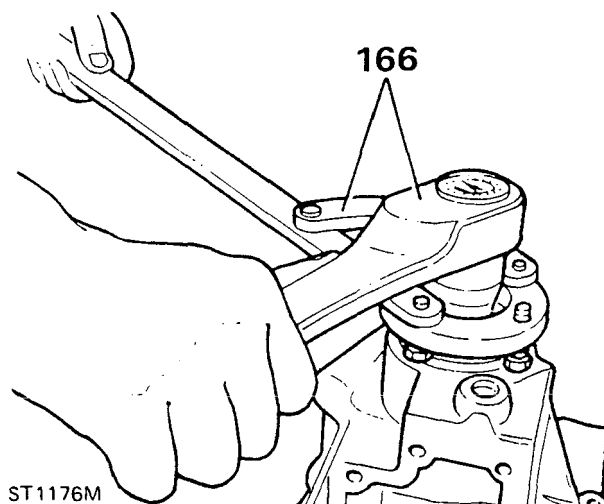
146. Carefully charge the lips of the seal with grease.
147. Slide the collar onto the front of the output shaft with its chamfered edge to the front.
148. Fit the output shaft through the back of the housing.
149. Examine the flange seal track to check for any damage that may harm the seal.

Obtaining bearing pre-load

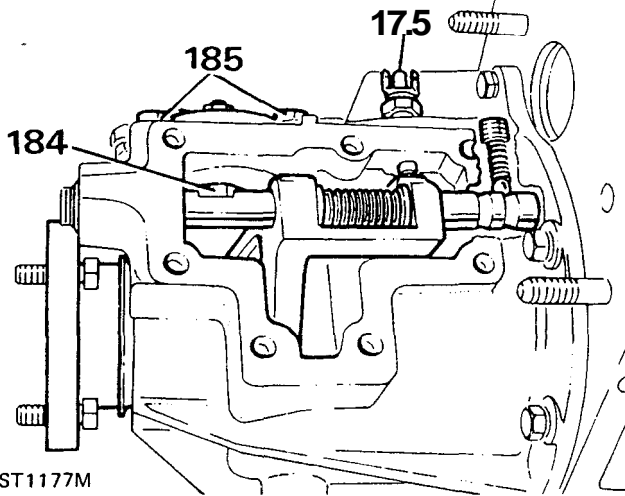
150. Measure the original differential front bearing track shim, noting its thickness.
151. Refit the original shim.
152. Drift the differential front bearing track into the housing.
153. Grease and fit a new gasket and locate the front output shaft housing on the transfer box.
154. Loosely retain the housing with the eight securing bolts (with spring washers), the upper middle bolt is longer. Do not fully tighten the bolts at this stage.

155. Engage high or low gear.
156. Check the rolling resistance of the differential, using a spring balance and a piece of string wound around the exposed splines on the high/low hub. Little or no resistance will register.
157. Tighten the bolts a little at a time, occasionally checking the rolling resistance. With the correct shim selected and the bolts tightened to the specified torque a pull of 1,8 to 4,5 Kg (4 to 10 lb) is required on the spring balance. This applies to new or used bearings.
158. If the reading is outside the above limits remove the front output shaft housing assembly from the transfer case.
159. Using a suitable extractor, withdraw the front differential bearing cup from the housing and exchange the shim for one of suitable thickness.
160. Refit the bearing cup.
161. Having obtained the correct rolling resistance prop-up the transfer box on the bench with the front side uppermost.
162. Grease and fit the front output shaft housing gasket and locate the housing on the transfer box.
163. Apply Loctite 290 to the threads of the housing securing bolts and fit the eight securing bolts (with spring washers). Note that the upper middle bolt is longer.
164. Turn the transfer box into its normal operating position.
165. Fit both input and output flanges as follows.
166. Using flange wrench 18G1205 and a torque wrench pull up output shaft to correct position. Check that the oil seal shield does not foul the housing.

NOTE: Ensure that flange bolts are fully engaged in the wrench.



167. Slide the dog sleeve onto the rear of the output shaft ensuring that the selector groove in the dog sleeve is to the front.
168. Compress the differential lock selector shaft spring, and fit it between the selector fork lugs.
169. Locate the selector fork inside the side cover aperture in the housing engaging the groove in the dog sleeve on the output shaft.
170. Fit the differential lock selector shaft into the housing from the back, grooved (detents) end last, and pass it through the selector fork lugs and spring and into the front of the housing.
171. Rotate the selector shaft until the two flats are uppermost.
172. Compress the spring slightly between the fork lugs and fit the two locating 'C' caps.



ST1177M

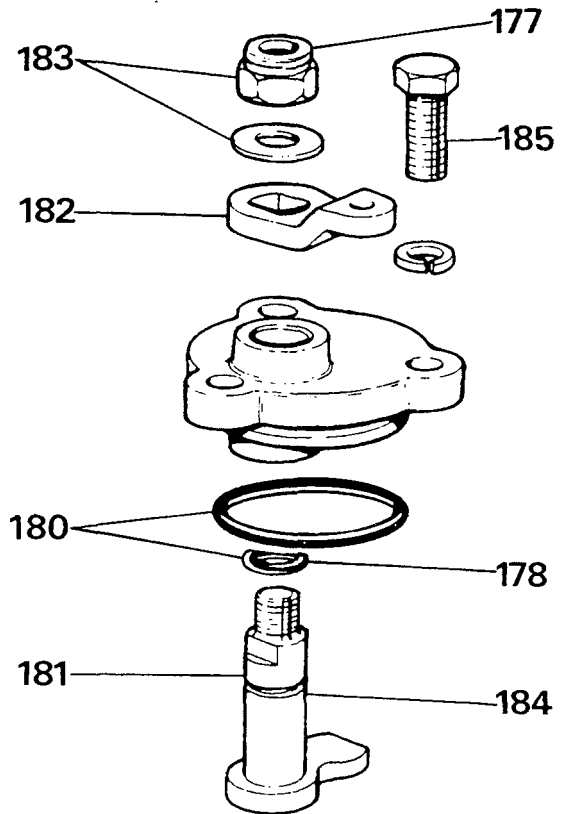
173. Fit the selector shaft detent ball and spring via the tapped hole in the top of the housing.
174. Apply Loctite 290 to the detent plug threads, screw in the detent plug until the spring is just coil bound, then back off two complete turns.
175. Loosely fit the differential lock switch in the tapped hole on top of the housing, leaving the locknut loose for adjustment.
176. Grease and fit the differential lock selector side cover gasket and fit the side cover, securing it with the seven bolts (with spring washers).

Differential lock finger housing — Overhaul

(Instructions 177 to 183)

Dismantling

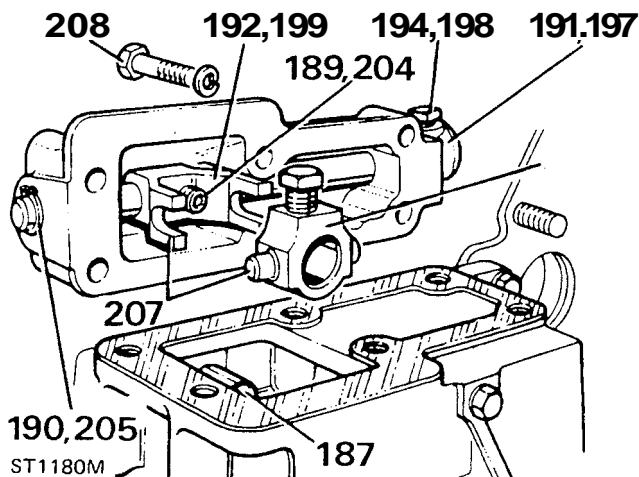
177. Remove and discard the Nyloc nut and release the lock lever and selector 'finger' from the 'finger' housing.
178. Remove and discard the 'O' rings from the selector finger and the selector finger housing.
179. Clean remaining parts, examine for wear or damage, renew as necessary.



ST1179M

Reassembly

180. Fit new 'O' rings to the finger housing and selector finger and lubricate with oil.
181. Locate the selector finger in the finger housing.
182. Fit the differential lock lever over the flats on the selector finger so that it will face forward in the operating position.
183. Fit the plain washer and a new Nyloc nut.
184. Fit the differential lock 'finger' housing assembly into the round aperture in the front output shaft housing locating the selector 'finger' on the flat on the selector shaft inside the housing.
185. Apply Loctite 290 to the 'finger' housing screw threads and fit the three securing screws (with spring washers) to the correct torque.
186. Grease and fit the differential lock selector side cover gasket and fit the side cover, securing it with the seven bolts (with spring washers).
187. Using a screwdriver inside the housing move the high/low selector shaft rearwards (i.e. into high range position) to provide access for fitting the yoke over the end of the selector shaft.
188. Locate the yoke on the selector shaft, apply Loctite 290 to the yoke set screw and fit the screw to the specified torque.



High/low selector housing — Overhaul

(Instructions 189 to 205)

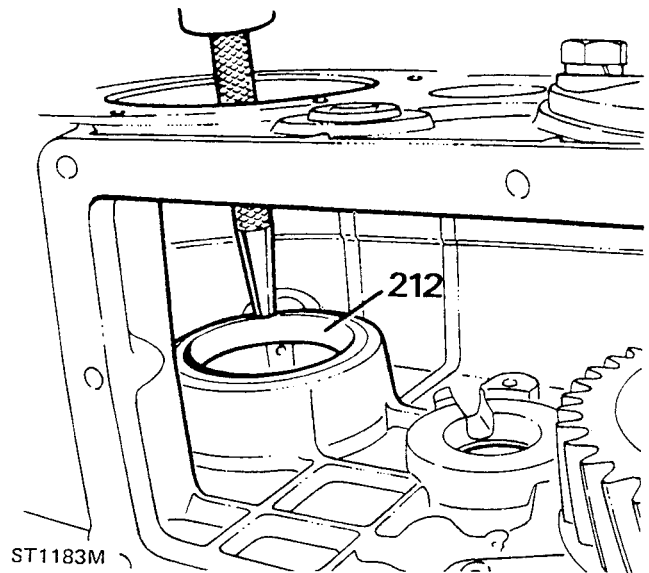
Dismantling

189. Remove the selector fork grub screw **completely**.
190. Remove the cross shaft retaining circlip.
191. Withdraw the cross shaft from the selector housing with the operating arm attached.
192. Lift out the selector fork from the housing.
193. Remove the two 'O' rings from the cross shaft.
194. Remove the operating arm from the cross shaft by removing the retaining set screw.
195. Clean parts ensuring that all traces of Loctite are removed, examine for wear or damage, renew as necessary.

Reassembling

196. Fit the 'O' ring to the operating arm end of the cross shaft.
197. Locate operating arm on the shaft blind hole.
198. Apply Loctite 290 to the operating arm set screw threads and fit the set screw.
199. Locate the selector fork inside the housing.
200. Slide the cross shaft into the housing passing it through the selector fork.
201. Fit the 'O' ring to the fork end of the cross shaft (inside the housing) and lubricate both 'O' rings.
202. Position the cross shaft fully home.
203. Locate the selector fork on the shaft blind hole.
204. Apply Loctite 290 to the fork grub screw threads and fit the grub screw.
205. Fit the circlip on the end of the cross shaft.
206. Grease and fit the gasket to the high/low selector housing aperture on the front output shaft housing.
207. Position the high/low selector housing so that the projecting selector fork engages the yoke side pins inside the housing.
208. Fit the six selector housing retaining bolts (with spring washers).
209. **Prop up the transfer box on the bench with front side uppermost.**

210. Fit the oil seal into the front of the transfer box (seal lip to rear of case) using replacer tool 18G1422.
211. **Prop up the transfer box on the bench with rear side uppermost.**
212. Drift in the input gear front bearing track from inside the back of the transfer box, using a suitable punch.

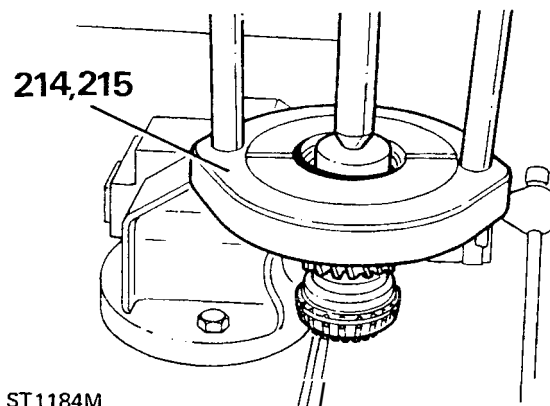


Input gear — Overhaul

(Instructions 231 to 237)

Dismantling

213. Clean all parts, examine for wear and damage, renew as necessary. Remove the bearings only if they are to be renewed.
214. **Secure hand press MS47 in vice** and using collars and buttons 18G47-7 remove the **front** taper roller bearing from the input gear assembly.
215. Reverse input gear assembly in hand press and remove the **rear** taper roller bearing.
216. **Remove the hand press from the vice.**



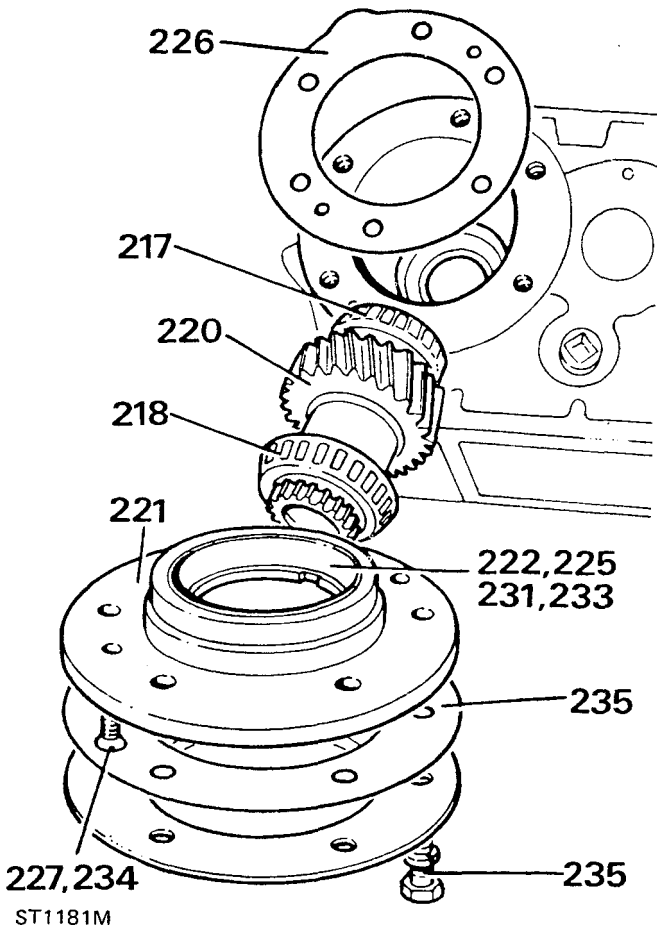
Reassembly

217. Locate the front taper roller bearing on the input gear assembly and press the bearing fully home.

- 218. Repeat above procedure and fit the **rear** taper roller bearing.
- 219. Lubricate both bearings with oil.
- 220. Fit input gear assembly into the transfer box from the rear (gear end first).

Obtaining bearing pre-load — with intermediate gear cluster removed

- 221. **Secure the mainshaft bearing housing in the vice.**
- 222. Press out the **rear** input gear bearing cup and remove the shim behind it.
- 223. Clean the main bearing housing and measure original shim, noting its thickness.
- 224. Fit the original shim to the main bearing housing.
- 225. Locate the **rear** bearing cup on the main bearing housing and press it fully home.
- 226. Apply grease to the gasket and fit onto the transfer box casing.
- 227. Fit the main bearing housing and tighten the two securing screws to the specified torque.



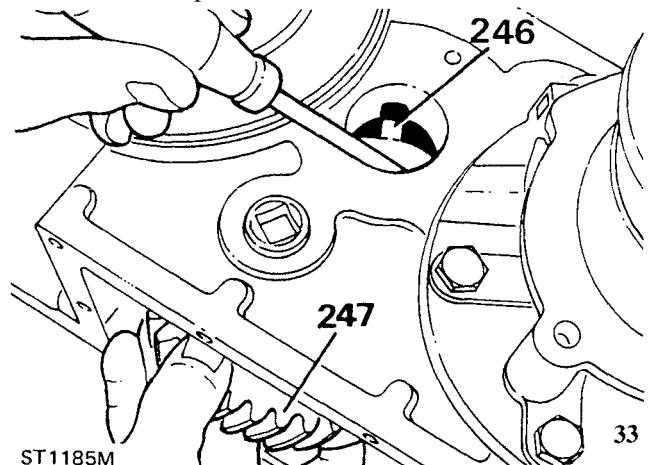
- 228. Wind sufficient string around the gear teeth to rotate the input gear. A pull of 1,4 to 3,6 Kg (3 to 8 lb) is required on the spring balance. This applies to new or used bearings.

NOTE: The pre-load can only be measured while the Transfer gearbox is separated from the main gearbox.

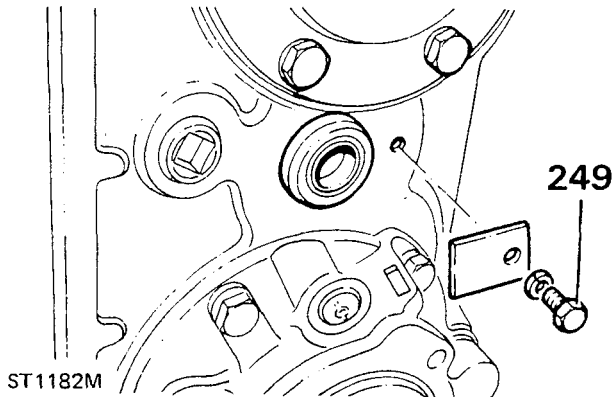
- 229. If the reading obtained is outside the above limits the original shim must be changed accordingly.
- 230. Remove the two screws retaining the mainshaft bearing housing.
- 231. Press out the rear bearing cup from the bearing housing and remove and discard the original shim.
- 232. Select a shim to the required thickness to obtain the correct pre-load of 0,02 to 0,07 mm (0.001 to 0.003 in) on reassembly.
- 233. Fit the shim to the main bearing housing and then press the rear bearing cup into position.
- 234. Fit the main bearing housing and tighten the two securing screws to the specified torque.
- 235. Grease and fit P.T.O. cover gasket and finally fit the P.T.O. cover securing it with six bolts (with plain washers) to the specified torque.

Intermediate gear assembly — Keassembly

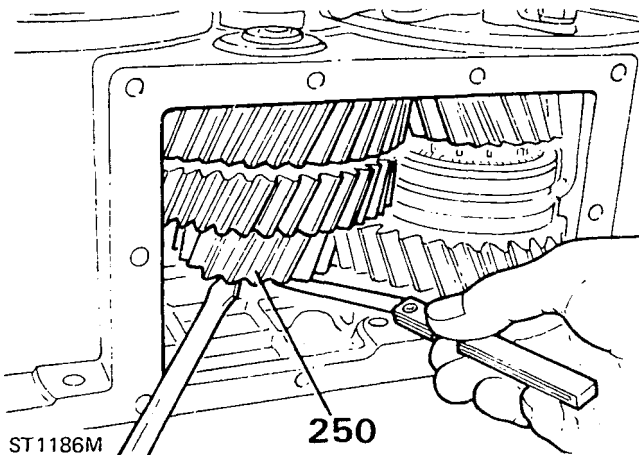
- 236. First remove the needle roller bearings and spacer from the gear assembly.
- 237. Clean the parts, including the thrust washers and lock plate and examine for wear or damage, renew as necessary. Refer to DATA at end of section for thrust washer thickness.
- 238. Fit the 'O' ring to the intermediate shaft.
- 239. Fit the 'O' ring into the front of the transfer case.
- 240. Lubricate thrust washers, bearings, shaft and spacer.
- 241. Fit needle bearings with spacer interposed. If the bearings have plastic cages, the flanged end of each cage must face the thrust washers, when fitted.
- 242. Fit front thrust washer to slot in transfer (plain side to case).
- 243. Locate gear assembly partially into the transfer case so that it rests on the front thrust washer.
- 244. Locate rear thrust washer (plain side uppermost) into slot in transfer case.
- 245. Gently push gear assembly into mesh.
- 246. Using a screwdriver through the intermediate shaft hole guide the locating tab on the rear thrust washer into the slot provided in the transfer case.
- 247. Align gear and thrust assembly and slide the intermediate shaft into the transfer box from the rear.
- 248. Align the shaft so that the lock plate slot in the end is on top.



249. Apply Loctite 290 to the lock plate bolt threads. Locate lock plate into position and fit securing bolt (with spring washer).



- 250.- Using a screwdriver via the bottom of the transfer case lift up the gear assembly and measure the end-float with feeler gauges. This should be between 0,08 and 0,35 mm (0.003 and 0.014 in).



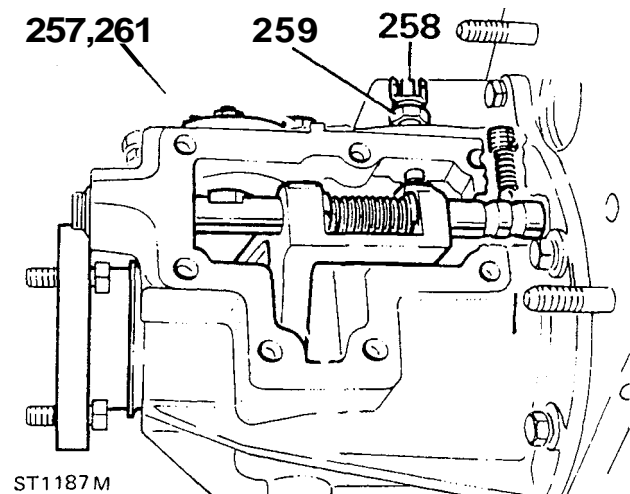
251. Grease and fit the bottom cover gasket.
252. Apply Loctite 290 to the ten bottom cover fixing bolts only.
253. Clean and fit the bottom cover, using the ten bolts (with spring washers).

Transmission brake assembly

254. Clean brake backplate and oil drip plate and apply silicone rubber sealant. Locate the backplate on the rear output shaft/speedometer housing so that the brake operating lever is on the right-side rear.
255. Fit the four Brako Durlok bolts, the lower two with plain washers, also retain the oil drip plate. Tighten to specified torque.
256. Clean and fit brake drum and fit the two countersunk retaining screws.

Differential lock switch adjustment

257. Select differential locked position by moving the differential lock lever towards the right side of the transfer box.
258. Obtain a battery and connect a test lamp circuit to the differential lock switch.
259. Slacken the lock nut off and screw in the lock switch until the bulb is illuminated.
260. Turn the lock switch another half turn and tighten the lock nut against the housing.
261. Disconnect the battery and move the differential lock lever towards the left side of the transfer box to disengage the differential lock.

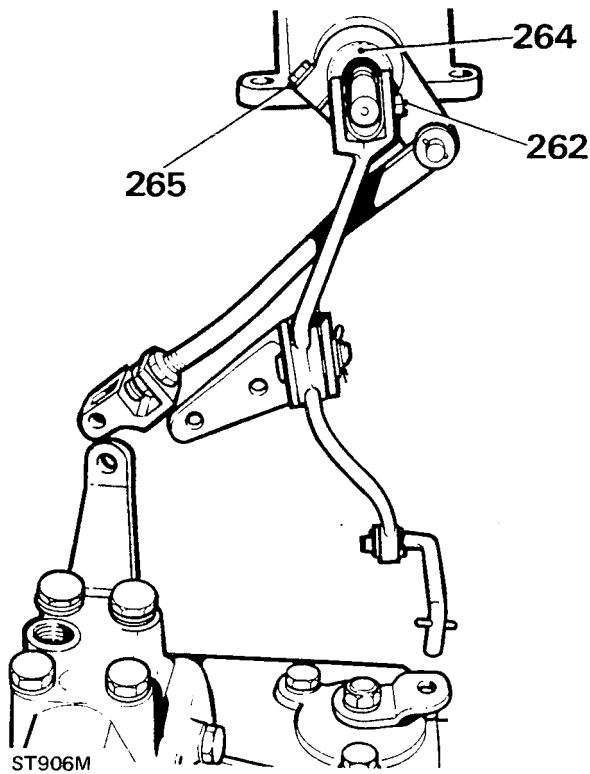


High/low gear change housing — Overhaul

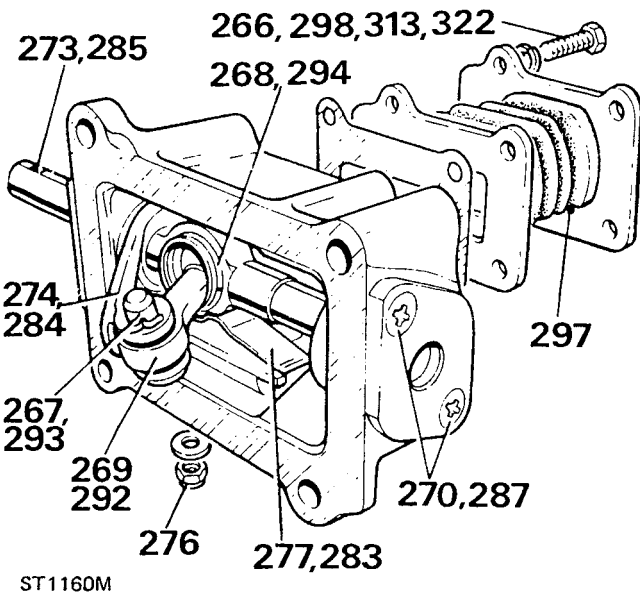
(Instructions 262 to 298)

Dismantling

262. Remove the split pin from the clevis pin at the top of the differential lock cross shaft lever which secures it to the gear change cross shaft.
263. Remove the washer and clevis pin and the anti-rattle nylon strip.
264. Mark the position of the high/low gear change operating arm on the splined shaft of the gear change crank arm.
265. Slacken the clamp bolt and remove the operating arm.
266. Remove the four bolts from the top of the gear change housing and lift off the grommet plate grommet, gate plate and gasket.
267. Remove the split pin from the gear change crank arm clevis pin and remove the clevis pin.
268. Remove the circlip from the high/low gear change lever bush.
269. Withdraw the gear change lever from the housing, with ball and socket bush.



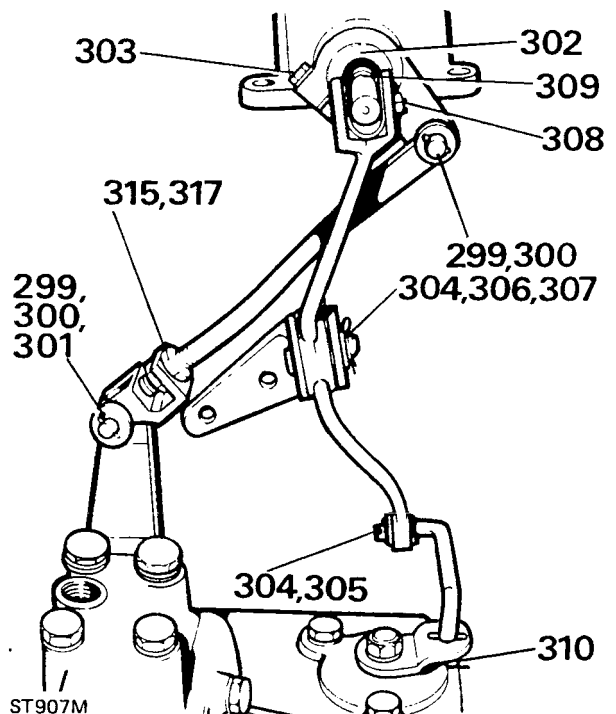
- 270. Remove the two countersunk screws from the housing end cover.
- 271. Remove the housing end cover.
- 272. Remove the two 'O' rings from the end cover.
- 273. Remove the cross shaft from the housing.
- 274. Compress the detent spring and remove the gear change arm from inside the housing.



- 275. Remove the two 'O' rings from the crank arm.
- 276. Remove and discard the two Nyloc nuts retaining the detent plate.
- 277. Remove the detent plate and spring from the housing.
- 278. Clean all parts, examine for wear or damage, renew as necessary.

Reassembly

- 279. Fit the two 'O' rings to the housing end cover.
- 280. Fit the two 'O' rings to the gear change crank arm.
- 281. Lubricate 'O' rings with oil.
- 282. Clip the detent spring onto the detent plate.
- 283. Fit detent plate assembly into housing and retain from outside with two Nyloc nuts (with plain washers).
- 284. Compress the detent spring and fit the gear change crank arm in the housing.
- 285. Fit cross shaft into position locating end in the crank arm.
- 286. Fit the housing end cover to support the other end of the cross shaft.
- 287. Finally secure the housing end cover with the two countersunk screws.
- 288. Before refitting the gear change lever remove the clevis pin bushes and the Nylon socket bush and ball.
- 289. Clean all parts, examine for wear or damage, renew as necessary.
- 290. Fit and grease gear lever ball and Nylon socket bush to gear lever.
- 291. Fit and grease clevis pin bushes.
- 292. Locate gear change lever assembly in cross shaft (do not fit socket bush retaining circlip at this stage).
- 293. Align gear change lever end with crank arm fork ensuring that the gear lever is cranked rearwards and fit clevis and split pin.
- 294. Finally secure Nylon socket bush with circlip.
- 295. Grease and fit gasket to gear change housing face.
- 296. Fit the gate plate.
- 297. Fit the grommet.
- 298. Fit the grommet plate and retain with the four securing bolts (with spring washers).



299. Before refitting the high/low connecting rod and gear change operating arms remove the respective clevis pins and Nylon bushes. Clean and examine for wear or damage, renew as necessary.
300. Grease and fit the Nylon bushes to the high/low selector and gear change operating arms.
301. Assemble both operating arms to the connecting rod with clevis pin, plain washer and split pin.
302. Slacken the gear change operating arm clamp bolt and fit the operating arm on to the splined shaft projecting from the high/low gear change housing, carefully aligning it to the marks on both components.
303. Tighten the clamp bolt to the specified torque.
304. Before refitting the differential lock cross shaft lever and pivot bracket remove the respective clevis pins and Nylon bushes. Also remove the split pin retaining the cranked lever and disconnect it. Clean and examine for wear or damage, renew as necessary.
305. Fit the cranked lever to the **bottom** of the cross shaft lever and secure with a new split pin (with plain washer).

NOTE: Early gearboxes were fitted with a short connecting link secured by a 'Nyloc' nut.

306. Grease and fit the Nylon bushes to the **middle** pivot of the cross shaft lever.
307. Fit the cross shaft lever to the (loose) pivot bracket with the clevis pin, washer and split pin.
308. Fit the cross shaft lever fork (top) to the gear change cross shaft.
309. Locate the anti-rattle Nylon strip and fit the clevis pin, plain washer and split pin.
310. Fit the cranked lever, at the bottom of the differential lock cross shaft lever, to the lock lever and retain the clevis pin and plain washer with a new split pin.
311. Grease and fit the Nylon bushes to the operating arm on the selector housing cross shaft.

Adjustment of high/low connecting rod

312. This operation is carried out in situ or on the bench, after assembly to the main gearbox.
313. Remove the four bolts from the top of the gear change housing and lift off the gear change lever grommet plate and the gear change lever grommet. Replace the four bolts temporarily to retain the gate plate in position.
314. Check that the gear lever does not foul the gate plate when high or low range is selected. If adjustment is required carry out the following procedure.
315. *Slacken off the connecting rod locknuts.
316. Move gear change lever into high range (rearwards) and move the operating arm on the selector housing cross shaft into high range (forwards).
317. Tighten locknut(s).
318. Check that the gear change lever does not foul the gate plate in this position.
319. Engage and check low range in the same way.

320. After adjustment return the gear change lever to the high range position.
321. Remove the four bolts retaining the gate plate and refit the grommet and grommet plate.
322. Refit the four bolts (with spring washers).

* On early versions of the transfer gearbox a different connecting rod fork end was used with a single locknut. In this case the following method of adjustment is recommended.

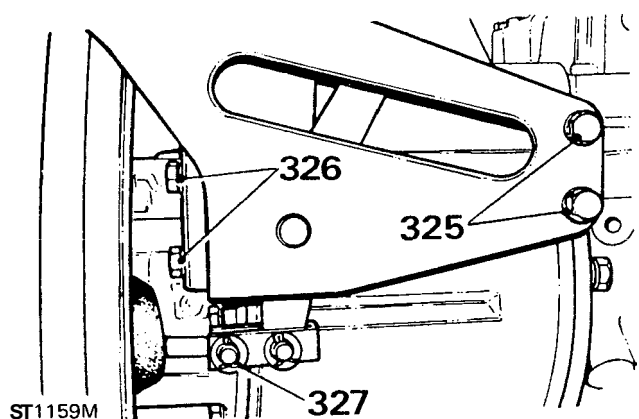
- (a) Disconnect the top of the differential lock cross shaft lever from the gear change cross shaft.
- (b) Remove the four bolts retaining the gear change housing to the remote gear change housing on the main gearbox.
- (c) Lift up the housing assembly (with the connecting rod attached) and rotate it as required to vary the length of the connecting rod.

Transfer box mounting — Refitting

323. Fit the rubber mounting plate to the right side of the front output housing by fitting the four securing bolts (with new lock tabs).

Handbrake linkage — Refitting

324. Locate the handbrake linkage bracket in position on the right hand side of the transfer box casing and secure as follows.
325. Fit the two bolts (with spring washers) and distance pieces to retain the front side of the linkage bracket.



326. Fit the two bolts (with spring washers) to secure the rear end of the linkage bracket. The lower bolt is shorter.
327. Insert the clevis pin through the brake operating lever, fit the handbrake link, plain washer and split pin.

DATA

Input shaft bearing pre-load	0,02 to 0,07 mm (0.001 to 0.003 inch)
Intermediate gear end-float	0,08 to 0,35 mm (0.003 to 0.014 inch)
Intermediate gear thrust washer thickness	2,70 to 2,75 mm (1.06 to 1.08 in)
Centre differential rolling resistance — (minus intermediate gear cluster and output shaft flange)	1,8 to 4,5 Kg (4 to 10 lb) pull
Input gear rolling resistance — (minus intermediate gear cluster)	1,4 to 3,6 Kg (3 to 8 lb) pull
Differential pinions backlash	0,02 to 0,07 mm (0.001 to 0.003 inch)
Output shaft bearing pre-load	0,02 to 0,07 mm (0.001 to 0.003 inch)
Low range gear end-float	0,05 to 0,15 mm (0.002 to 0.006 inch)
High range gear end-float	0,05 to 0,15 mm (0.002 to 0.006 inch)
High range gear/bush running clearance diameter	0,03 to 0,09 mm (0.0012 to 0.0035 inch)

REMOVE LT 95 FOUR SPEED GEARBOX WITH INTEGRAL TRANSFER BOX — ONE TEN V8 MODELS

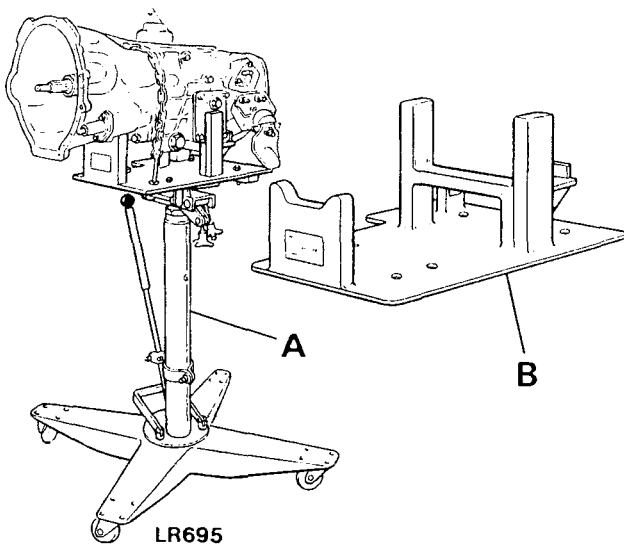
Service tools:

RO 1001 — Lifting bracket for gearbox. A hydraulic or mechanical chassis spreader is also required.

The gearbox should be removed from underneath the vehicle using a suitable lifting hoist. Number 3, chassis cross-member is removable to allow easy removal of the gearbox.

WARNING: It is essential, because of the considerable weight and offset position of the centre of gravity of the gearbox, that a hydraulic transmission hoist of adequate strength and stability is used. Failure to observe this precaution could result in the hoist tipping over and causing serious personal injury or damage to the gearbox.

Suitable hydraulic lifting equipment (**A**) is made by Blackhawk International Limited. A special adaptor plate (**B**) is produced by Claydrum Engineering Services for holding the Land Rover V8 gearbox. This adaptor plate can be used with various transmission hoists provided they meet the safety requirements indicated above.



Remove

Gear change levers.
Central section of exhaust system.

Disconnect

Handbrake and speedometer cables.
Front and rear propeller shafts from the gearbox.
Vacuum pipes and electrical leads from differential lock actuator.
Electrical leads from reverse light switch.
Make any remaining disconnections and note the following important points during removal.

When removing the chassis cross-member, do not allow it to fall. After removing the fixings, use a spreader on the chassis side members to free the cross-member.

Remove the cover plate from the front lower half of the bell housing.

Remove the clutch slave cylinder from the bell housing.

Position the transmission hoist under the gearbox and support it.

Release the two rear gearbox mounting brackets from the chassis side members.

Support the engine under the sump.

Pass the safety chain around the gearbox and make fast.

Remove the bell housing bolts (eight bolts).

Withdraw the gearbox from the engine.

Fit the lifting bracket RO 1001 to facilitate any subsequent removal from the transmission lift.

After refitting the gearbox into the vehicle, refill the main and transfer gearboxes with the correct grade oil, to the oil level plug hole.

For further information regarding the hydraulic transmission hoist and the special gearbox adaptor plate, please contact the equipment manufacturers direct. Their addresses are as follows:—

Transmission Hoist — type 67556 (T-3)

Blackhawk Automotive Limited
Brookfield Industrial Estate
Leacon Road
Ashford
Kent, England
Telephone: Ashford (0233) 32151
Telex: 965621 BLUK G

Gearbox Adaptor Plate — type DS RT

Claydrum Engineering Services
P.O. Box 5
Clayland Avenue
Worksop, England
Telephone Worksop (0909) 4802 1

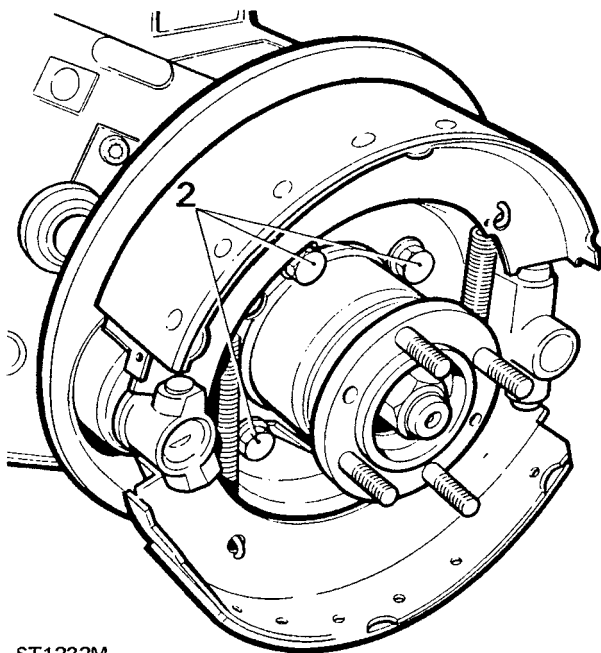
OVERHAUL LT 95 FOUR SPEED GEARBOX

The following overhaul instructions assume that the gearbox is removed from the vehicle and the oil drained.

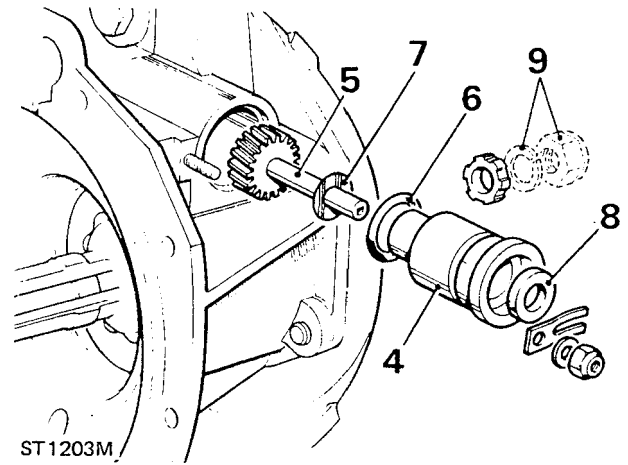
Remove the clutch slave cylinder, release mechanism and bearing assembly, stand the gearbox on a wood block on the bell housing end.

REMOVE AND OVERHAUL SPEEDOMETER DRIVE HOUSING

1. Remove the brake drum retaining screws and withdraw the drum.
2. Remove the four bolts retaining back plate, remove oil catcher and back plate assembly.

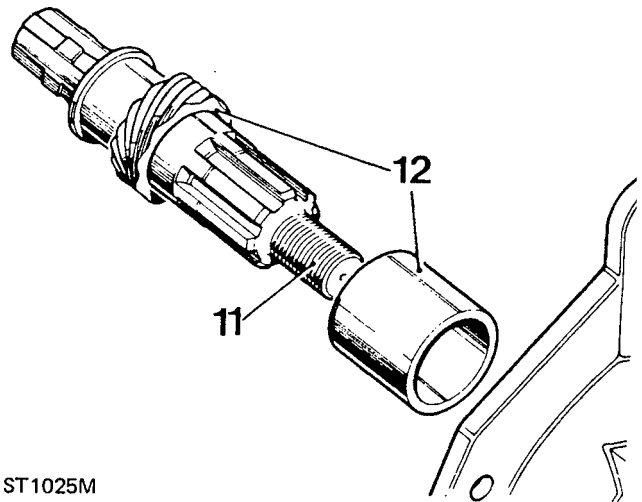


ST1232M



ST1203M

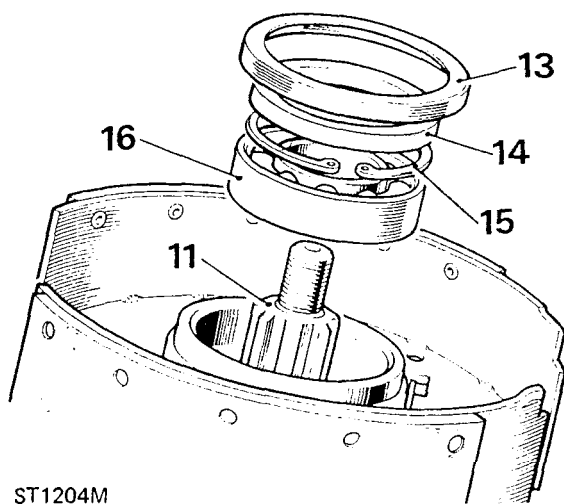
11. Drive out the rear output shaft, using a hide mallet on the threaded end.
12. Slide off the spacer and speedometer worm.



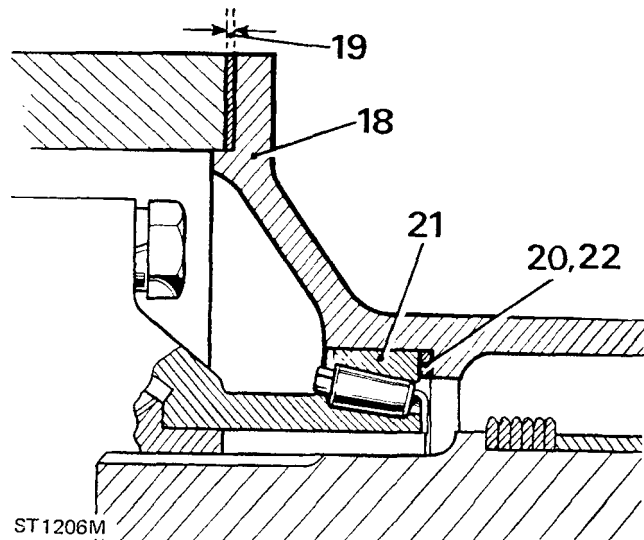
ST1025M

3. Remove the eight bolts and withdraw the speedometer drive housing.
4. Remove the speedometer spindle housing.
5. Lift out the driven gear and spindle.
6. Take off the 'O' ring seal.
7. Remove the thrust washer.
8. Withdraw the oil seal.
9. Remove the locking nut, using a flange tool, washer and felt seal, output coupling flange to output shaft.
10. Withdraw the coupling flange complete.

13. Withdraw the oil shield.
14. Prise-out the oil seal.
15. Remove the circlip.
16. Tap out the ball bearing race.



ST1204M



ST1206M

Check differential pre-load

This check must be carried out if a replacement speedometer drive housing is to be fitted. The check is also required if a replacement gearbox, differential unit or differential unit bearing is being fitted.

17. Measure and record the thickness of the new joint washer for the speedometer drive housing.
18. Offer the speedometer housing, less joint washer, to the gearbox.
19. Measure the clearance between the drive housing and gearbox joint faces. This must be 0,10 to 0,15 mm (0.004 to 0.006 in) more than the recorded thickness of the new joint washer. With the gasket fitted and the bolts tightened to 3 kgf.m (22 lbf.ft) a final rolling resistance check should be made using a spring balance and string wrapped round the differential case. The resistance should be 14-16 lbs (6-7 kg). The differential lock must be disengaged to allow free rotation of the unit whilst making this check.
20. To adjust the joint face clearance, adjust the thickness of shimming fitted behind the rear bearing outer face as follows: instructions 21 and 22.
21. Drive out the bearing outer race.
22. Withdraw the shim washer and select a replacement of the required thickness. Shim thickness range is 1,65 to 2,80 mm (0.065 to 0.110 in) in 0,05 mm (0.002 in) stages.

Assemble the housing

23. Fit the rear output shaft ball bearing and circlip.
24. Press in the output coupling flange oil seal, open face first, until the seal plain face just clears the chamfer on the seal housing bore.
25. Fit the oil shield, which must be a close fit on the speedometer housing.
26. Fit the speedometer worm followed by the spacer.
27. Fit the rear output shaft.
28. Fit the coupling flange.
29. Fit the felt seal, plain washer and locking nut to secure the output flange and tighten to the correct torque.
30. Assemble the following parts to the speedometer spindle housing:
 31. Fit the oil seal.
 32. Fit the thrust washer.
 33. Fit a new 'O' seal.
 34. Fit the speedometer driven gear and spindle.
 35. Fit the speedometer spindle housing assembly to the drive housing.

Assemble speedometer drive housing to gearbox

36. Place a new joint washer in position.
37. Offer the drive housing to the gearbox and engage the rear output shaft splines in the differential unit.
38. Position the flat on the drive housing adjacent to the flat on the intermediate shaft.
39. Secure the assembly with eight bolts and evenly tighten to the correct torque.
40. Fit back plate assembly.
41. Fit oil catcher and seal with Hylosil.
42. Tighten special bolts to 55 to 60 lbf.ft (75 to 80Nm) noting that plain washers are fitted.

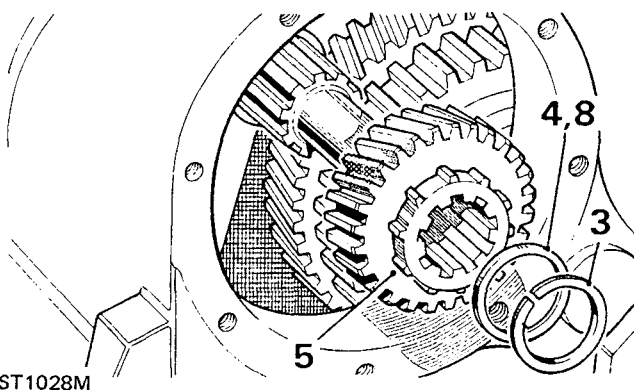
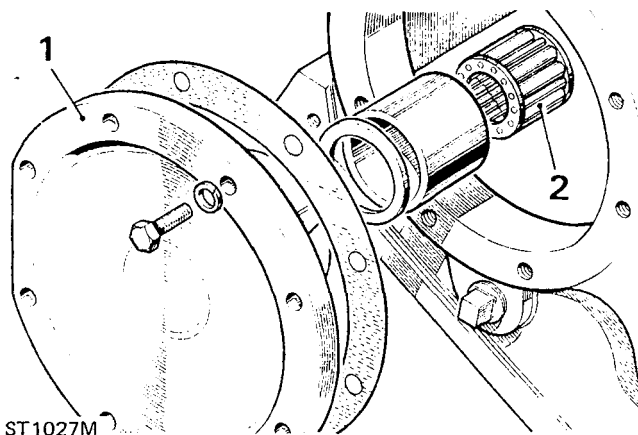
REMOVE AND OVERHAUL MAINSHAFT TRANSFER GEAR

Special tool:

18G1388 — mainshaft output gear puller

1. Remove the mainshaft rear bearing housing.
2. Lift out the roller bearing.
3. Remove the snap-ring.
4. Withdraw the shim washer.
5. The transfer gear is retained on the splines with Loctite 275. Use a puller 1861388 to withdraw it.

NOTE: The roller bearing outer race is located by a roll pin which must be punched-out before the race can be removed.



Assembling

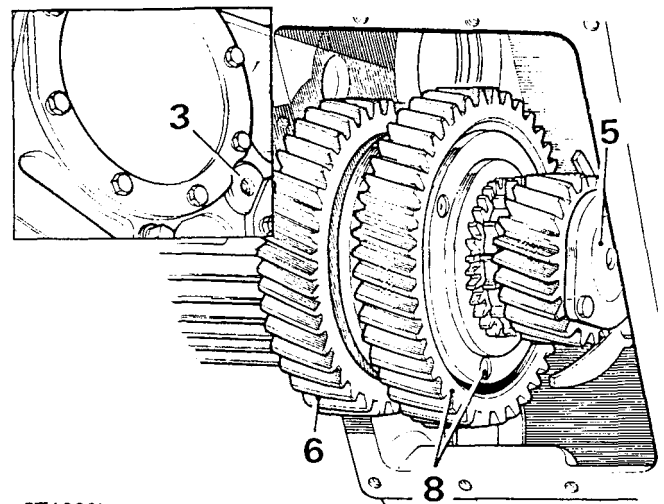
6. Fit the transfer gear to the mainshaft.
7. Fit the shim washer and snap-ring.
8. Check the end-float between the shim washer and snap-ring. End-float to be 0,050 mm (0.002 in) maximum. Shim washer range 1,8 to 2,0 mm (0.071 to 0.079 in) in 0,05 mm (0.002 in) stages.
9. Fit the roller bearing and rear bearing housing.

REMOVE AND OVERHAUL INTERMEDIATE GEARS ASSEMBLY

Special tool:

RO1003 — slave intermediate shaft

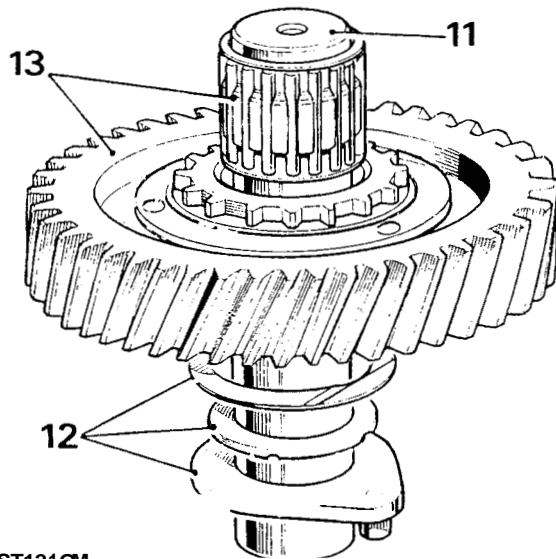
1. Remove the speedometer drive housing.
2. Remove the gearbox bottom cover.
3. Screw a suitable extractor into the 8 mm threaded hole provided in the intermediate gear shaft.
4. Hold the intermediate gear cluster in position and withdraw the shaft.
5. Insert the slave shaft RO1003 to retain together the gears assembly.
6. Withdraw the intermediate gears assembly.
7. Slide the thrust washers, bearings and gears from the slave shaft.
8. The input gear and outer member is a riveted assembly and no dismantling is permitted.



9. Remove the 'O' ring seal from the intermediate gear shaft.
10. Wash and degrease all parts and inspect for wear and renew if necessary. When new, the thrust bearing washers have a lead/tin coating, if this only has worn away there is no need to renew them.

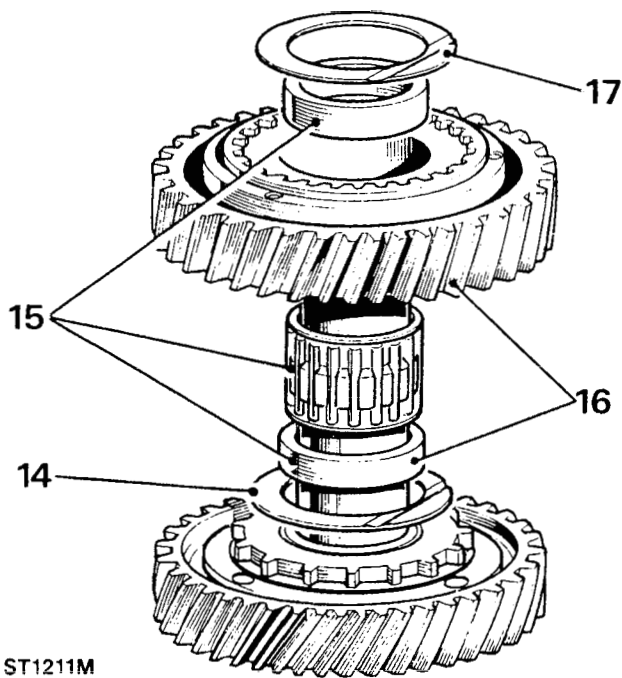
Assemble intermediate gears

11. Place the slave shaft on the bench, extractor thread end uppermost.
12. Fit a pear-shaped thrust washer, inner ring and a thrust bearing washer to the shaft (ring grooved face downwards).
13. Fit a needle-roller bearing and the 'high' gear (plain face first) to the shaft.



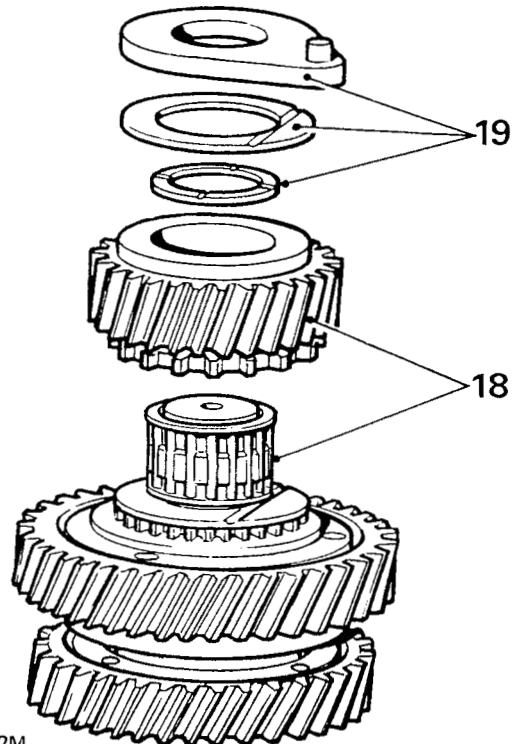
ST1210M

14. Position a thrust bearing washer on the 'high' gear.
15. Fit a spacer, needle-roller bearing and a further spacer to the input gear inner member.
16. Position the assembled input gear on the shaft and engage the lower spacer in the previously positioned thrust bearing washer.
17. Locate a thrust bearing washer over the upper spacer.



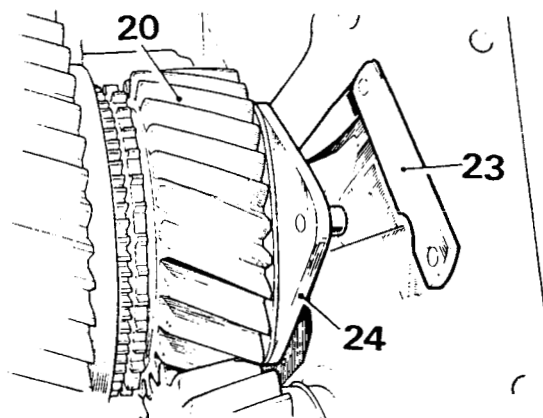
ST1211M

18. Fit a needle roller bearing and the 'low' gear (plain side last) to the shaft.
19. Fit the remaining thrust needle bearing, inner ring and thrust washer (ring grooved face upwards).



ST1212M

20. When the foregoing bearing clearance check has been completed, slide the gears and slave shaft assembly into the transfer gearbox and engage the selector forks.
21. Withdraw the slave shaft and lubricate the bearings through the shaft aperture.
22. Fit the intermediate shaft and 'O' ring seal with the flat on the shaft toward the differential unit.
23. Measure the clearance between the rear thrust washer and the gear casing. This must be 0,15 to 0,23 mm (0.006 to 0.009 in).
24. Adjustment is carried out by substituting one or both of the thrust washers. The washers are available in 3,55 mm (0.139 in), 3,63 mm (0.143 in) and 3,74 mm (0.147 in) thicknesses.
25. Refit the gearbox bottom cover.
26. Refit the speedometer drive housing.



ST1213M

REMOVE AND OVERHAUL DIFFERENTIAL UNIT

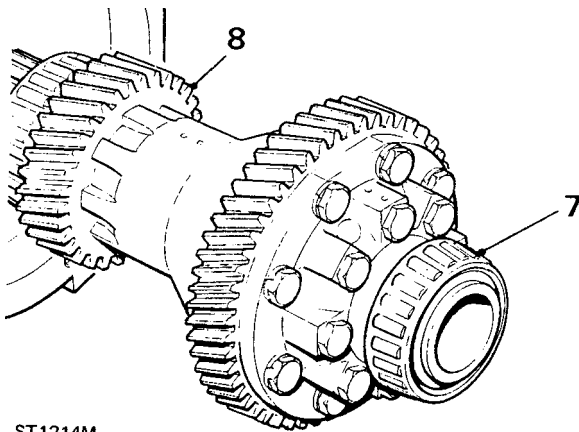
Special tool:

18G47BB — bearing extractor

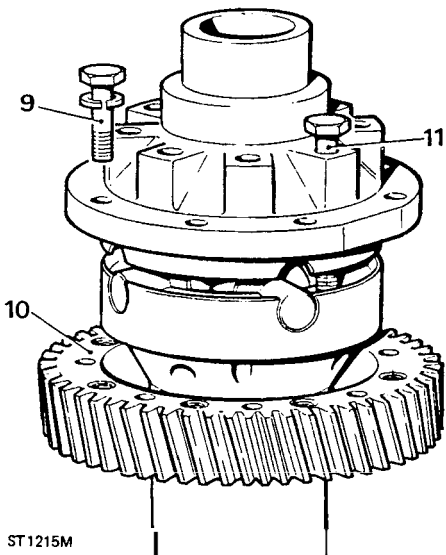
1. Select the differential lock.
2. Remove the differential lock actuator assembly
3. Remove the front output shaft and housing.
4. Remove the speedometer drive housing.
5. Remove the intermediate cluster assembly.
6. Remove the differential assembly.

NOTE: During dismantling it is essential that all components are marked in their original position and relative to other components, so that if original components are refitted, their initial setting is maintained.

7. Press off the roller bearings using tool 18G47BB.
8. Withdraw the high-speed gear, which is secured by Loctite.



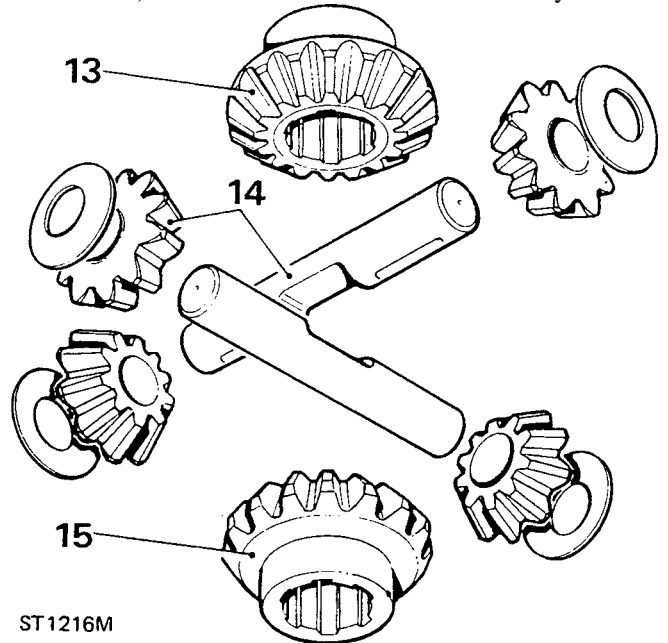
ST1214M



ST1215M

9. Remove the fixings, low-speed gear to casing.
10. Withdraw the gear.

11. Remove the casing securing bolts.
12. Lift off the rear case assembly (and oil retaining ring — later gearboxes).
13. Withdraw the side gear (and thrust washer — later boxes).
14. Slide out the cross-shafts and remove the bevel pinions and thrust washers from the front case assembly.
15. Withdraw the side gear (and thrust washer — later boxes) to dismantle the front case assembly.

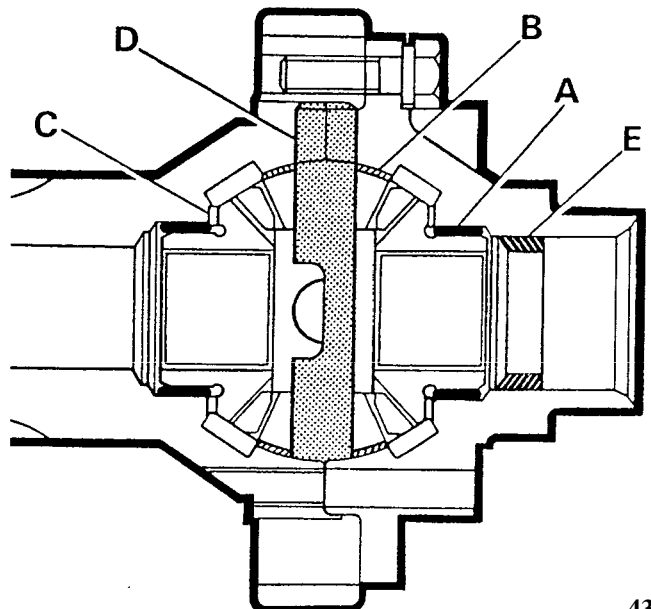


ST1216M

NOTE: From gearbox numbers 1300 3481A and 1700 0007A the following modifications have been made to the differential.

- A. Introduction of side gear bushes.
- B. Improved thrust washers.
- C. Addition of thrust washer on side gears.
- D. Modified cross pins.
- E. Addition of oil retaining ring.

The new differential part number FRC 7740 is only interchangeable with superseded unit part number 594 340.



ST1799M

NOTE: If replacements are required, replace the following items **16** and **17** as sets.

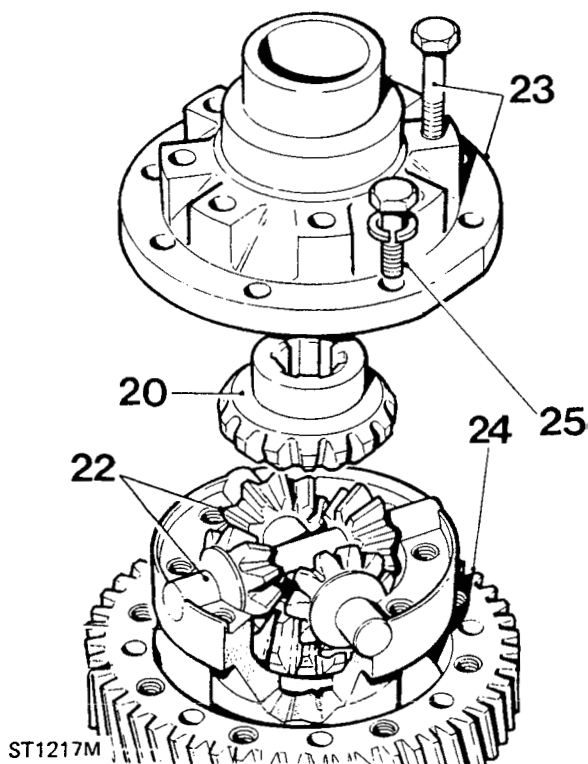
16. Bevel pinions and side gears (set of six).
17. Cross-shafts (set of two).
18. Check the gear teeth for damage.
19. Check all parts for satisfactory general condition including the side gear bushes.

NOTE: The differential case halves are a matched pair, and halves must not be changed individually.

Assemble differential

CAUTION: It is essential that during the following assembly all components are well lubricated with new oil of the correct grade.

20. Fit a side gear into the rear casing.
21. Fit a side gear into the front casing.
22. Fit the bevel pinions, thrust washers and cross-shafts into the front casing.
23. Fit the rear casing to the front casing. Tighten the bolts evenly in sequence to the correct torque. Use Loctite 275 on threads.
24. Offer the low gear to the differential casing.
25. Align the fixing holes and fit the bolts evenly in sequence to the correct torque. Use Loctite
26. Fit the roller bearings and refit the differential unit.



NOTE: If the differential case or bearings have been replaced, carry out the 'Differential bearing pre-load check'.

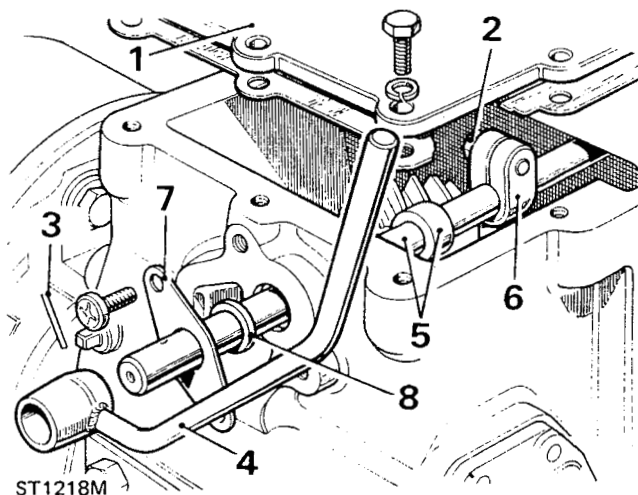
Assemble differential to gearbox

27. Refit the differential unit.
28. Refit the speedometer drive housing.
29. Refit the front output shaft and housing.
30. Refit the differential lock actuator assembly

NOTE: If a replacement differential unit is being fitted, carry out the 'Differential bearing pre-load check', described in 'Speedometer drive housing — Overhaul'.

REMOVE AND OVERHAUL TRANSFER GEAR LEVER AND CROSS-SHAFT

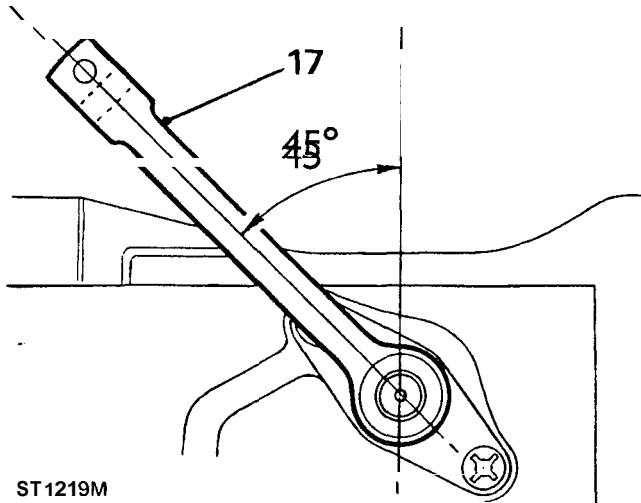
1. Remove the top cover.
2. Slacken the selector finger pinch bolt.
3. Drive out the retaining pin, gear lever to cross-shaft.
4. Withdraw the gear lever.
5. Withdraw the cross-shaft and spacer.
6. Lift out the selector finger.
7. Remove the retaining plates.
8. Withdraw the scaling rings.



Assemble gear lever and cross-shaft

9. Position the selector finger in the gearbox.
10. Fit the cross-shaft and spacing collar and engage the selector finger.
11. Fit the sealing ring and retaining plate at the R.H. side of the gearbox.
12. Fit the gear lever and retaining pin.

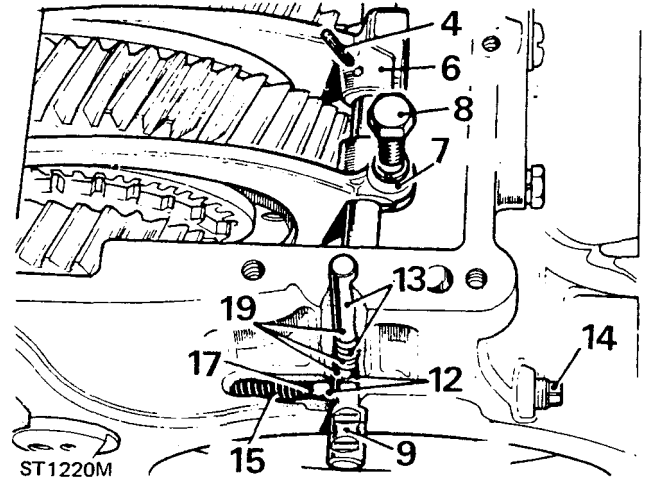
13. Fit the remaining sealing ring and retaining plate.
14. Tighten the selector finger pinch bolt.
15. Select 'High' transfer range, that is, the larger intermediate gear engaged.
16. Slacken the selector finger bolt.
17. Rotate the cross-shaft until the gear lever is inclined 45 degrees to the vertical position.



ST1219M

18. Tighten the selector finger pinch bolt.
19. Fit the top cover using a new joint washer and evenly tighten the retaining bolts.

12. Withdraw the two detent balls.
13. Lift out the spacing rod and spring.
14. Remove the blanking plug.
15. Withdraw the detent spring from the cross drilling.



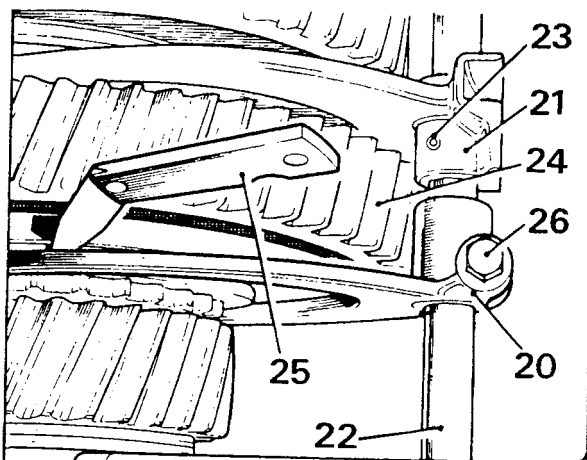
ST1220M

Assemble shaft and selectors

16. Position the detent spring in the inner bore in the cross drilling.
17. Locate the detent ball on the spring.
18. Enter the selector shaft, push the ball against the spring and push in the shaft.
19. Fit the detent ball, spring and spacing rod to the vertical drilling.
20. Position the rear selector fork, plain face to rear, in the gearbox.
21. Position the front selector fork, extended boss to the rear, in the gearbox.
22. Align the retaining pin holes and engage the selector shaft in the selector forks.
23. Fit the retaining pin, front fork to shaft.
24. Set transfer gears in 'Neutral' position.
25. Adjust the rear fork position until there is 0,12 to 0,25 mm (0.005 to 0.010 in) clearance between the front face of the rear fork and the rear face of the input gear inner member.
26. Tighten the rear fork pinch bolt.

REMOVE AND OVERHAUL TRANSFER BOX SELECTORS AND SHAFT

1. Remove the speedometer drive housing.
2. Remove the transfer gearbox top cover.
3. Select 'Low' range transfer gear.
4. Drive out the retaining pin from the front selector fork sufficient to free the fork.
5. Ease the differential unit to the rear.
6. Push the forward selector fork forward on the shaft.
7. Pull to the rear on the rear selector fork to move the selector shaft out of engagement with the detent balls in the casing rear face.
8. Remove the pinch bolt on the rear fork.
9. Partially withdraw the selector shaft and lift out the selector forks.
10. Remove the retaining pin from the front fork.
11. Withdraw the selector shaft, closing the shaft housing by hand to prevent the detent balls from dropping into the casing.

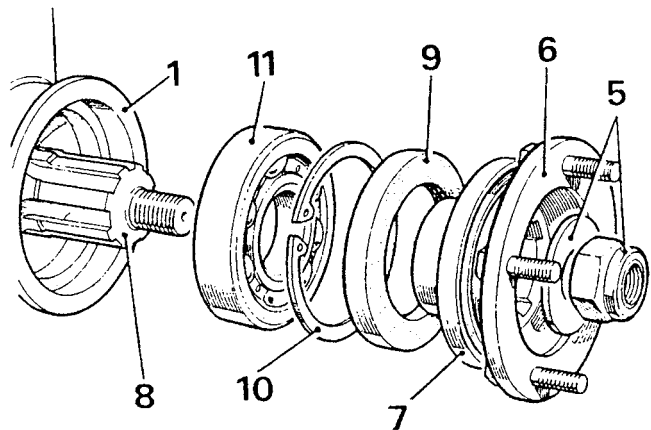


ST1221M

27. Fit the blanking plug to the cross drilling.
28. Fit the transfer box top cover using a new joint washer and evenly tighten the bolts to the correct torque.
29. Fit the speedometer drive housing.

Overhaul assembly

5. Hold the output shaft in a vice or use a flange restraining tool and remove the flange retaining nut and washer.
6. Withdraw the coupling flange complete with mudshield.
7. If required, press off the mudshield.
8. Press out the shaft toward the rear.
9. Withdraw the oil seal.
10. Remove the circlip.
11. Withdraw the output shaft bearing.
12. Wash and degrease all parts, examine for wear and renew as necessary.

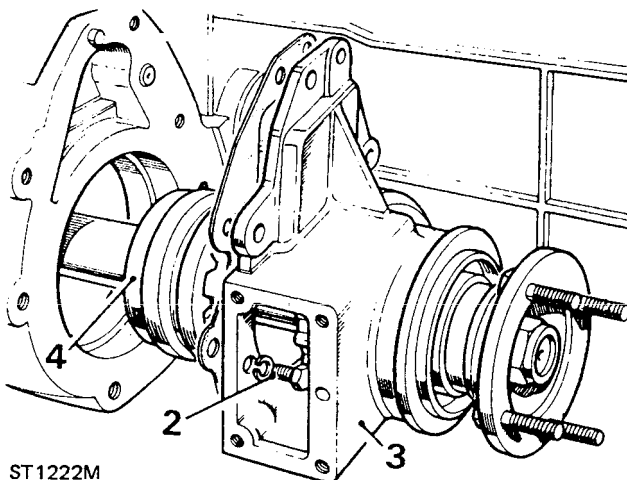


ST1223M

REMOVE AND OVERHAUL FRONT OUTPUT SHAFT AND HOUSING

Remove output shaft assembly

1. Remove the differential lock actuator assembly.
2. Remove the six retaining bolts, spring washers and gasket.
3. Withdraw the output shaft and housing complete.
4. Lift out the lock-up dog clutch.



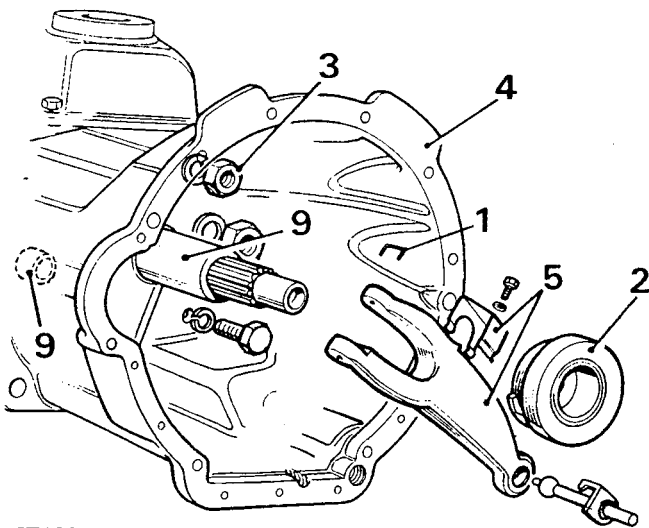
ST1222M

Assemble output shaft assembly to housing

13. Fit the output shaft bearing and secure with the circlip.
14. Fit the oil seal, lip side towards the bearing.
15. Press in the output shaft from the rear.
16. Fit the coupling flange complete with mudshield and flange bolts. Secure with the locking nut to the correct torque.

REMOVE AND OVERHAUL BELL HOUSING AND CLUTCH RELEASE

1. Withdraw the locating staple from the clutch release sleeve and release lever.
2. Lift out the release sleeve and bearing assembly.
3. Remove the bell housing fixings and make a note of the position of each bolt and nut.
4. Withdraw the bell housing complete with clutch release lever.
5. If required, remove the push rod clip and the spring clip and withdraw the clutch release lever.



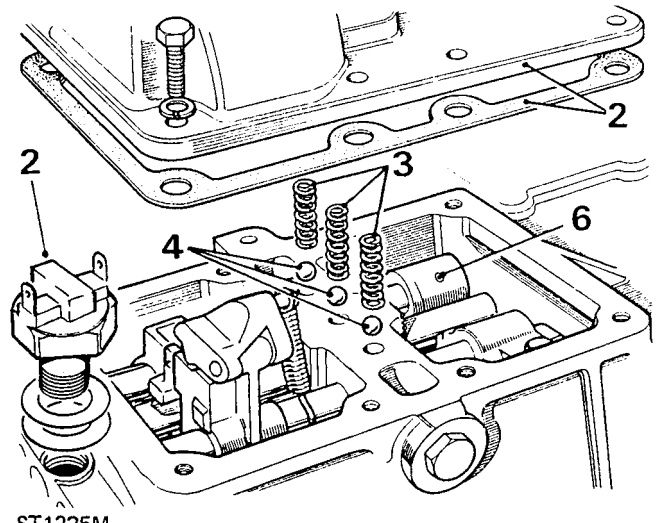
ST1224M

Assemble clutch release and bell housing

6. If removed, fit the release lever spring clip.
7. Apply a thin film of Unipart Universal or other suitable jointing compound around the three selector shaft holes in the bell housing rear face.
8. Fit the bell housing, locating on the dowels.
9. Apply a thin film of molybdenum disulphide grease onto the front cover extension sleeve.
10. Fit the release sleeve and bearing assembly.
11. Fit the locating staple to the clutch release sleeve and lever.

REMOVE AND OVERHAUL GEAR CHANGE SELECTORS

1. Remove the bell housing.
2. Select neutral, remove the reverse light switch and remove the gearbox top cover and joint washer.
3. Lift out the detent springs.
4. Withdraw the detent balls, using a small magnet or an air blast.
5. Slacken the pinch bolt securing the reverse selector finger.
6. Drive out the four retaining pins until the shafts are free in the selectors.

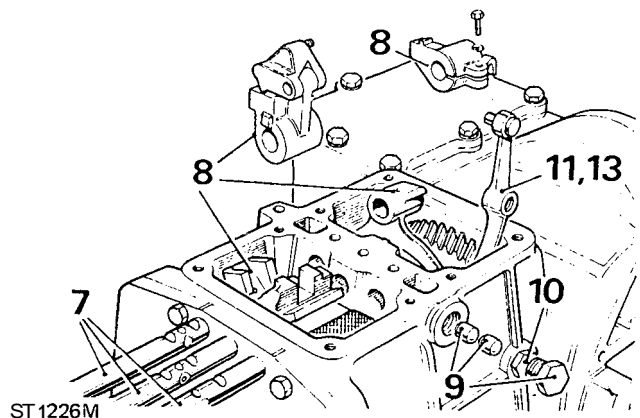


ST1225M

7. Tap out the selector shafts.
8. Withdraw the selector jaws and forks.
9. Withdraw the two interlock plungers from the cross-drilling.
10. Remove the lock-wired pivot bolt.
11. Lift out the reverse cross-over lever.

Overhaul

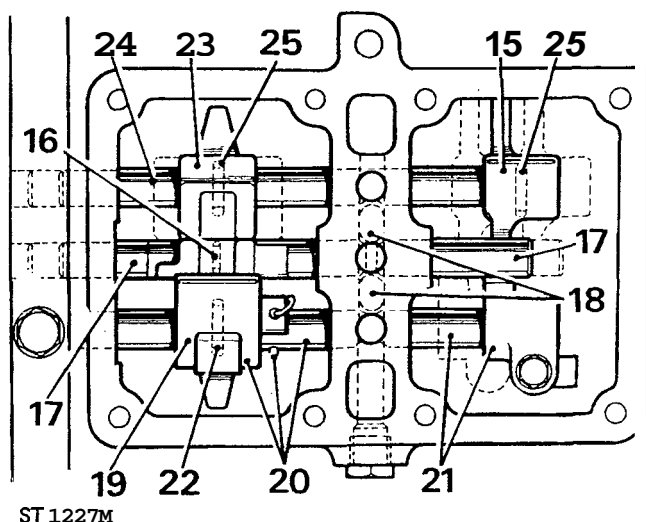
Examine all parts and renew if worn. Renew the detent springs. Ensure that the retaining pins are an interference fit, if not, renew.



ST1226M

Assemble gear change selectors

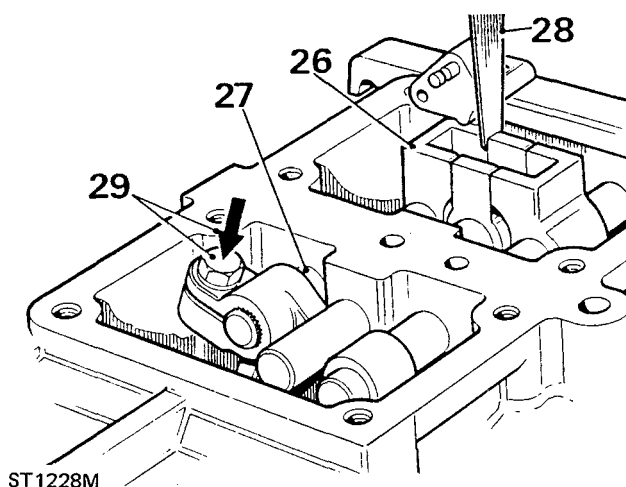
12. Withdraw the retaining pins from the selector jaws.
13. Engage the cross-over lever and locate fully in the groove in the reverse idler with the peg in the top of the cross-over lever fully in the selector finger.
14. Start the pivot bolt in the lever threads. Should it not start properly move the lever away from the selector finger but not out of engagement with the idler.
15. Locate the first/second gear selector fork in the groove in the outer member, with the boss on the fork to the rear. Position the boss to the R.H. side of the box.
16. Locate the third/fourth gear selector fork in the groove in the outer member. Position the fork with the retaining pin entry hole at the top R.H. side.
17. Fit the third/fourth gear selector shaft and interlock pin assembly and secure to the selector **fork** with a retaining pin.
18. Fit the two interlock pins to engage in the grooves each side of the third/fourth gear selector shaft.
19. Position the reverse stop hinge plate and selector jaw in the gearbox, adjacent to the third/fourth gear selector jaw.
20. Fit the reverse gear selector shaft and engage the selector jaw and hinge spring.
21. Push the shaft home and engage the reverse cross-over lever selector finger. Do not secure the pinch bolt at this stage.
22. Secure the reverse gear selector jaw to the shaft with a retaining pin.



26. Move the reverse shaft forward until the selector jaw abuts the casing.
27. Holding the reverse shaft as described in the previous item, move the reverse selector finger forward on the shaft until it abuts the casing, then move it rearward until it is just clear of the casing.
28. Place a 0,25 mm (0.010 in) feeler gauge between the upper edges of the reverse and third/fourth selector jaws.

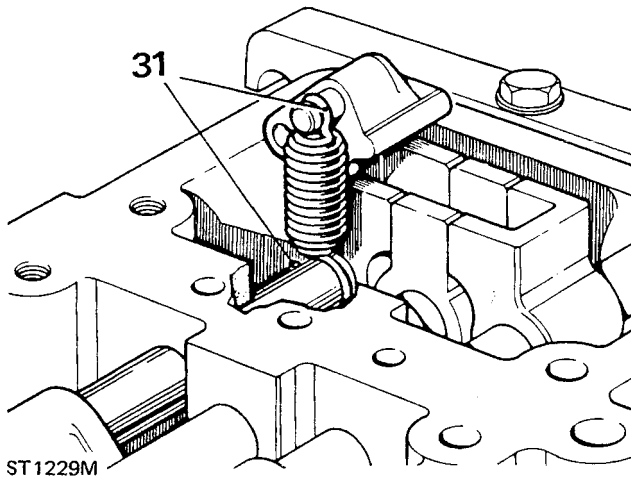
NOTE: The edges of the selector jaws taper slightly, therefore, it is important that the feeler gauge is positioned between the upper edges.

29. Hold the reverse and third/fourth selector jaws together to retain the feeler gauge, then rotate the reverse selector finger until it abuts the third/fourth selector shaft and tighten the pinch bolt.



30. Wire lock the cross-over lever pivot bolt.
31. When fitting the hinge spring to the reverse stop hinge, first engage the large hook around the selector shaft, as illustrated, before fitting the small hook to the reverse stop hinge pin.

23. Position the first/second gear selector jaw in the gearbox.
24. Fit the first/second gear selector shaft; engage the selector jaw and selector fork as the shaft is pushed home.
25. Fit the retaining pins, fitting the rear pin first.

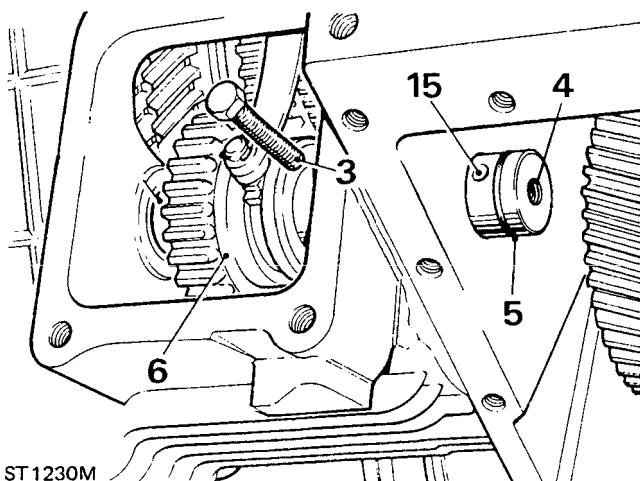


32. Fit the detent balls and springs.
33. Select neutral and using a new joint washer, fit the gearbox top cover and secure with the eight bolts, and evenly tighten to the correct torque.
34. Fit the reverse light switch
35. Fit the bell housing.

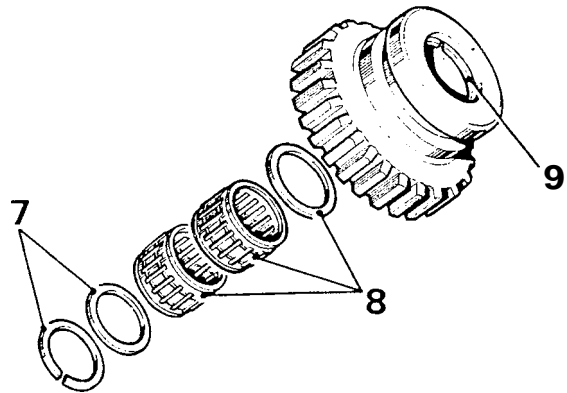
REMOVE AND OVERHAUL REVERSE IDLER GEAR AND SHAFT

Special tool:
18G1335 — extractor for shaft

1. Remove the gearbox side cover.
2. Remove the gearbox bottom cover.
3. Remove the bolt securing the idler gear shaft in the gearbox casing.
4. Withdraw the idler gear shaft, using extractor 18G1335.
5. Remove the 'O' ring seal.



6. Lift out the reverse idler gear assembly.
7. Remove the circlip and plain washer.
8. Lift out the needle roller bearings and further plain washer.
9. Withdraw the remaining circlip.



ST1231M

Assemble reverse idler gear and shaft

10. If removed, fit the shaft support bush, using Locquic primer grade 'T' and 'AVV' grade.
11. Fit the circlip to selector groove end of the gear.
12. Fit the plain washer and two needle roller bearings.
13. Fit the outer plain washer and secure with circlip.
14. Fit a new 'O' ring seal to the idler gear shaft.
15. Offer the idler shaft to the gearbox and align the retaining bolt holes.
16. Smear clean gearbox oil onto the 'O' ring seal.
17. Position the reverse idler assembly in the casing.
18. Engage the selector foot in the idler gear groove.
19. Drive in the idler gear shaft until the retaining bolt holes are aligned.
20. Before fitting the retaining bolt, treat the threads with Locquic primer grade 'T' and allow to dry. Then, fit the bolt using Loctite Studlock grade.
21. Fit the gearbox bottom cover using a new joint washer and secure with the fourteen bolts evenly tightening to the correct torque.
22. Using a new joint washer fit the side cover with the four bolts and tighten to the specified torque.

ST1230M

REMOVE AND OVERHAUL FRONT COVER AND OIL PUMP

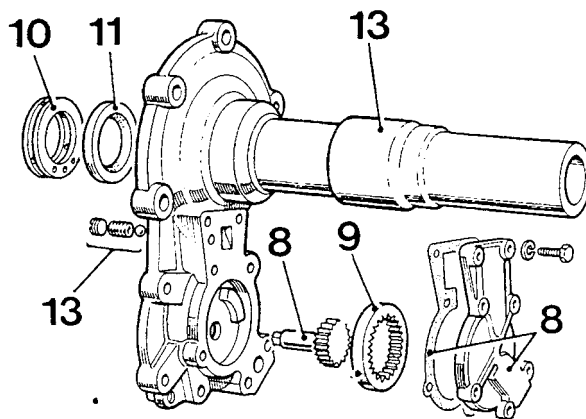
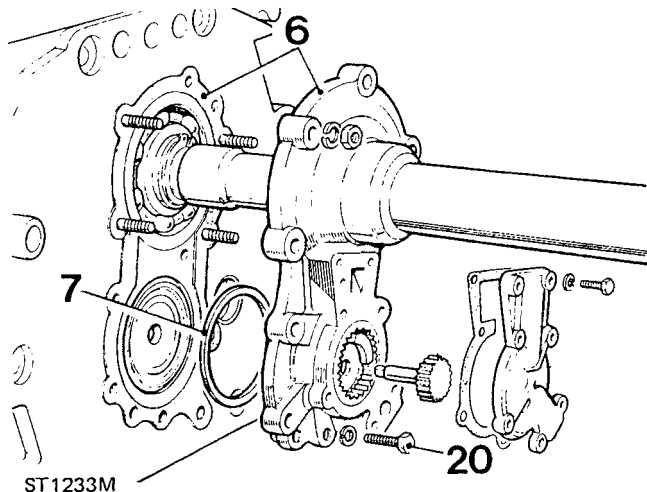
Service tools:

RO1005 — Centralising tool

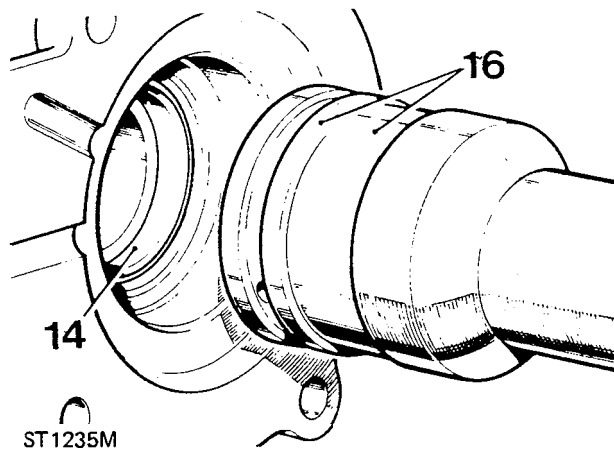
18G134 — guide and

18G134DG — assembly tool for fitting oil seal and oil feed ring.

1. Lift out the retainer staple from the clutch release bearing assembly and the release lever. See clutch release overhaul.
2. Withdraw the release bearing assembly.
3. Remove the slave cylinder pushrod.
4. Remove the spring clip.
5. Withdraw the clutch release lever.
6. Remove the front cover assembly, complete with oil pump joint washer.
7. Remove the shim washer located between the front cover and the layshaft front bearing.



16. Press in the oil feed ring, using 18G134 guide and 18G134DG adaptor.
17. Fit the ball, spring and plug. When fitted, the plug must be flush with, or not more than 0,25 mm (0.010 in) below the front cover rear face.
18. Fit the oil pump ring gear.

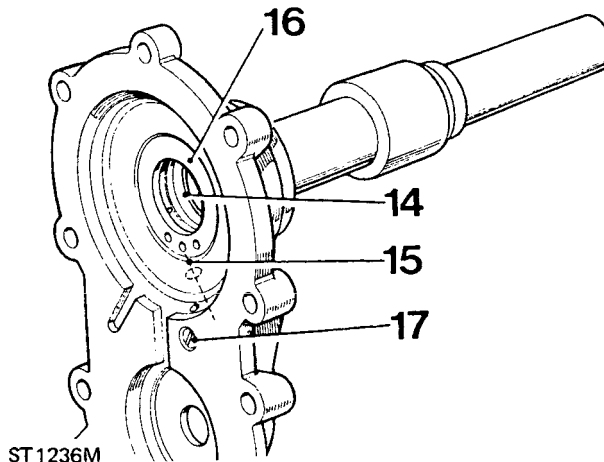


Overhaul

8. Remove the pump cover gasket and oil pump drive.
9. Withdraw the oil pump ring gear.
10. Remove the oil feed ring.
11. Withdraw the oil seal.
12. Remove the plug and withdraw the ball and spring from the relief valve housing.
13. If required, drift off the extension sleeve. Fit a replacement using Loctite 275 grade.

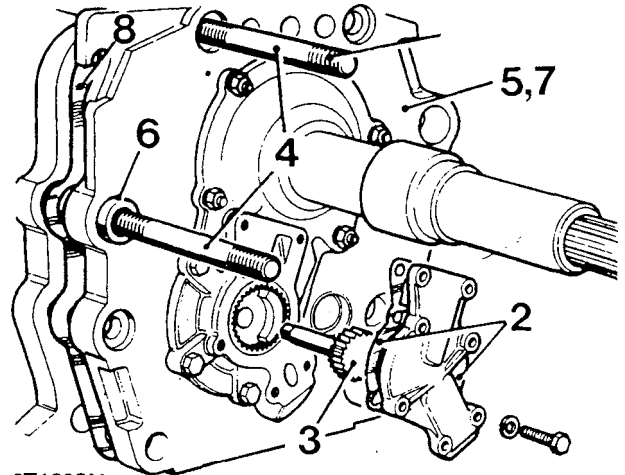
Reassemble

14. Press in the oil seal, plain face first, using 18G134 guide and 18G134DG adaptor.
15. Align the centre hole of three in the oil feed ring with the oil delivery hole in the front cover.

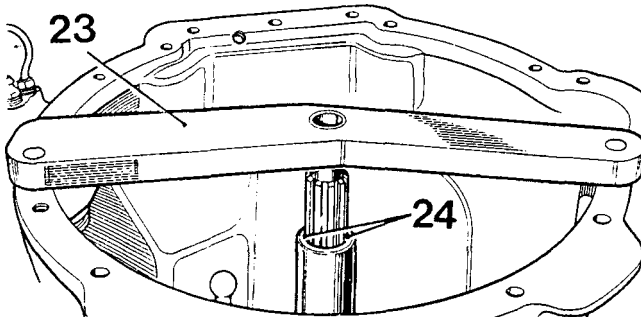


Fit cover assembly to gearbox

19. Position the layshaft bearing shim washer.
20. Position the front cover assembly and loosely fit the fixings.
21. Fit the oil pump drive gear to engage the drive square in the layshaft.
22. Fit the oil pump cover and joint washer and fit the fixing screws and washers and carefully tighten to the correct torque.
23. Fit the gauge RO1005 to align the primary pinion with the bell housing.
24. Visually check that the front cover is concentric about the primary pinion. Adjust the front cover position about its fixings to suit.



ST1238M



ST1237M

25. When satisfactory, tighten the front cover fixings.
26. Fit the clutch release lever and spring clip.
27. Fit the slave cylinder push-rod.
28. Fit the release bearing assembly.
29. Fit the retainer staple to the clutch release bearing assembly and lever.

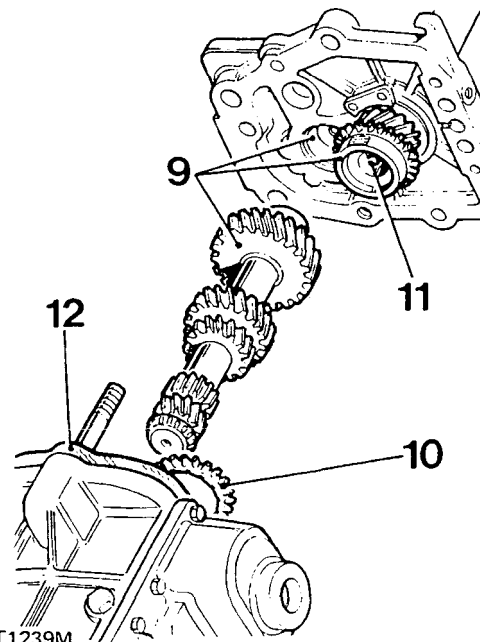
Assemble bearing plate assembly

NOTE: To replace a bearing plate, a bearing plate and gearbox casing mated assembly must be fitted.

10. Locate the cone into the third/fourth-speed synchromesh unit.
11. Lubricate the oil tube, using clean gearbox oil.
12. Position the joint washer.
13. Engage the layshaft with the primary pinion and front bearing outer member.
14. Fit the bearing plate and layshaft.
15. Align the bearing plate with the gearbox casing and slide home the dowel sleeves.
16. Refit the studs. Smear Loctite 'Studlock' grade CVX, on the two upper studs securing threads before fitting.
17. Fit the oil pump drive gear.
18. Using a new joint washer fit the oil pump gear cover.
19. Fit the bell housing.

REMOVE AND OVERHAUL BEARING PLATE ASSEMBLY

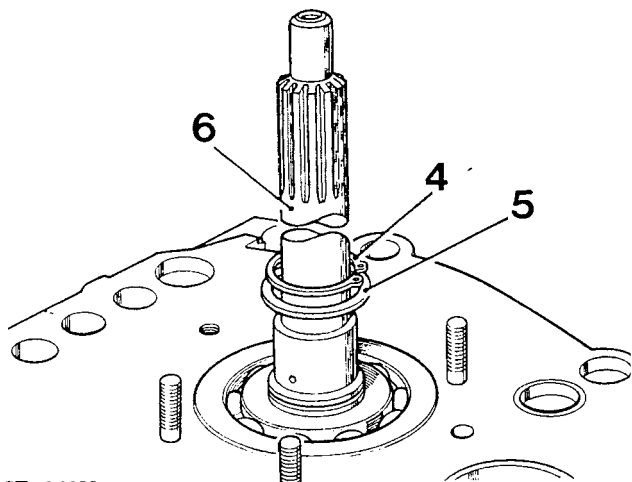
1. Remove the bell housing and position the gearbox with the front end uppermost.
2. Remove the oil pump gears cover and joint washer.
3. Withdraw the oil pump drive gear.
4. Temporarily remove the four fixing studs from the gearbox front face.
5. Ease the bearing plate away from the gearbox.
6. Withdraw the two dowel sleeves which locate the bearing plate.
7. Withdraw the bearing plate assembly complete with primary pinion and layshaft.
8. Withdraw the joint washer.
9. Withdraw the layshaft.



ST1239M

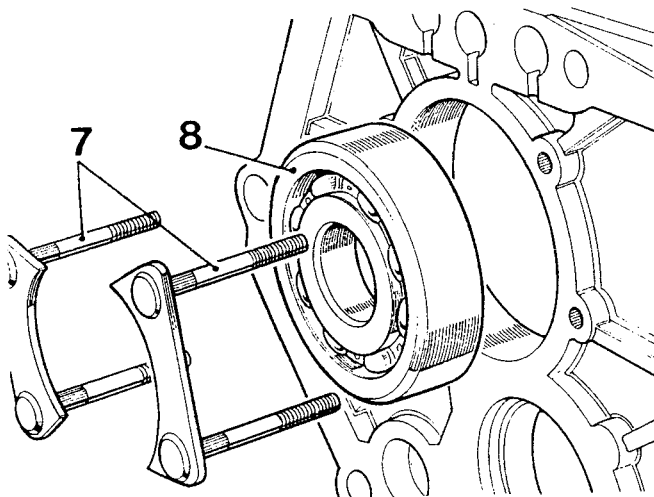
REMOVE AND OVERHAUL PRIMARY PINION

1. Remove the bell housing.
2. Remove the front cover and oil pump assembly.
3. Remove the bearing plate assembly.
4. Remove the circlip.
5. Lift off the shim washer.
6. Press out the primary pinion.



ST1240M

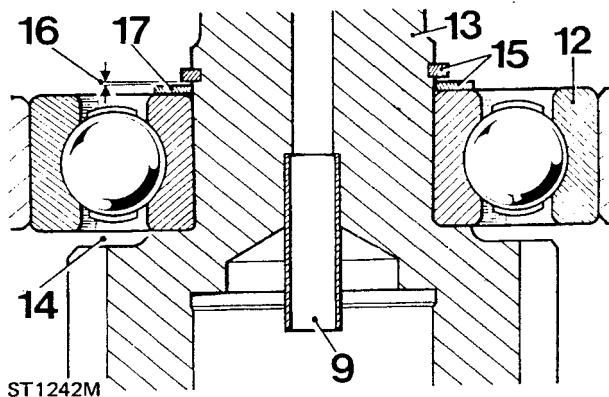
7. Withdraw the bearing retaining plates and serrated bolts.
8. Press out the primary pinion bearing.



ST1241M

Assemble primary pinion

9. Check that the orifice drilled in the oil tube is clear.
10. During refitting, take care to avoid damage to the oil tube. Rotate the shaft in the bearing to ensure that the oil tube is straight.
11. Support the bearing plate using suitable wooden blocks. Position the blocks across the bearing housing aperture to act as assembly stops.
12. Press in the bearing until flush with the bearing plate.
13. Press in the primary pinion. Check that the bearing remains flush with the bearing plate.
14. Fit the retaining plates and serrated bolts.
15. Fit the shim washer and circlip.
16. Measure the clearance between the circlip and the shim washer. There must be a clearance of 0,05 mm (0.002 in) maximum.
17. If required, adjust the clearance by fitting a replacement shim washer. Shim range is 2,0 to 2,15 mm (0.079 to 0.085 in) in 0,05 mm (0.002 in) stages.



ST1242M

18. Fit the bearing plate assembly.
19. Fit the front cover and oil pump assembly.
20. Fit the bell housing.

REMOVE AND OVERHAUL THE MAINSHAFT ASSEMBLY

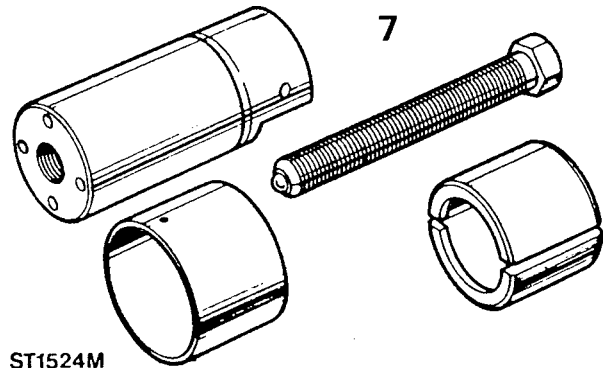
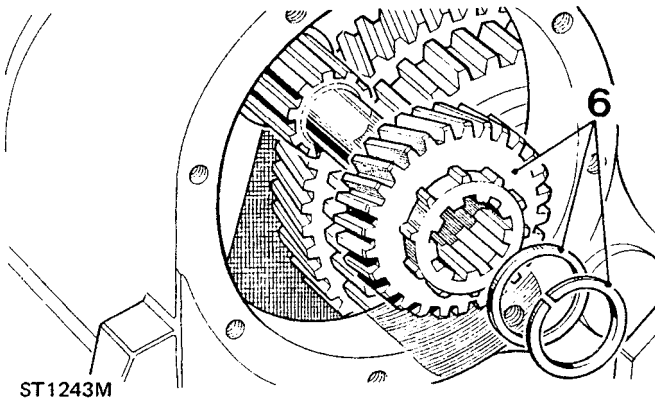
Special tool:

1861388 — extractor for mainshaft spacer and gear

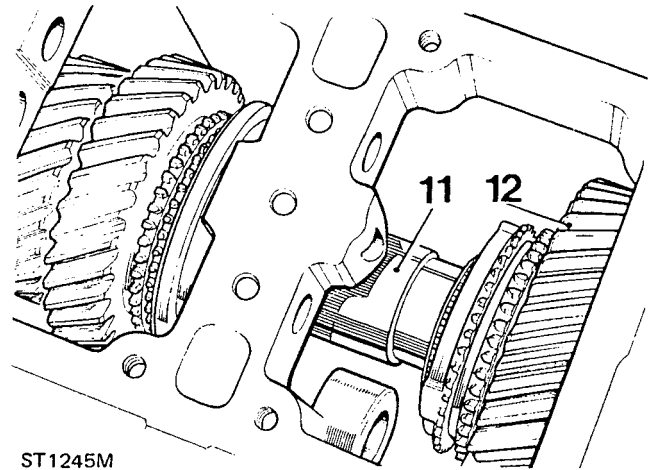
1. Remove the bell housing.
2. Remove the front bearing plate.
3. Remove the main gearchange selectors.
4. Remove the mainshaft rear bearing housing and roller bearing.
5. Remove the bottom cover from the transfer gearbox.

NOTE: At this stage in the dismantling, on early gearboxes only, it is necessary to remove the transfer top cover selector finger and shaft. On later gearboxes the cross-shaft is machined to enable the spacer to be completely withdrawn. Also the main shaft spacer and transfer gear are secured by Loctite 275 to the main shaft.

6. Remove the snap-ring, shim washer and mainshaft transfer gear, using special tool 18G1388.

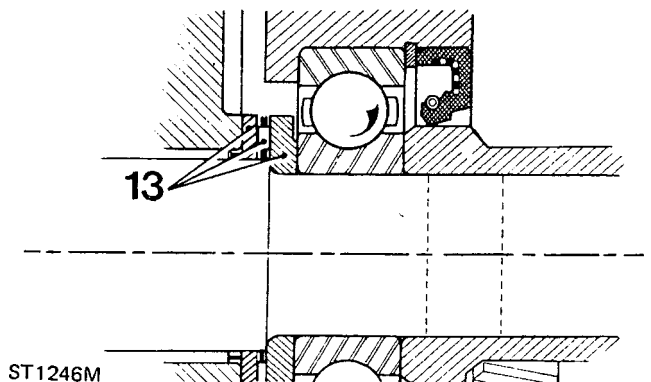


11. Withdraw the mainshaft assembly, allowing the first-speed gear to remain behind to avoid fouling on the casing.
12. Lift out the first-speed gear.



13. Refit the first-speed gear, scalloped thrust washer, thrust needle bearing and stepped thrust washer, stepped face outwards.
14. Withdraw the mainshaft spacer.

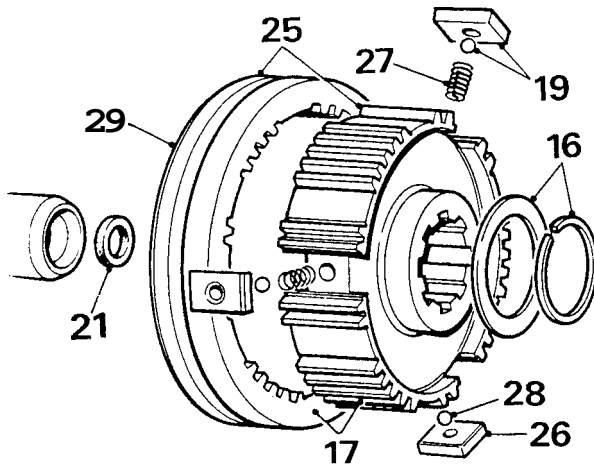
7. Fit extractor 18G1388 to transfer gear spacer.
8. Withdraw the spacer along the mainshaft until the larger diameter on the spacer reaches the transfer gear lever cross-shaft.
9. Withdraw the spacer through the machined scollop.
10. When the spacer is free on the mainshaft remove the extractor.



Overhaul mainshaft assembly

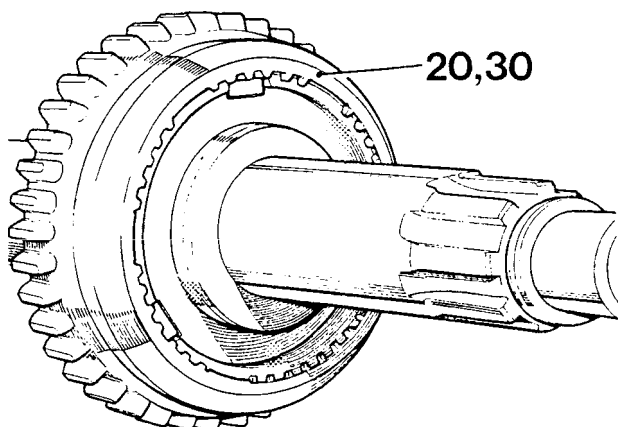
Dismantle

15. Withdraw the first-speed gear, thrust washers and roller bearings from the rear of the shaft.
16. Remove the snap-ring and shim washer from the front of the shaft.
17. Lift off the third/fourth gears synchromesh assembly.
18. Withdraw the third and second-speed gears and the associated thrust washers and needle-roller bearings.
19. Dismantle the third/fourth gears synchromesh assembly, first pushing down the sliding blocks to free the synchromesh balls from the retaining groove in the outer member.



ST1247M

20. Dismantle the first/second gears synchromesh assembly in a similar manner, particularly noting their position for refitting.
21. Withdraw the oil seal from the Sore in the mainshaft front end.



ST1248M

Assemble

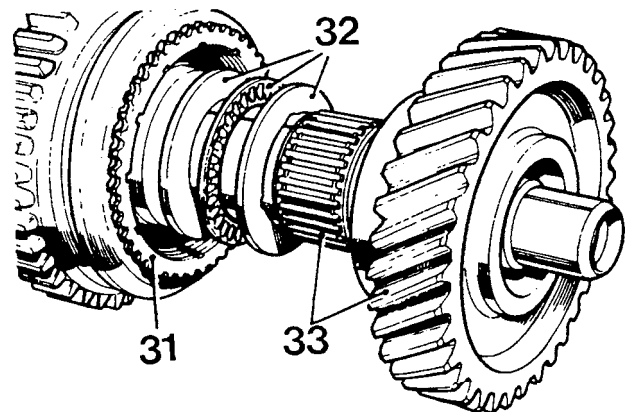
22. Replacement thrust washers and roller bearings must not be degreased.
23. Lubricate all items before assembly, using clean main gearbox oil.
24. Fit the oil seal to the mainshaft front end.

Assemble synchromesh units

25. Fit together the third/fourth gear synchromesh outer and inner members, outer member coned face toward inner member plain face.
26. Fit the sliding blocks, radius face outward.
27. Locate the springs through the sliding blocks into the housing bores in the inner member.
28. Position the balls on the spring ends; press home in sequence and retain by hand.
29. Lift the outer member to retain the balls. Continue lifting until the balls spring home into the annular groove in the outer member.
30. Assemble the first/second gear synchromesh unit in the manner described for third/fourth gear unit. Fit the outer member coned face toward the front end of the mainshaft.

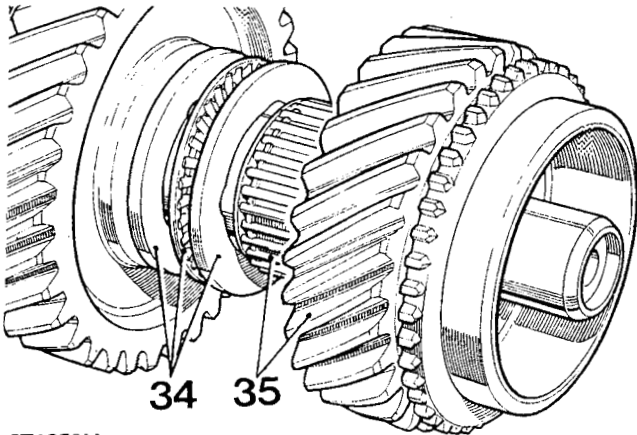
Assemble mainshaft front end

31. Fit a synchromesh cone to the first/second gear synchromesh outer member.
32. Position a chamfered thrust washer, a thrust needle bearing and a scalloped thrust washer on the mainshaft.
33. Fit a radial needle bearing and the second-speed gear.

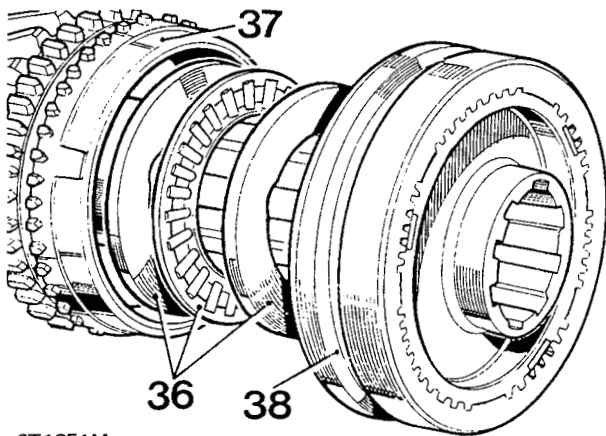


ST1249M

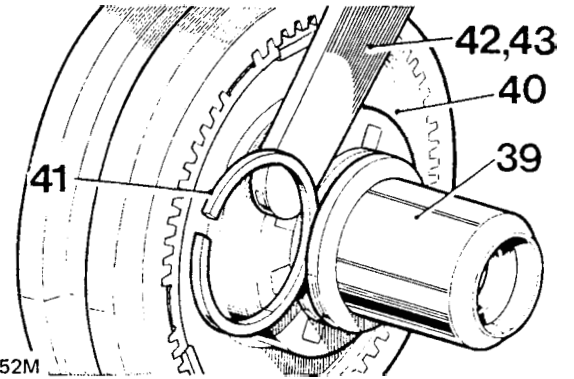
34. Fit a scalloped thrust washer, a thrust needle bearing and a further scalloped thrust washer.
35. Fit a radial needle bearing and the third-speed gear.
36. Fit a scalloped thrust washer, a thrust needle bearing and a further scalloped thrust washer.
37. Position a synchronesh cone onto the third-speed gear.
38. Fit the synchronesh unit, coned face to rear.



ST1250M



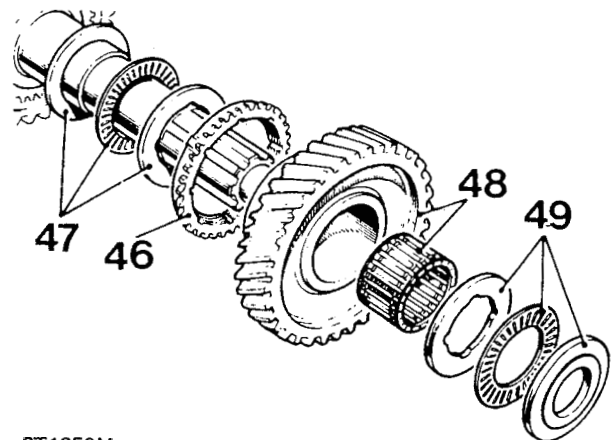
ST1251M



ST1252M

Assemble mainshaft rear end

46. Fit a synchronesh cone to the first/second gear synchronesh outer member.
47. Position a chamfered thrust washer, a thrust needle bearing and a scalloped thrust washer on the mainshaft.
48. Fit the first-speed gear and bearing.
49. Fit a scalloped thrust washer, a thrust needle bearing and the stepped thrust washer, stepped face outwards.
50. The mainshaft spacer, transfer gear, shim washer and snap-ring are fitted during mainshaft refitting.



ST1253M

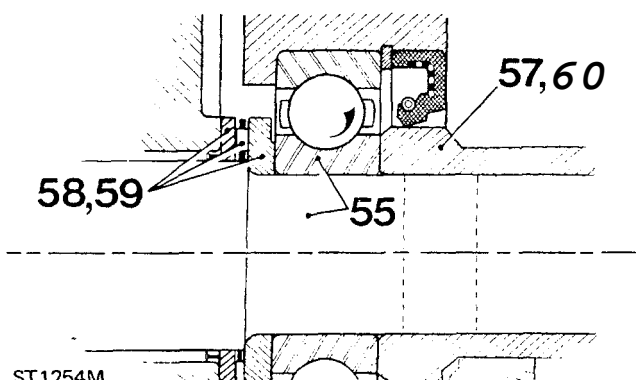
Set end-float of gears

39. Position the mainshaft assembly vertical, front end uppermost.
40. Apply a light loading on the gears to remove end-float.
41. Position the snap-ring in the mainshaft groove.
42. Measure the distance between the snap-ring lower edge and the synchronesh unit inner member.
43. Select a shim to reduce the measured clearance to 0,025 to 0,150 mm (0.001 to 0.006 in) when fitted.
44. Shim range is 1,85 to 2,45 mm (0.073 to 0.096 in) in 0,15 mm (0.006 in) increments.
45. Fit the selected shim washer and the snap-ring.

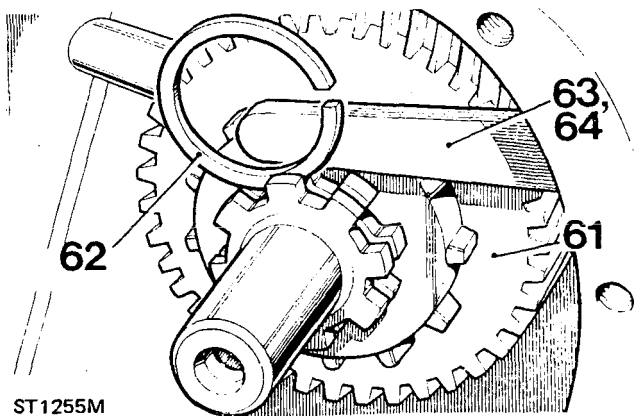
Assemble mainshaft assembly to gearbox

51. Position the gearbox with the R.H. side downwards to aid refitting.
52. Remove the gearbox side cover.
53. Temporarily move the first-speed gear toward the rear of the shaft.
54. Offer the assembled mainshaft to the gearbox and manoeuvre the first-speed gear past the reverse idler gear.

- 55. Engage the shaft into the main bearing.
- 56. Engage the first/second gear synchromesh outer member and the reverse idler gear.
- 57. Push the mainshaft home enough to allow the mainshaft spacer to be located on the rear end, with the spacer larger diameter forward of the transfer gear lever cross-shaft.



- 58. Re-position the first-speed gear, thrust washers and thrust needle bearing correctly on the mainshaft.
- 59. Push the mainshaft fully home, ensuring that the thrust washers and needle bearing remain correctly located against the first-speed gear.
- 60. Move the mainshaft spacer along the shaft, and into the oil seal, to abut the main bearing.
- 61. Temporarily fit the mainshaft transfer gear.
- 62. Position the snap-ring in the groove in the mainshaft.
- 63. Hold the mainshaft fully to the rear and measure the clearance between the snap-ring and the transfer gear.
- 64. Select a shim washer to allow 0,050 mm (0.002 in) maximum clearance between the snap-ring and transfer gear when fitted. Shim range 1,8 to 2,0 mm (0.071 to 0,079 in) in 0,05 mm (0.002 in) increments.

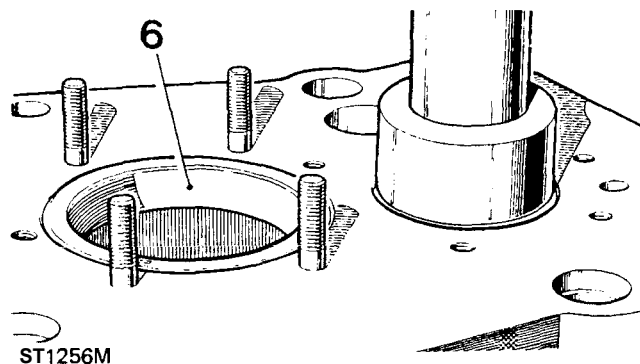


- 65. Temporarily remove the snap-ring and the mainshaft transfer gear.
- 66. Slide back the mainshaft spacer as far as the transfer gear lever cross-shaft will allow.
- 67. Apply a thin coating of Loctite 275 grade to the exposed area of the mainshaft.
- 68. Push home the mainshaft spacer.
- 69. Fit the mainshaft transfer gear.
- 70. Fit the previously selected shim washer and secure with the snap-ring.
- 71. Fit the bottom cover to the transfer box using a new joint washer and evenly tighten the fourteen retaining bolts to the correct torque.
- 72. Fit the mainshaft rear bearing housing and roller bearing.
- 73. Assemble the main gearchange selectors to the gearbox.
- 74. Fit the front bearing plate.
- 75. Fit the bell housing.

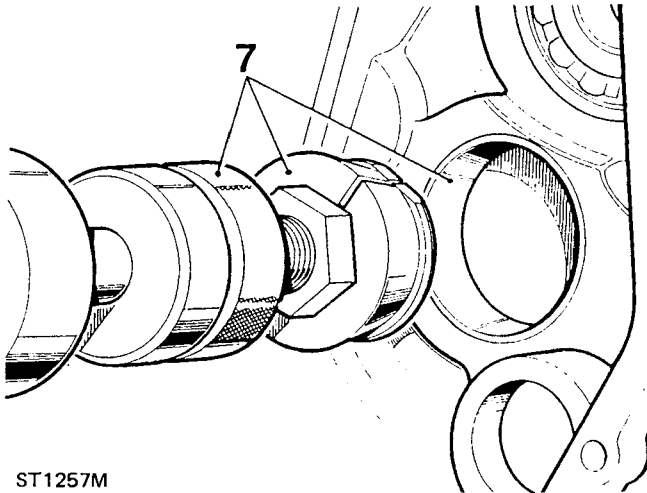
REMOVE AND OVERHAUL LAYSHAFT BEARINGS

Special tools:
RO1004 — extractor mainshaft spacer
18G284 — extractor and **18G284AR** — adaptor, extractor layshaft rear bearing outer member
18G47 — Press and **18G47BA** — Collars, extractor for layshaft bearing inner members

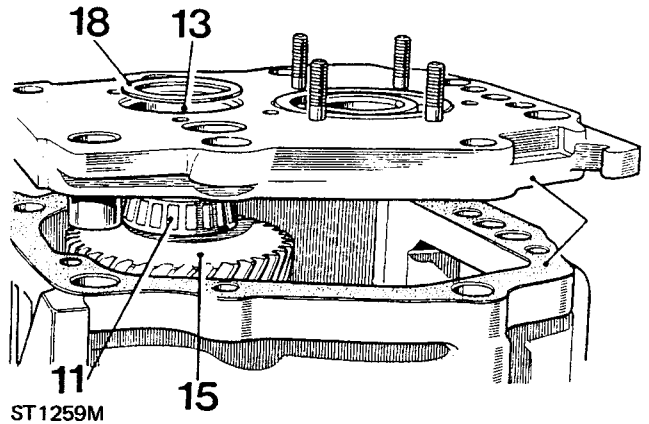
- 1. Remove the bell housing.
- 2. Remove the front cover and oil pump assembly.
- 3. Remove the main gears selectors.
- 4. Remove the front bearing plate assembly.
- 5. Remove the mainshaft assembly.
- 6. Press out the layshaft front bearing outer member from the front bearing plate.



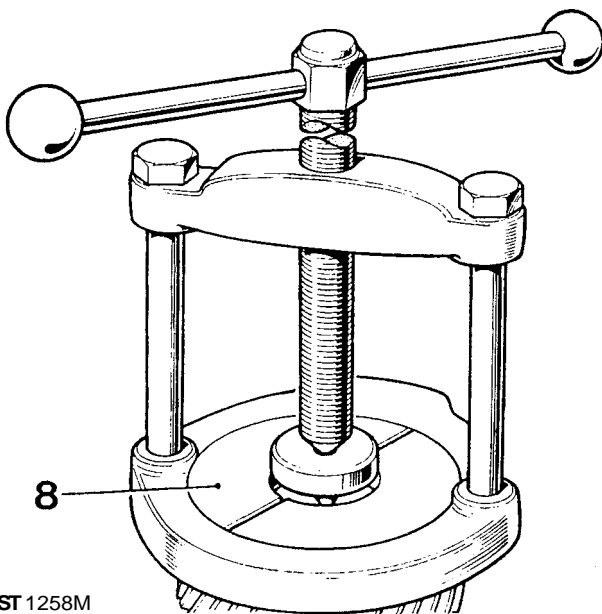
7. Extract the layshaft rear bearing outer member from the gearbox casing, extiaetor 186284 and adaptor 18G284AR.



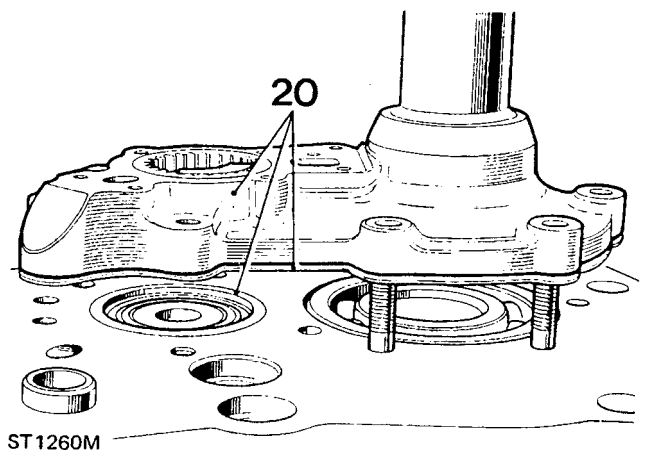
12. Press the rear bearing outer member into the gearbox casing.
13. Enter the front bearing outer member into the front bearing plate. Do not fit fully in at this stage.



8. Withdraw the bearing inner members from the layshaft. Extractor 18647 press and 18G47BA collars.



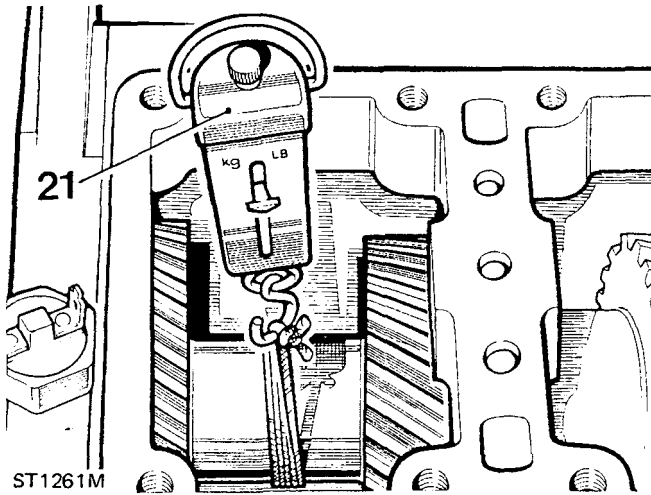
14. Remove the primary pinion from the bearing plate.
15. Position the layshaft in the gearbox casing.
16. Temporarily fit the front bearing plate and joint washer.
17. Press in the front bearing outer member until there is no end-float on the layshaft and no end-load on the bearings.
18. On the bearing outer member position a shim washer of a thickness suitable to stand 0,25 mm (0.010 in) approximately proud of the front bearing plate. This shim thickness may be subsequently adjusted depending on the amount of bearing pre-load it affords.
19. Temporarily remove the oil pump top cover and withdraw the pump drive gear.
20. Temporarily fit the front cover and new joint washer to the bearing plate. Ensure that the shim washer remains in position.



Check bearing pre-load

9. Replacement bearings inner and outer members are supplied as matched pairs and not as separate items.
10. The replacement bearings must not be degreased. Before fitting, lubricate with correct grade gearbox oil. Refer to lubrication chart.
11. Press the bearing inner members onto the layshaft.

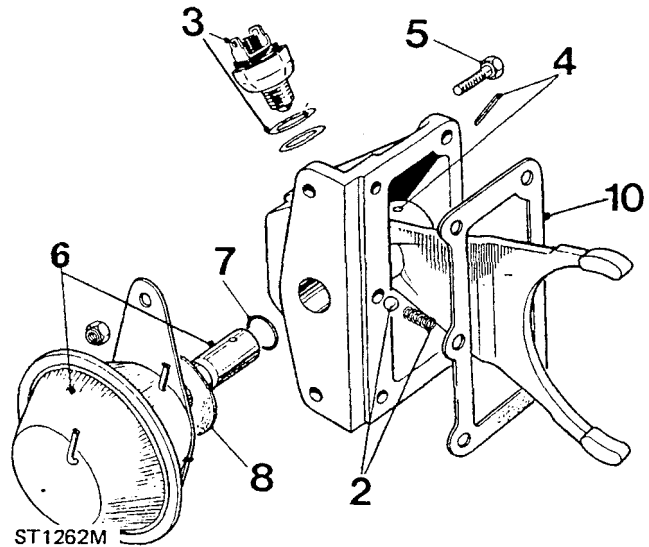
21. Measure the rolling resistance of the layshaft, using a spring balance and a cord coiled around the layshaft larger diameter. The rolling resistance must be 7 to 3,38 kg (6 to 7.5 lbs).



22. To adjust the pre-load, fit a replacement shim of suitable thickness to the front bearing outer member. Shim range is from 1,55 mm (0.059 in) to 2,50 mm (0.098 in) in 0,05 mm (0.002 in) increments.
23. When the pre-load is satisfactory, remove the front cover assembly.
24. Remove the front bearing plate.
25. Fit the primary pinion.
26. Fit the oil pump cover and drive gear.
27. Fit the front bearing plate assembly.
28. Assemble the selectors for the main gears.
29. Fit the front cover and oil pump assembly.
30. Fit the bell housing.

REMOVE AND OVERHAUL DIFFERENTIAL LOCK ACTUATOR ASSEMBLY

1. Remove the four bolts and withdraw the assembly from front output shaft housing.
2. Remove the detent spring and ball.



Dismantle and overhaul assembly

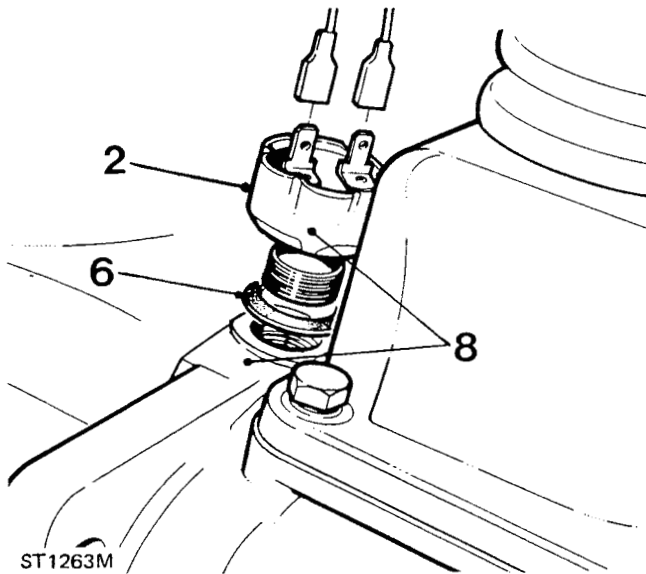
3. Remove the differential lock warning switch and washers.
4. Drive out the retaining pin.
5. Remove the actuator fixings.
6. Withdraw the actuator and shaft.
7. Withdraw the 'O' ring seal.
8. Withdraw the joint washer.

Assemble

9. Fit a new 'O' ring seal to actuator shaft.
10. Coat both sides of the joint washer with Hylomar PL32M.
11. Fit the actuator and shaft and secure to the housing.
12. Fit the actuator shaft retaining pin.
13. Fit the differential lock warning switch and washers.

Assemble to gearbox

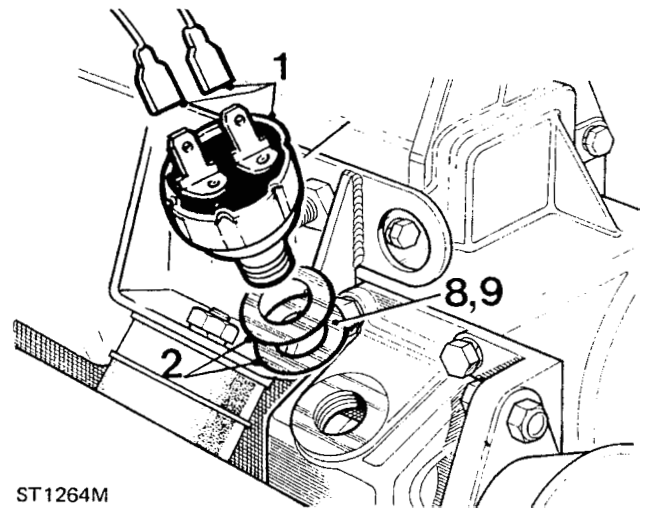
14. Fit the ball and detent spring.
15. Apply Hylomar PL32M jointing compound to both sides of a new actuator housing joint washer.
16. Fit and secure the assembly to the gearbox and evenly tighten the four retaining bolts.



ST1263M

Renew

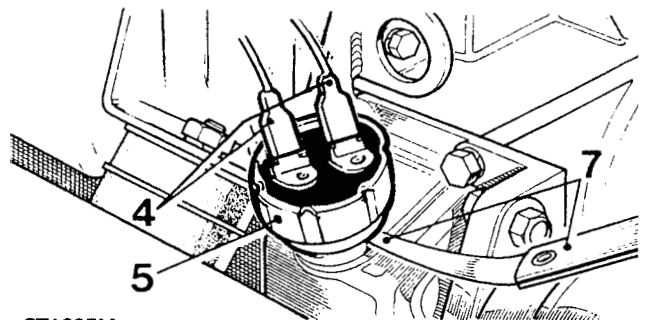
3. Engage reverse gear.
4. Connect the electrical leads to the switch.
5. Switch the ignition 'ON'.
6. Screw in the switch, less shim washers, until the switch contacts are made.
7. Screw in a further half turn.
8. Measure the clearance between the switch lower face and the gearbox.
9. Select shim washers to suit the clearance. Shim thicknesses are 0,5 mm (0.020 in) and 0,137 mm (0.005 in).
10. Fit the selected shim washer(s) and switch. Tighten to a torque of 1,4 to 2,0 kgf m (15 to 20 lbf ft) (20 to 27 Nm).



ST1264M

Renew

3. Start the engine and move the differential lock vacuum control valve to the 'up' position.
4. Connect the electrical leads to the actuator switch.
5. Screw in the switch, less shim washers, until the switch contacts are made.



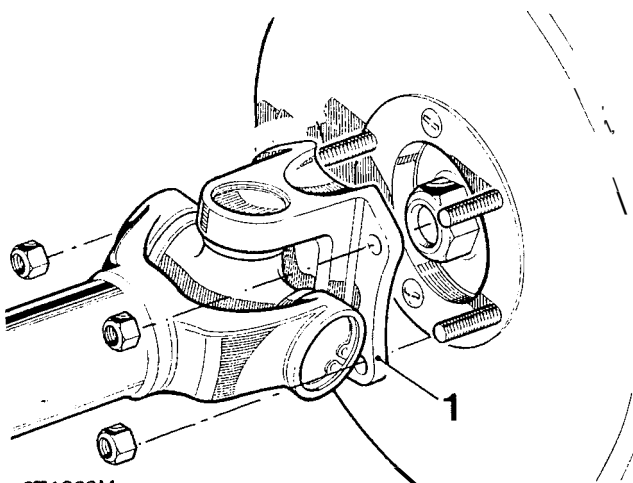
ST1265M

6. Screw in a further half turn.
7. Measure the clearance between the switch lower face and the housing.
8. Select shim washers to suit the clearance. Shim thicknesses are 0,5 mm (0.020 in) and 0,137 mm (0.005 in).
9. Fit the selected shim washer(s) and the switch.
10. Re-position control valve and stop engine.

RENEW REAR OUTPUT SHAFT OIL SEAL

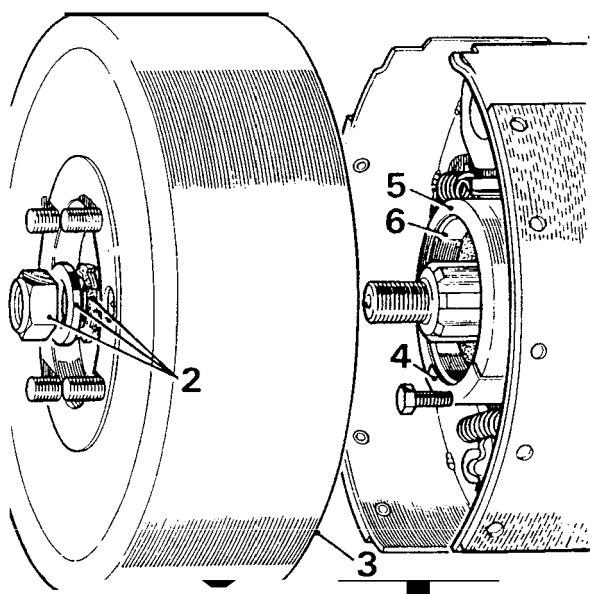
Remove

1. Disconnect the rear propeller shaft at the transmission brake.



ST1266M

2. Remove the locking nut, washer and the felt oil seal.
3. Withdraw the transmission brake drum complete with rear coupling flange.
4. Remove the oil catcher.
5. Prise off the oil shield.
6. Withdraw the oil seal.



ST1267M

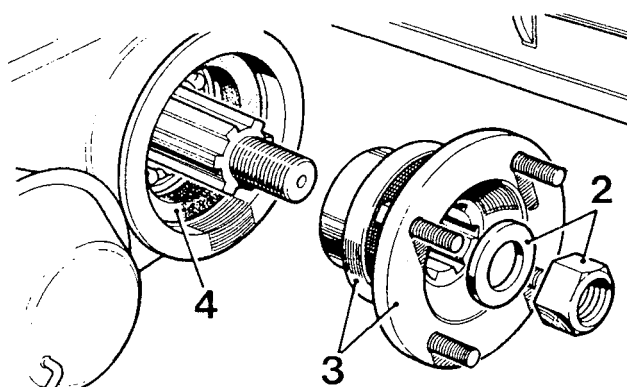
Renew

7. Press in the oil seal, open face first, until the seal plain face just clears the chamfer on the seal housing bore.
8. Fit the oil shield, which must be a close fit on the speedometer housing.
9. Fit the oil catcher, applying Bostik compound 771 to seal the oil catcher against the brake back plate.
10. Fit the transmission brake drum complete with rear coupling flange.
11. Fit the oil seal washer and locking nut and tighten to the correct torque.
12. Connect the rear propeller shaft to the transmission brake.

RENEW FRONT OUTPUT SHAFT OIL SEAL

Remove

1. Disconnect the front propeller shaft.
2. Remove the coupling flange locknut and washer.
3. Withdraw the coupling flange complete with mudshield.
4. Withdraw the oil seal.



ST1268M

Renew

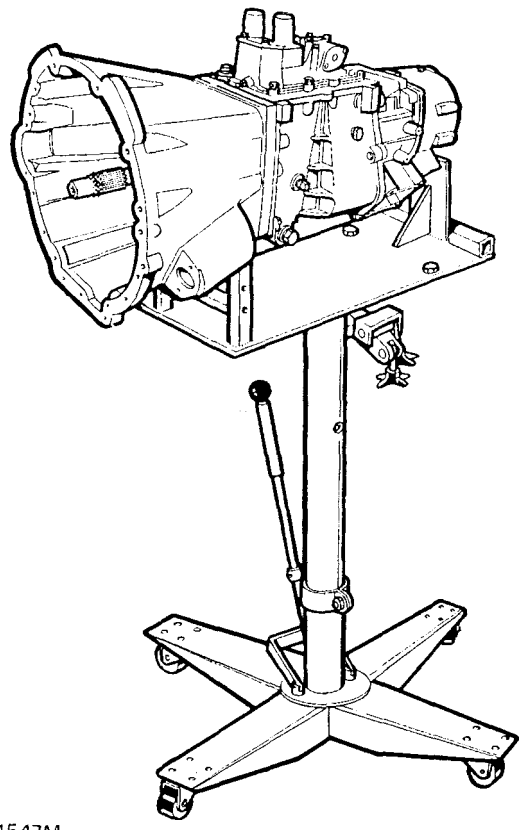
5. Fit the oil seal, lip side facing.
6. Fit the flange coupling with mudshield.
7. Secure the flange with locknut and washer and tighten to the correct torque.
8. Connect the propeller shaft.

REMOVE LT85/LT230T MAIN GEARBOX AND TRANSFER BOX

Cradle for removing gearbox

The gearbox should be removed from underneath the vehicle, using a hydraulic hoist, as illustrated; a cradle for locating the gearbox on to the hoist can be manufactured to the drawing below. If a similar cradle was made for the LT77 gearbox, it can be modified to suit both the LT77 and LT85 gearboxes by making the modifications shown by the large arrows.

Manufacture a cradle to the dimensions given in the drawing and attach it to a transmission hoist. To achieve balance of the transmission unit when mounted on the transmission hoist, it is essential that point **A** is situated over the centre of the lifting hoist ram. Drill fixing holes **B** to suit hoist table. Secure the transmission unit to the lifting bracket at point **C**, by means of the lower bolts retaining the transfer gearbox rear cover.

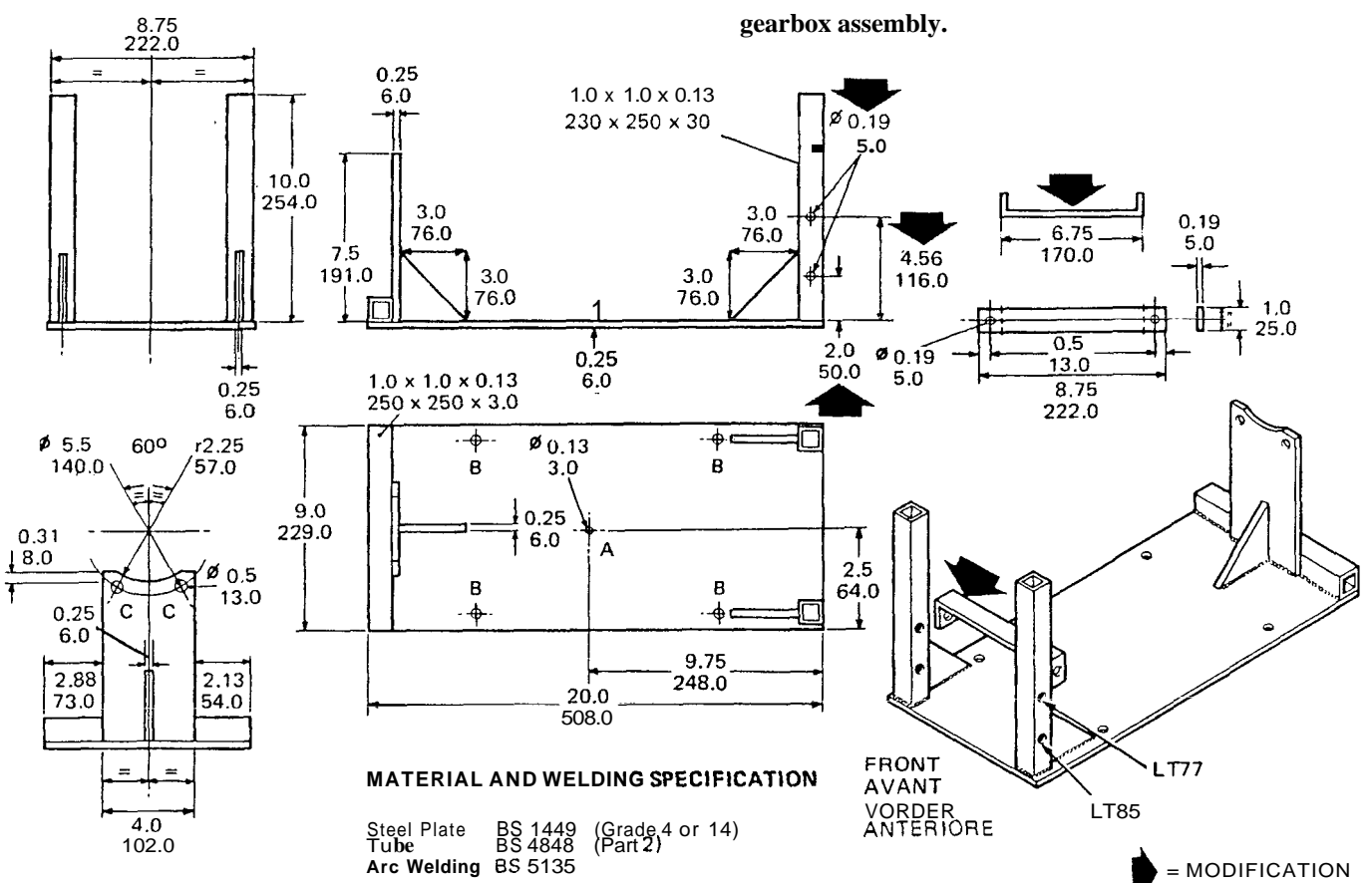


Refer to the Removal instructions for the LT77 gearbox page 1. The method for removing the LT85/LT230T gearbox assembly is similar, except for the following.

1. It is not necessary to remove the engine fan cowl.
2. Remove the air cleaner.
3. Remove the high/low selector housing from the transfer box.
4. Use the cradle and hydraulic hoist already described, to remove the gearbox.

NOTE: It may be necessary to remove the transmission brake drum to allow removal of the gearbox assembly.

ST1547M



ST 538M

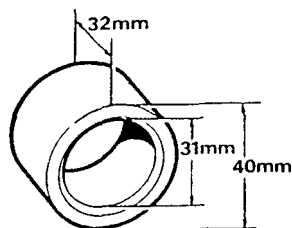
OVERHAUL LT85 FIVE SPEED GEARBOX

— Ninetyand One Ten **V8** models

Service Tools:

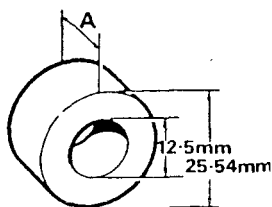
- 18G 1294** — Guidestuds
- 18G 1400** — Two legged puller
- 18G 1431** — Replacer, mainshaft bearings
- MS 284** — Slide hammer
- MS 550** — Driver handle
- LST 101** — Gauge, first gear end float
- LST 102** — Remover-Replacer, mainshaft rear oil seal
- LST 284-1** — Adaptor-Remover, reverse idler shaft
- LST 550-1** — Adaptor-Remover-Replacer, layshaft front bearing roller
- LST 550-2** — Adaptor-Remover-Replacer, layshaft rear bearing outer track
- LST 550-3** — Adaptor-Remover-Replacer, mainshaft front and rear bearing
- LST 1431-1** — Remover-Replacer, front plate and mainshaft

In addition to the above Service Tools, the following five items should be manufactured locally to facilitate dismantling and reassembly of the gearbox.



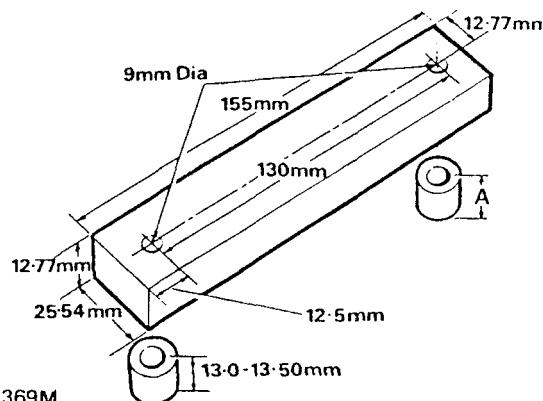
ST1476M

Spacer for retaining layshaft rear bearing



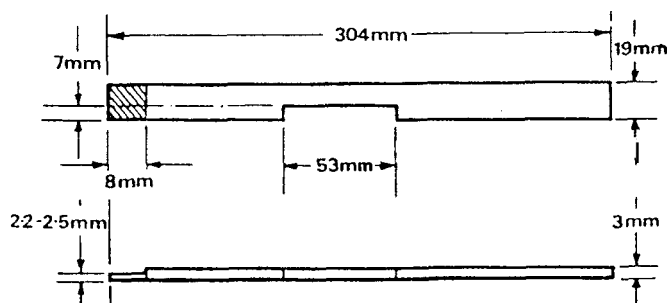
ST1475M

Spacers for retaining front bearing plate. Two required.
A — This dimension must be more than 12 mm.



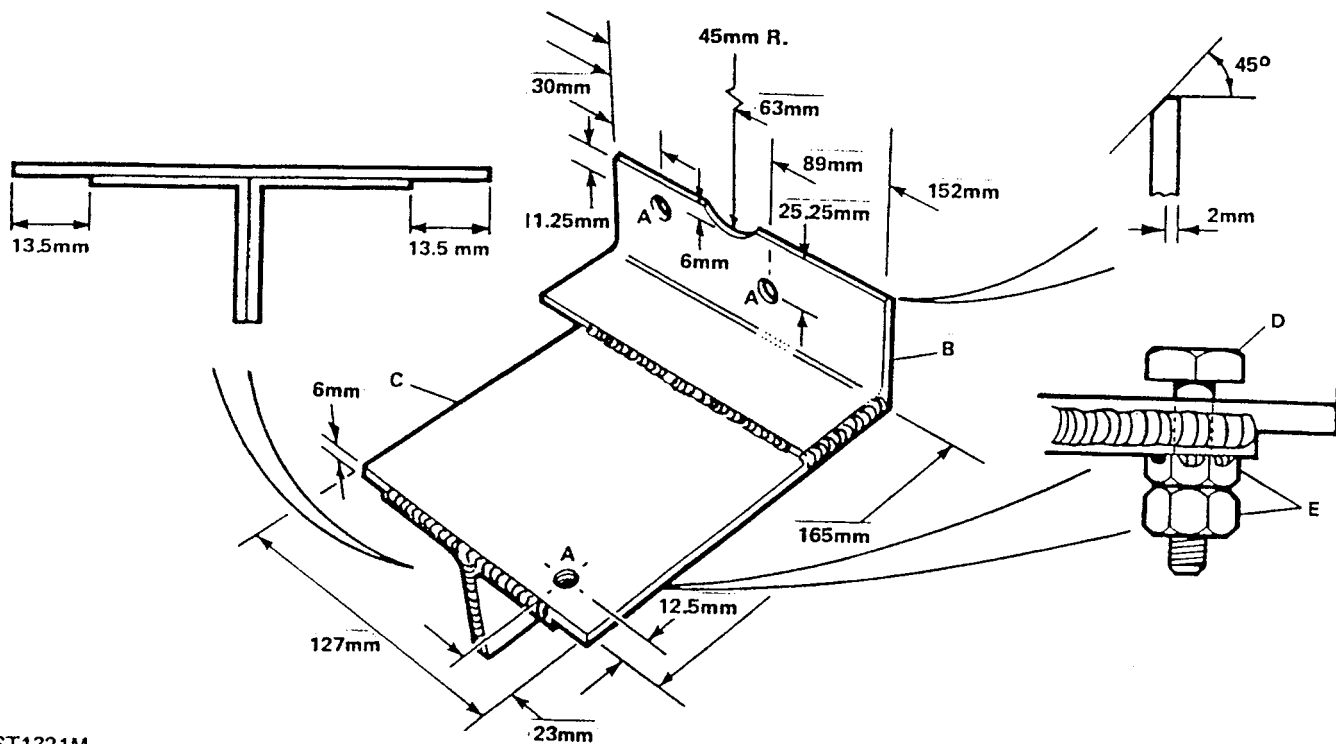
ST1369M

Selector detent spring retaining tool and spacers.
A — Spacers can be made **up** from washers



ST1371M

Gauge for reverse cross-over lever adjustment.



ST1321M

Stand for securing the gearbox in a vice

- A. 11 mm diameter holes
- B. Make from 50 mm x 6 mm steel angle
- C. Make from 6 mm steel plate
- D. 10mm diameter bolt with hexagonal head
- E. 10 mm nuts

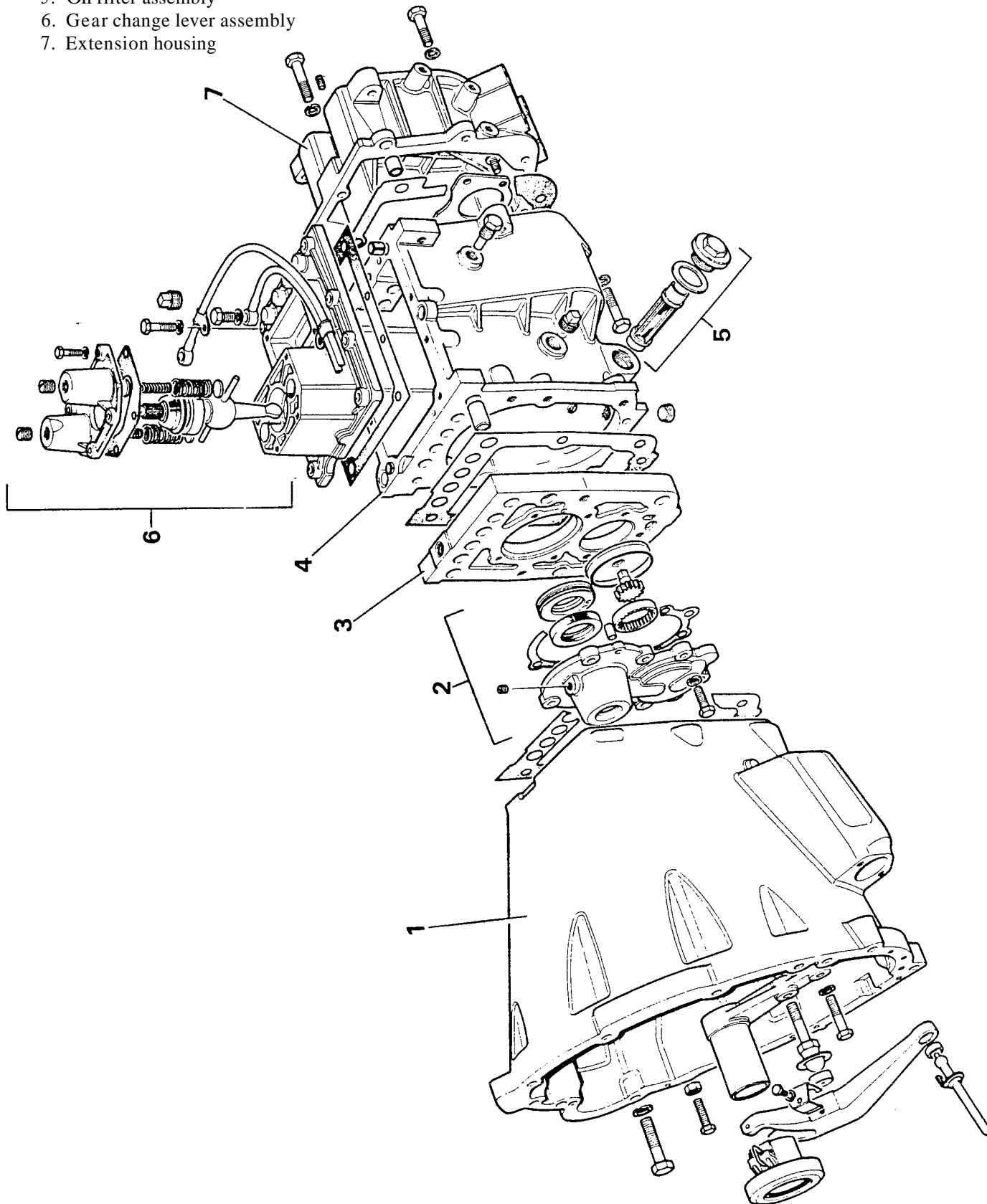
MATERIAL AND WELDING SPECIFICATION

Steel Plate BS 1449 (Grade 4 or 14)

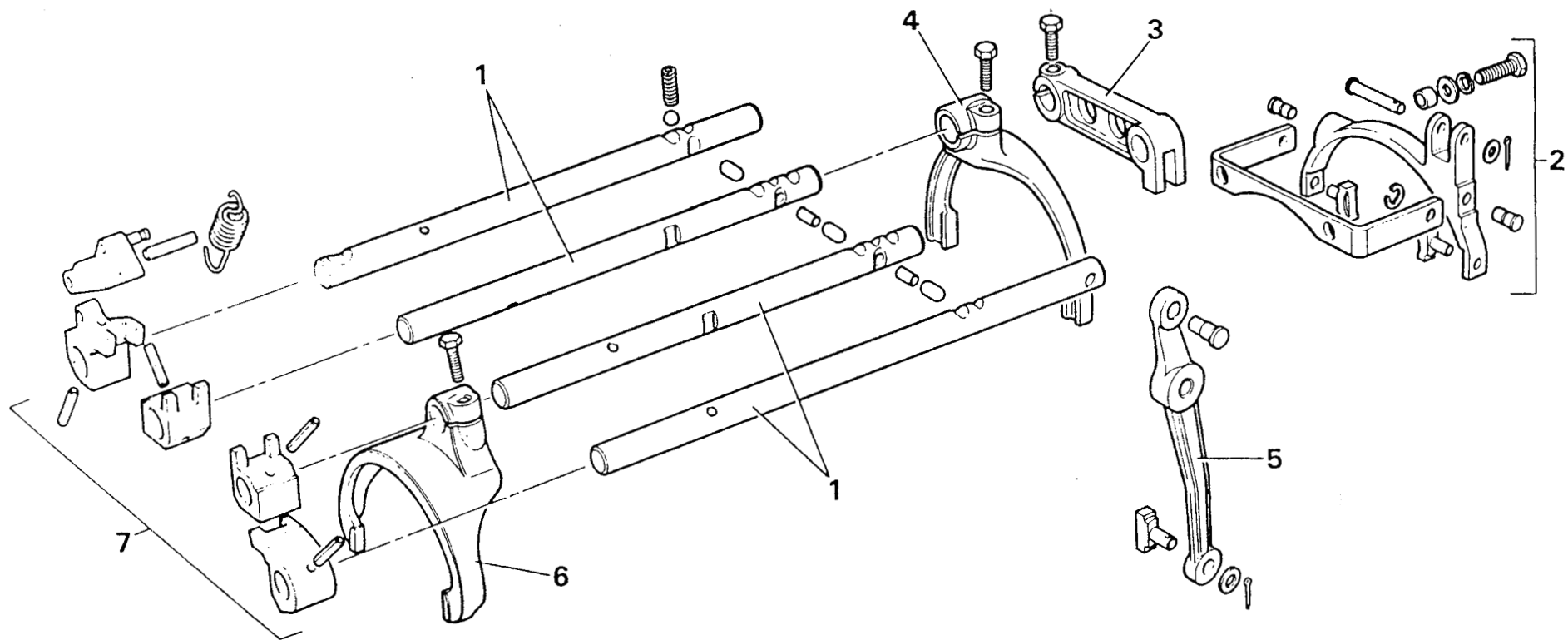
Arc Welding BS 5135

GEAR CASINGS

- 1. Bell housing and clutch release assembly
- 2. Oil pump assembly
- 3. Front bearing plate
- 4. Main gear case
- 5. Oil filter assembly
- 6. Gear change lever assembly
- 7. Extension housing

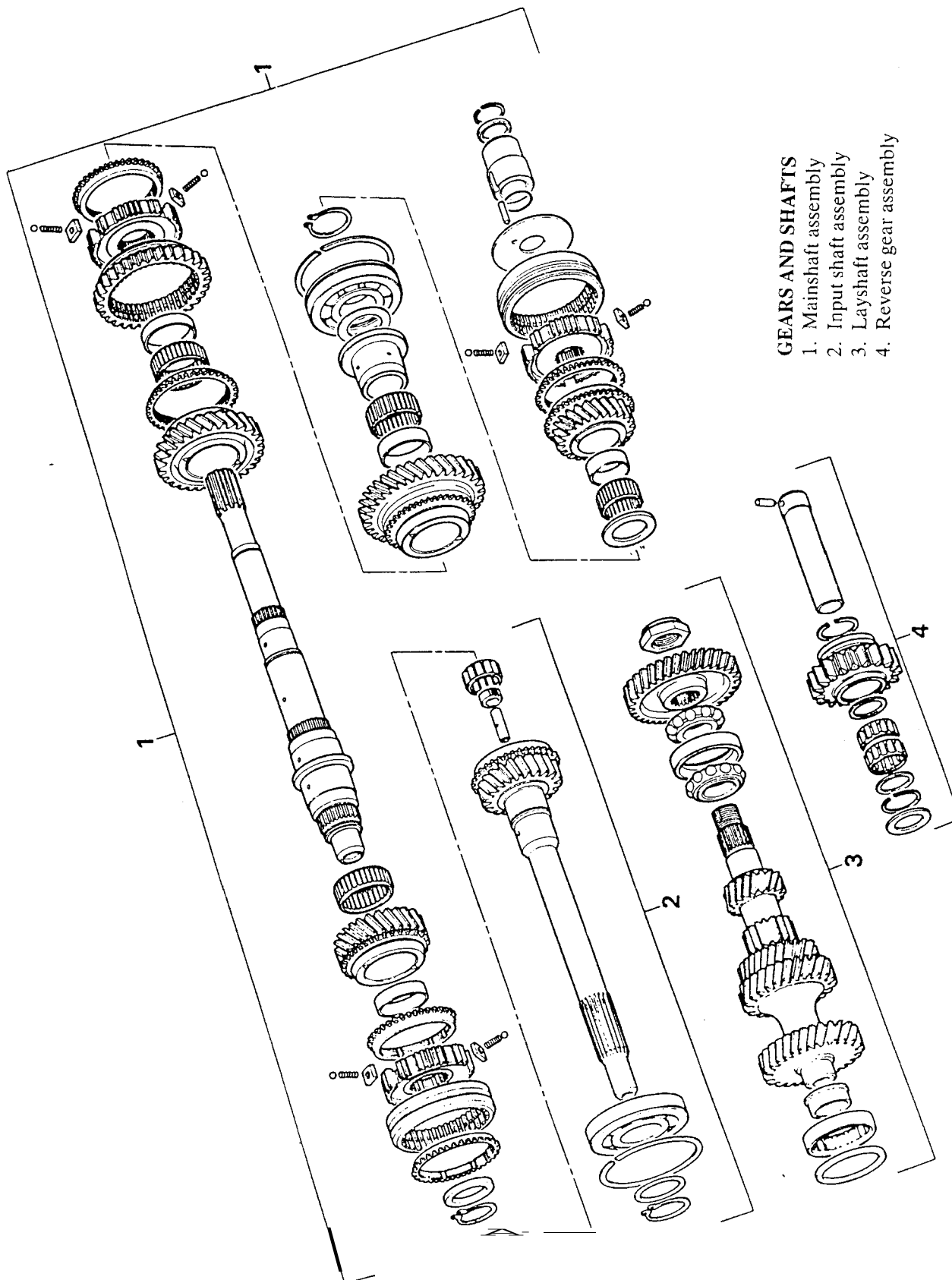


ST1319M



GEAR SELECTORS

1. Selector rails
2. Selector **fork** assembly for 5th gear
3. Selector arm for reverse gear
4. Selector fork for 1st and 2nd gear
5. Reverse gear cross-over lever assembly
6. Selector **fork** for 3rd and 4th gear
7. Selector jaws



GEARS AND SHAFTS
1. Mainshaft assembly
2. Input shaft assembly
3. Layshaft assembly
4. Reverse gear assembly

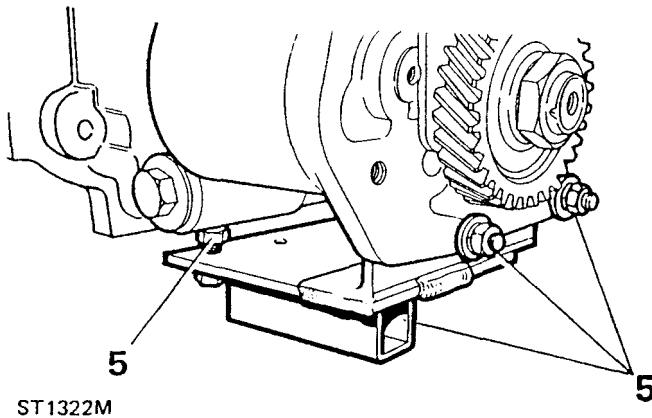
ST1320M

GEARBOX DATA

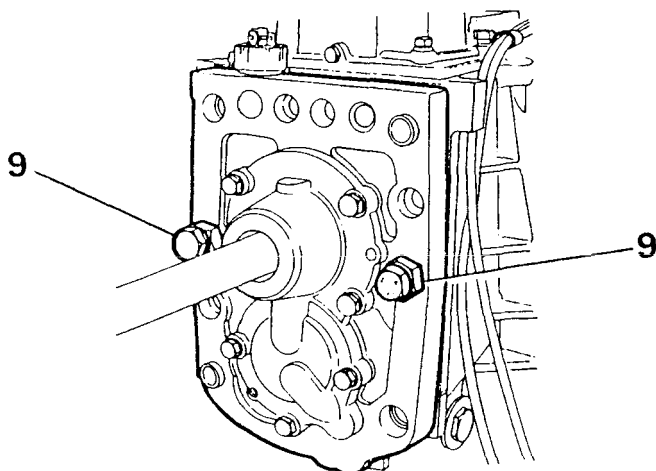
Mainshaft first speed gear running clearance	0,075 mm maximum
Mainshaft third speed gear running clearance	0,075 mm maximum
Mainshaft fifth speed gear running clearance	0,075 mm maximum
Input shaft bearing running clearance	0,075 mm maximum

DISMANTLING

1. Ensure gearbox oil has been completely drained.
2. Position gearbox on bench and support with suitable wooden block.
3. Remove four bolts and detach L.H. gearbox mounting bracket.
4. Remove extension housing and gasket.
5. Fit manufactured stand to gearbox and secure with two bolts, nuts, spring and plain washers. Adjust bolt under filter housing as necessary.

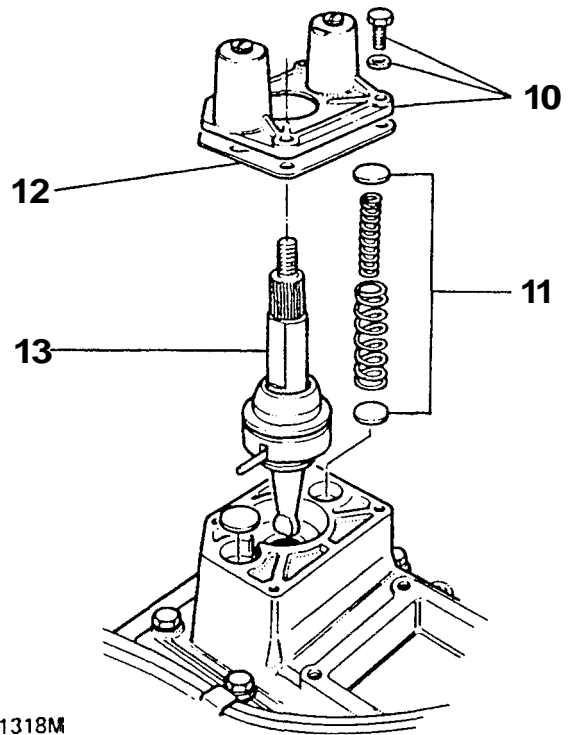


6. With assistance, fit gearbox and stand into a suitable vice and firmly secure.
7. Remove six bolts and washers and lift bell housing, complete with clutch release lever, sleeve and thrust bearing, from gearbox.
8. Remove bell housing gasket.
9. Fit two bell housing fixing bolts, with spacers to front bearing plate.



Bias spring housing and gear lever

10. Remove four bolts and spring washers and lift bias spring housing from gearbox.
11. Remove bias springs and shims. Care should be taken when removing lower shims to avoid them slipping under gear lever pivot bar and into gearbox.
12. Remove bias spring housing gasket.
13. Remove gear lever, complete with gaiter and nylon cup.

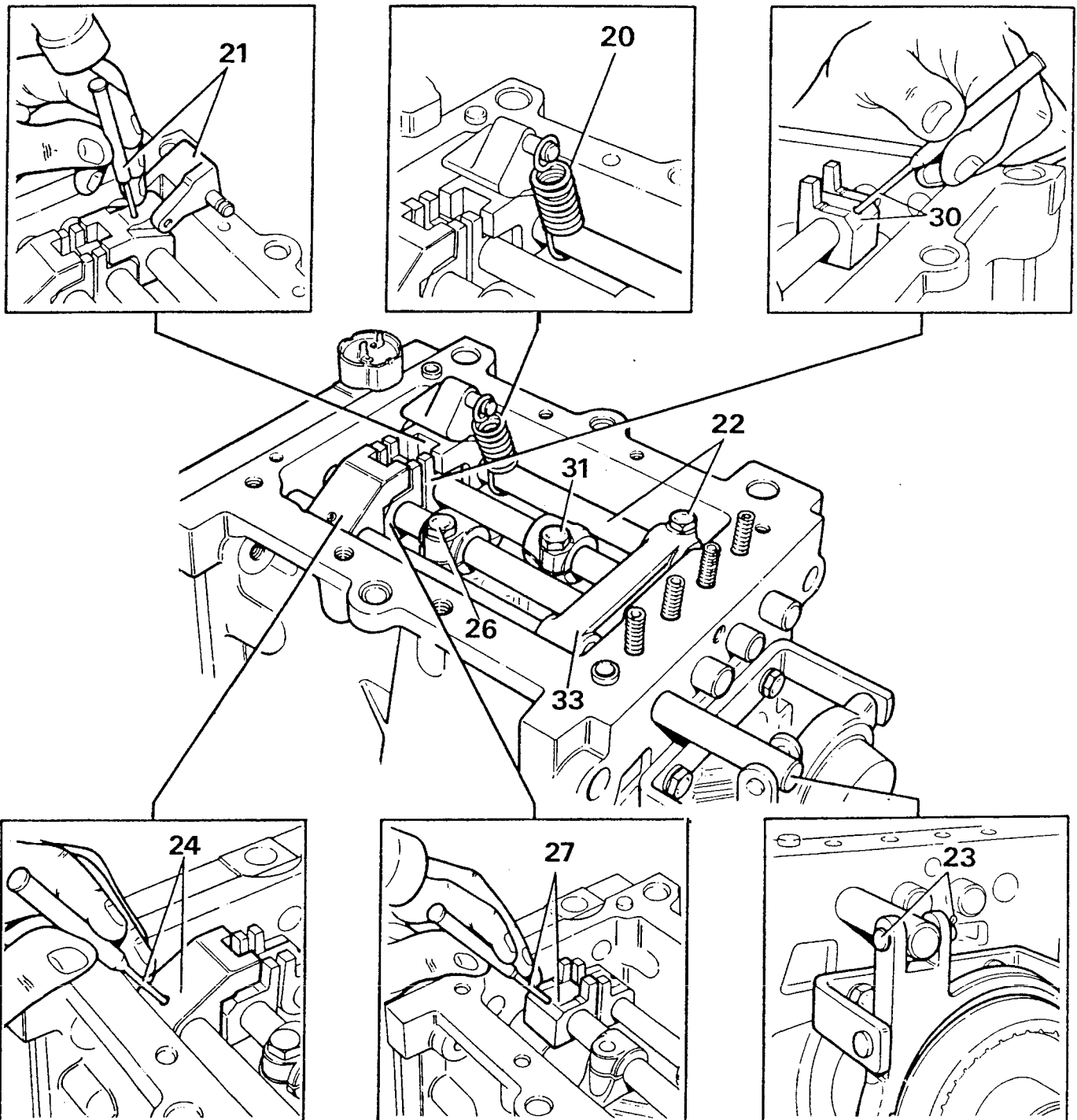


Gearbox top cover

14. Remove reverse light switch, if fitted.
15. Remove breather pipe banjo union fixing bolt.
16. Remove eight bolts and spring washers and lift top cover and breather pipes from gearbox.
17. Remove detent springs.
18. Remove top cover gasket.

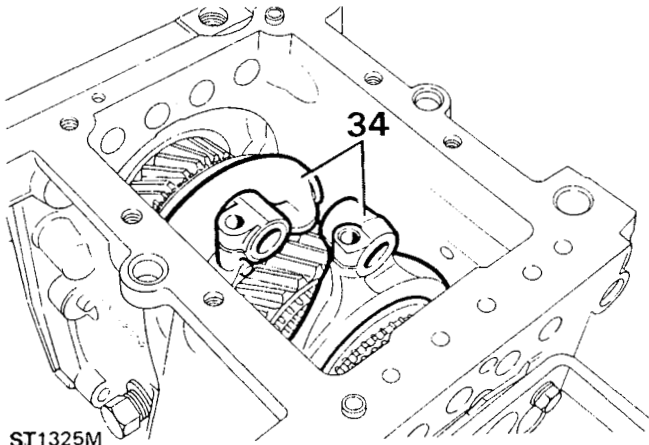
Selector rails and forks

19. Using a suitable magnet withdraw the selector rail detent balls from drillings in gearbox. If detent balls are tight leave operation until after selector rails have been withdrawn, when the detent balls can be pushed down into the selector rail bore, then removed.
20. Release reverse gate spring from knock-over lever and remove from reverse gear rail.
21. Raise knock-over lever and tap down reverse jaw roll-pin until jaw is free on rail.
22. Remove clamp bolt from reverse cross-over lever and withdraw reverse selector rail and jaw from gearbox.
23. Remove split pin washer and clevis pin securing 5th gear selector rail to selector fork and bracket assembly.
24. Push selector rail forwards and tap down 5th gear jaw roll pin until jaw is free on rail.
25. Withdraw 5th gear selector rail and jaw from gearbox.
26. Remove clamp bolt from 3rd/4th selector fork and move selector rail forward.

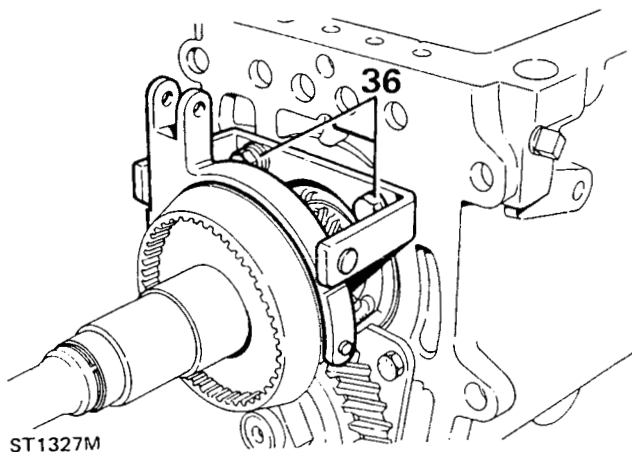
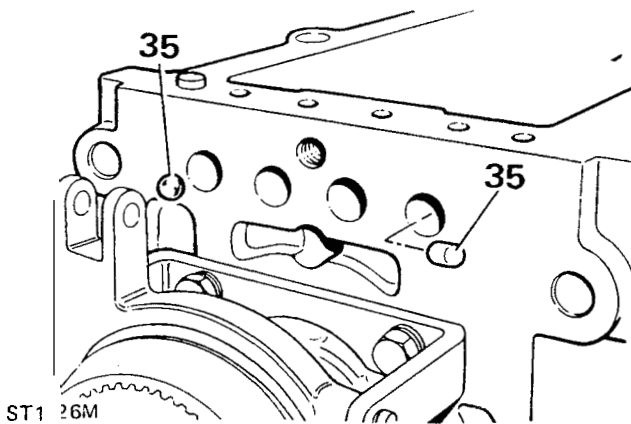


ST1324M

- 27. Tap down 3rd/4th jaw roll pin until jaw is free on selector rail.
- 28. Withdraw 3rd/4th selector rail and jaw.
- 29. Remove interlock from 3rd/4th selector rail.
- 30. Tap down 1st/2nd jaw roll pin until jaw is free on selector rail.
- 31. Remove clamp bolt from 1st/2nd selector fork and withdraw 1st/2nd selector rail and jaw.
- 32. Remove interlock from 1st/2nd selector rail.
- 33. Lift reverse cross-over lever from gearbox.
- 34. Remove 1st/2nd and 3rd/4th selector forks.



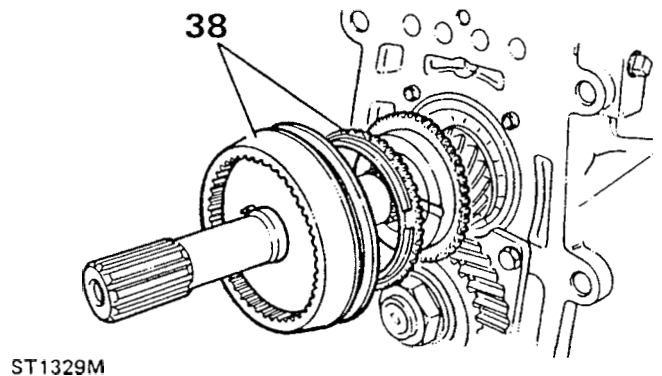
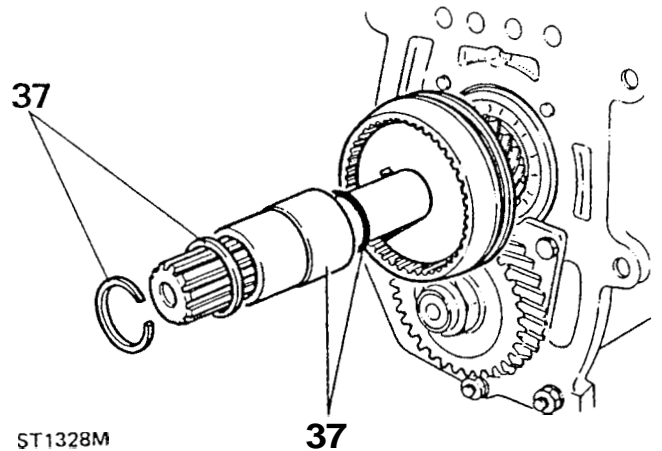
- 35. Remove interlock plungers and also detent balls if not removed in operation 19.



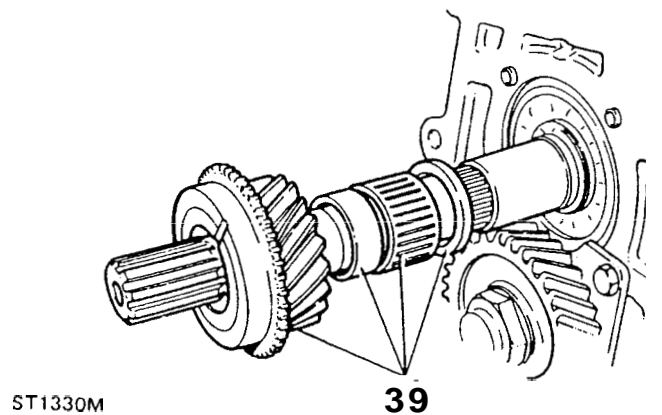
- 36. Remove two bolts, spring washers and plain washers securing 5th gear fork and bracket assembly to gearbox. Do not displace selector fork slipper pads when removing fork.

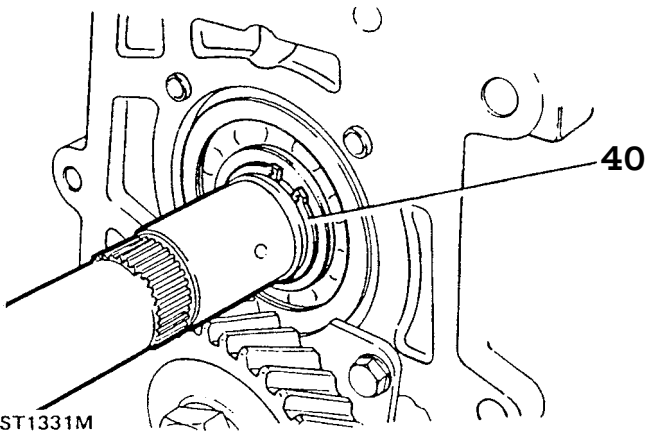
Reverse idler shaft, mainshaft and layshaft

- 37. Remove circlip, selective washer, oil seal collar and 'O' ring from mainshaft.



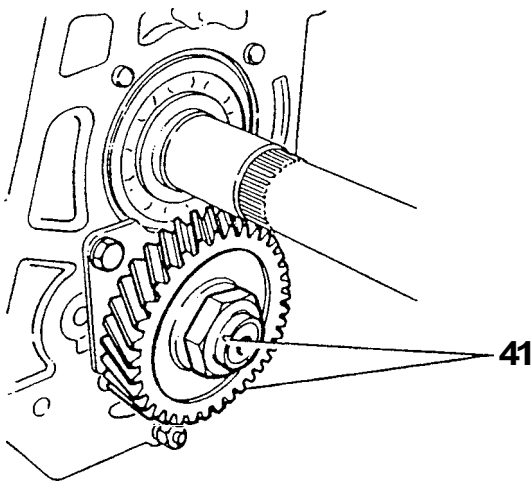
- 38. Remove 5th gear synchro hub and baulk ring.
- 39. Remove 5th gear, spacer, needle roller bearing and thrust washer.



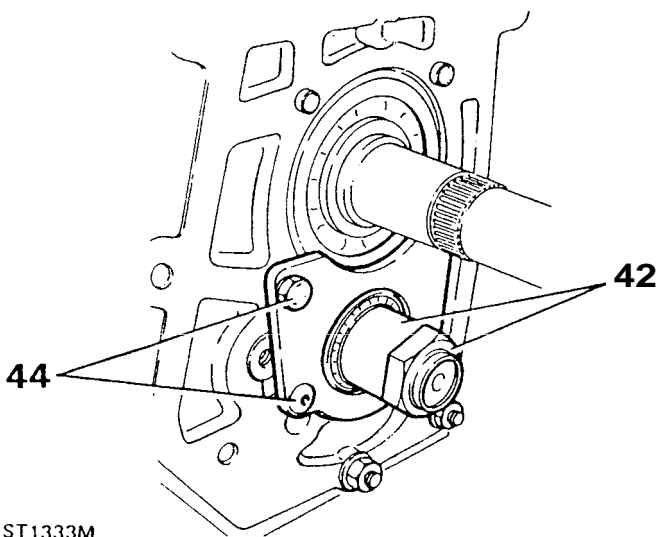


- 40. Remove mainshaft rear bearing circlip.
- 41. Release stake nut collar from recess in layshaft, remove stake nut and 5th gear from layshaft.

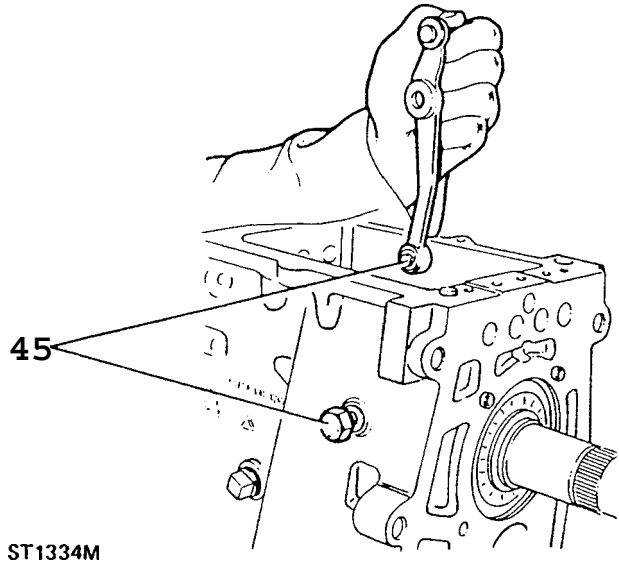
NOTE: To facilitate this operation lock gearbox by engaging both 1st and 4th gears.



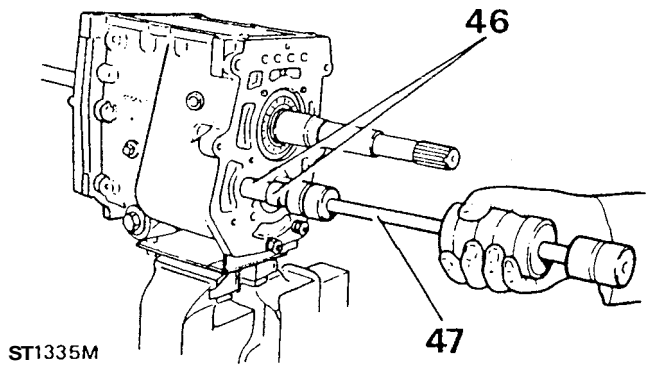
- 42. Fit manufactured spacer to layshaft to retain rear bearing and secure in position with stake nut finger-tight only



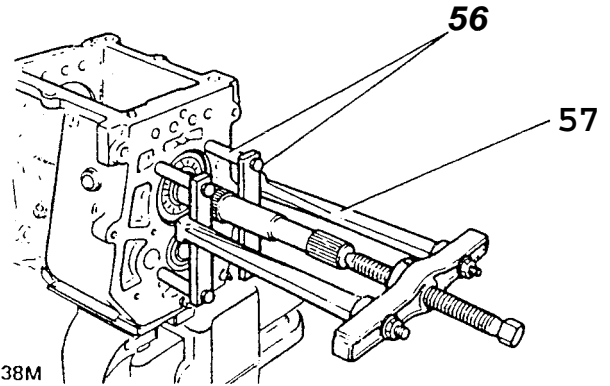
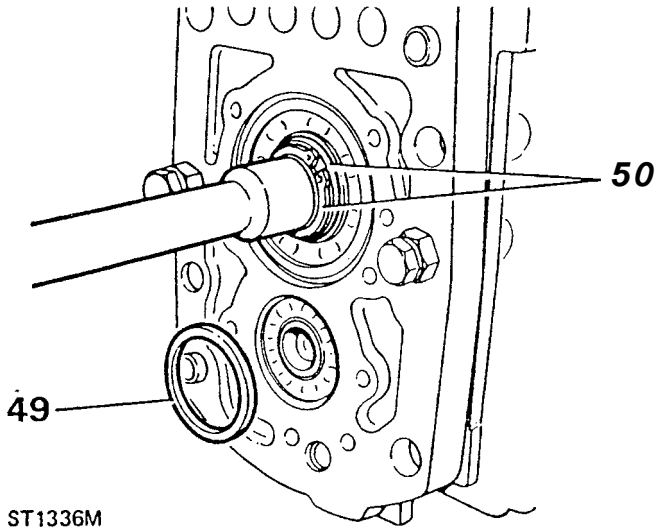
- 43. Disengage 1st and 4th gears.
- 44. Remove two socket head set screws and two bolts with spring washers and remove reverse shaft and layshaft bearing track retaining plate.
- 45. Remove reverse lever pivot bolt and lift reverse lever from gearbox.



- 46. Fit extractor adaptor Tool No. LST 284-1 to reverse idler shaft.
- 47. Fit slide hammer Tool No. MS 284 to adaptor and withdraw reverse idler shaft from gearbox. Reverse idler gear and thrust washer will drop into bottom of gearbox.
- 48. Remove seven bolts and spring washers and withdraw front cover and gasket from front bearing plate.



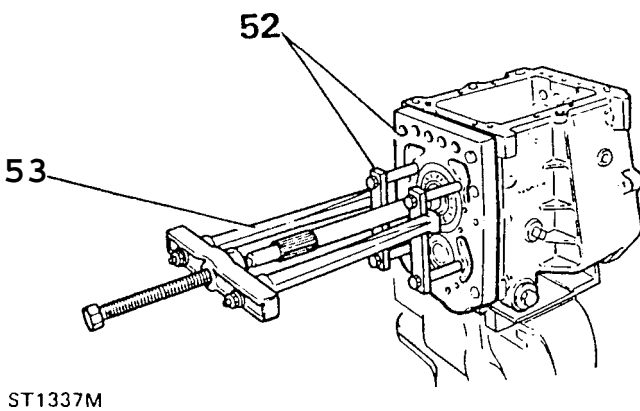
- 49. Remove layshaft front bearing spacer.
- 50. Remove input shaft bearing circlip and selective washer.
- 51. Remove bolts and spacers retaining front bearing plate to gearbox.



- 58. Extract mainshaft from rear bearing. To facilitate operation assistance will be needed to support mainshaft and layshaft.
- 59. Tap layshaft forwards and remove rear bearing race.
- 60. Withdraw mainshaft and layshaft assemblies.
- 61. Remove reverse idler gear and thrust washer from gearbox.

- 52. Fit plates and spacers of Tool No. LST 1431-1 to front bearing plate with 90 mm bolts.
- 53. Locate two legged puller Tool No. 18G 1400 as shown and remove front bearing plate from input shaft and gearbox.

NOTE: Centre bolt and legs of puller must be aligned squarely with input shaft.

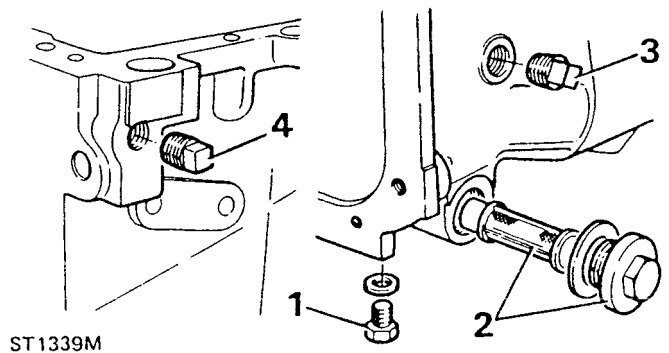


- 54. Remove bearing plate gasket.
- 55. Remove stake nut and spacer from layshaft.
- 56. Fit plates and spacers of Tool No. LST 1431-1 to rear of gearbox with 95 mm bolts in top locations and 90 mm bolts in lower.
- 57. Locate two legged puller Tool No. 18G 1400, again ensuring centre bolt and legs of puller are aligned squarely.

OVERHAUL

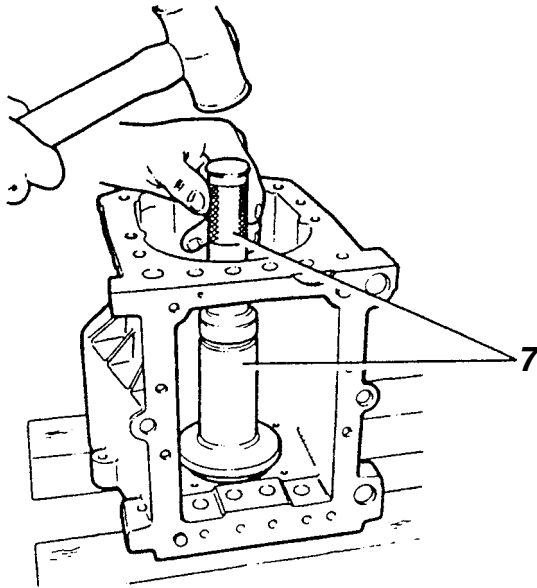
Main gearbox case

- 1. Remove drain plug.
- 2. Remove retaining plug and oil filter.
- 3. Remove filler/level plug.
- 4. Remove interlock cross drilling plug.



- 5. Remove top cover location dowels and 5th gear fork bracket dowels, if necessary.
- 6. Remove gearbox stand.

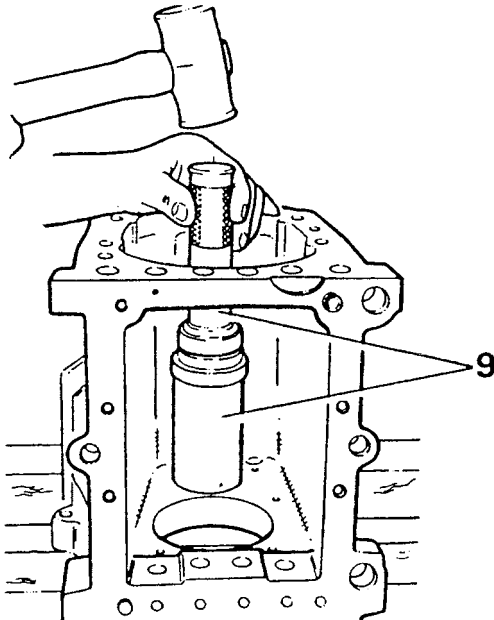
7. Position gearbox on suitable wooden blocks and remove mainshaft rear bearing using Tool Nos. LST 550-3 and MS 550.



ST1340M

8. Remove rear bearing circlip and clean.
9. Using Tool Nos. LST 550-2 and MS 550 remove layshaft rear bearing outer track.

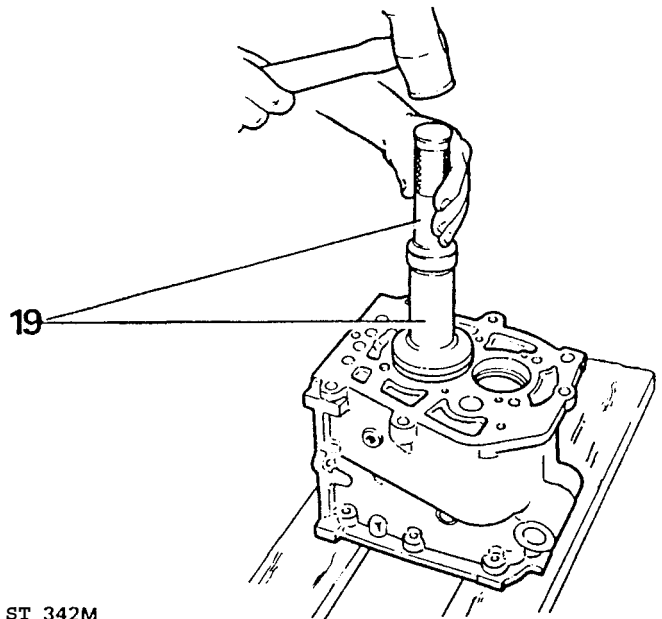
NOTE: Use rounded end of tool.



ST1341M

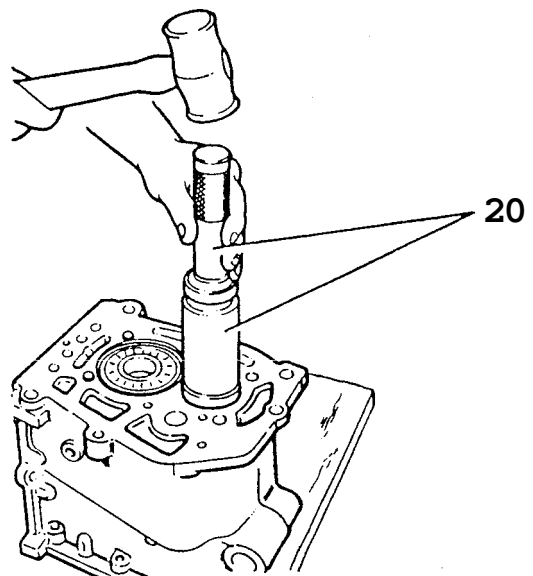
10. Clean gearbox caseasket faces, interior and exterior and inspect for cracks and obvious signs of damage etc.
11. Clean magnetic drain-plug, oil filter retaining plug, level/filler plug and oil filter.

12. Clean mainshaft and layshaft bearing seatings.
13. Clean rcverse gear idler shaft seating, drain plug, and level/filler plug tappings.
14. Using an air line blow out filter plug tapping and oil-way, detcnt and interlock seatings.
15. Clean top cover face and 5th gear fork bracket dowels.
16. Heat gearbox case to facilitate fitting of mainshaft rear bearing and layshaft bearing track.
17. Fit circlip to mainshaft rear bearing.
18. Position rear bearing in gearbox seating.
19. Using Tool Nos. LST 550-3 and MS 550 tap rear bearing into position.



ST 342M

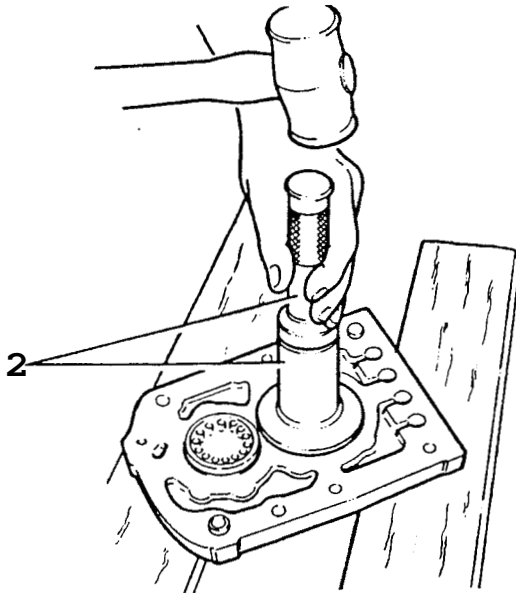
20. With gearbox still warm fit layshaft rear bearing outer track using Tool Nos. LST 550-2 and MS 550.
21. Refit interlock drilling plug.
22. Refit level/filler plug — do not tighten at this stage.
23. Refit oil filter and retaining plug using new copper washer.
24. Refit magnetic drain plug and new copper washer.



ST1343M

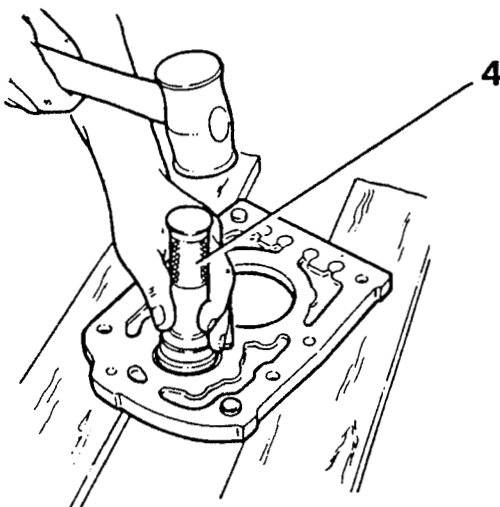
Front bearing plate

1. Support front bearing plate on suitable wooden blocks as shown.
2. Using Tool Nos. LST 550-3 and MS 550 remove input shaft bearing.



ST1344M

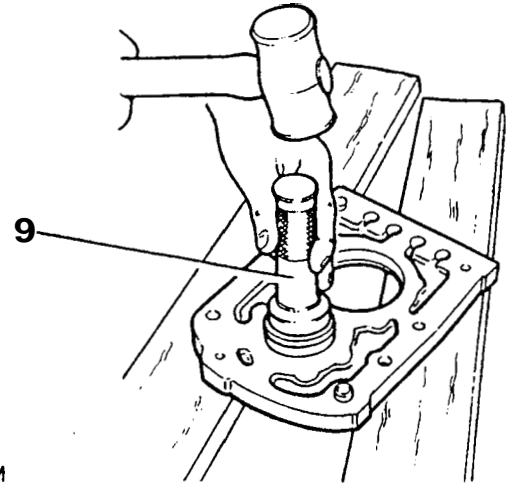
3. Remove circlip from bearing.
4. Remove layshaft front bearing from bearing plate using Tool No. LST 550-1.



ST1345M

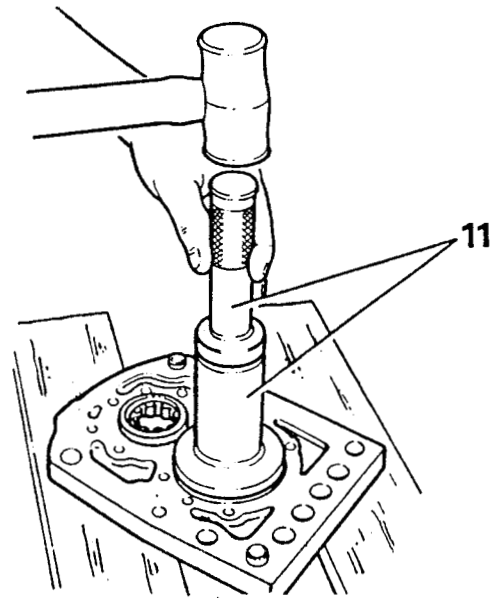
5. If necessary, replace bearing plate dowels.
6. Clean bearing plate, gasket forces and input shaft and layshaft bearing seatings.
7. Using an air line blow out oil-way in bearing plate.
8. Heat front bearing plate to facilitate refitting of input shaft and layshaft bearings.

9. Using Tool No. 550-1 fit layshaft bearing, with 6,5-7 mm of bearing protruding from front of bearing plate. This allows easier assembly of the layshaft and mainshaft at a later stage.



ST1347M

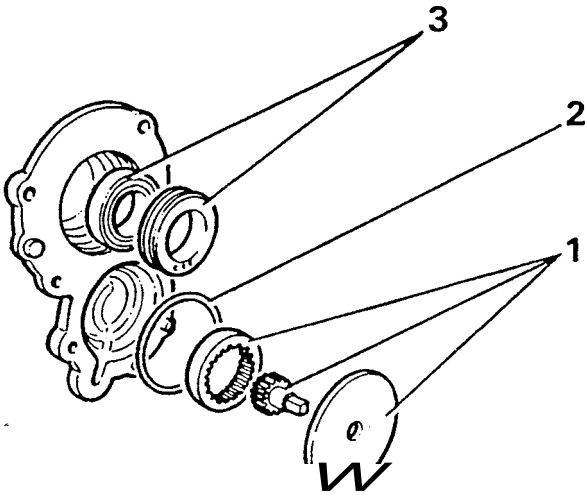
10. Fit circlip to input shaft bearing.
11. With the front bearing plate still warm fit input shaft bearing, using Tool Nos. LST 550-3 and MS 550.



ST1346M

Front cover and oil pump

1. Remove cover plate, drive gear and impellor gear.
2. Remove cover plate 'O' ring.
3. Position wooden blocks under front cover and remove oil feed ring and oil seal.

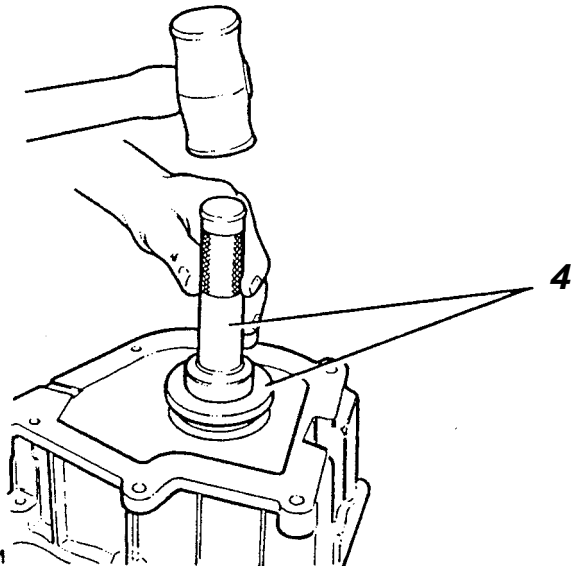


ST1348M

4. Clean all front cover components.
5. Lubricate lip of new oil seal and position in front cover seating with close side downwards.
6. Fully seat oil seal in position using suitable tube.
7. Fit oil feed ring, ensuring the three holes of the feed ring are at the bottom and the centre hole is aligned with the mating oil pump feed drilling in the front cover.
8. Fully seat feed ring in position using suitable tube.
9. Fit cover plate 'O' ring, lubricate and fit impellor gear, and drive gear.
10. Fit cover plate, ensuring chamfer of centre hole is facing towards oil pump.

Gearbox extension housing

1. Remove rear oil seal from extension housing using suitable drift.
2. If necessary, replace extension housing dowels.
3. Clean gasket faces and interior and exterior surfaces.
4. Using Tool No. LST 102 fit new oil seal to extension housing.



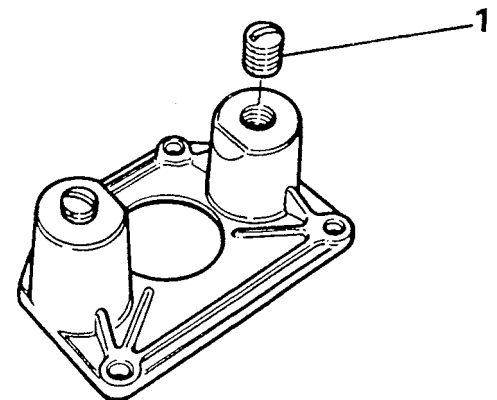
ST1349M

Top Cover

1. Clean top cover gasket faces and interior and exterior surfaces.
2. Remove top filler plug, clean, apply sealant and refit plug.

Bias spring housing and lower gear lever

1. Fit housing to vice and remove bias spring adjusting screws

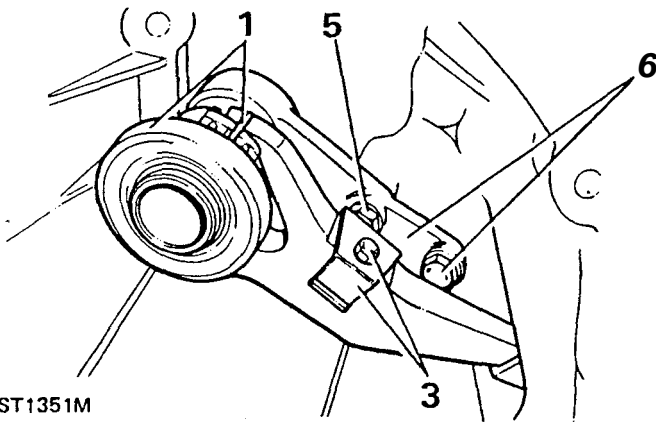


ST1350M

2. Clean lower gear lever and nylon cup.
3. Clean housing, adjusting screws, bias spring bores, springs and shims.
4. Refit bias spring screws — two turns only at this stage.

Bell housing

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



7. Remove bearing sleeve dowels, if necessary.
8. Clean bell housing interior, exterior and mating faces.
9. Apply grease to lever pivot and inner face of bearing carrier.
10. Reassemble in reverse order.

Input shaft

1. Remove 4th gear baulk ring and needle roller bearing.
2. Clean all components, ensuring oil-way on input shaft is blown through with air line.
3. Clean input bearing circlip and selective washer.

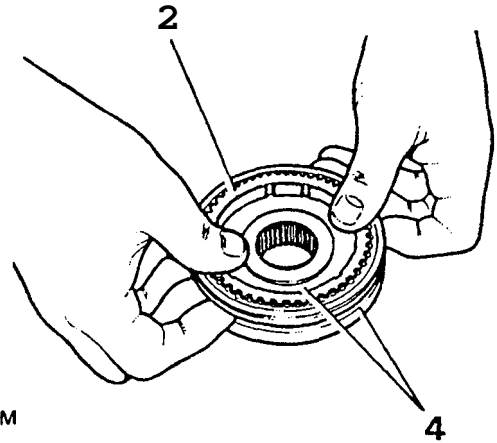
Mainshaft

1. Remove shim and 1st gear bush.
2. Remove 1st gear, needle roller bearing and bearing spacer.
3. Remove 1st gear baulk ring, 1st/2nd gear synchro assembly and 2nd gear.
4. Remove 2nd gear baulk ring, 2nd gear, needle roller spacer and needle roller bearing.
5. Fit mainshaft into vice and remove circlip retaining 3rd/4th synchro hub and gear assembly.
6. Remove selective washer, 3rd/4th synchro assembly and baulk ring.
7. Remove 3rd gear, needle roller spacer and needle roller bearing.
8. Remove oil seal from front of mainshaft.
9. Clean mainshaft, and all mainshaft components and check for obvious wear. Ensure oil-ways in mainshaft are blown through with air line.

1st/2nd synchro assembly

Before dismantling

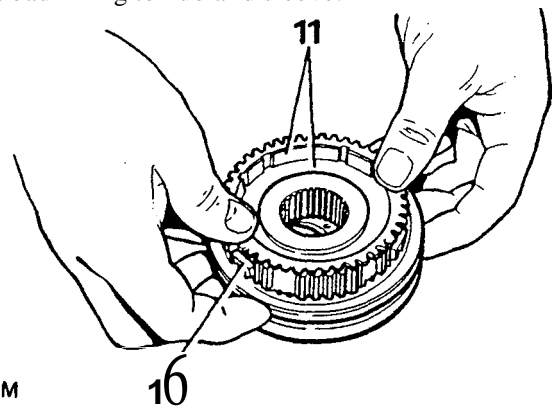
1. Before dismantling, mark relationship of synchro hub to sleeve.
2. Fit synchro baulk rings.
3. Place synchro assembly and baulk rings into a plastic bag to ensure none of the components are lost during next operation.
4. Press sleeve from hub.



5. Retrieve synchro balls, springs and slipper pads and remove baulk ring.
6. Clean all synchro assembly components.

NOTE: Before reassembling the synchro assembly, carry out the checks for 3rd and 2nd gear end floats, as described in the following paragraphs under the heading 'Mainshaft and gear train'.

7. Fit synchro hub to sleeve ensuring the alignment marks match up.
8. Place hub and sleeve over suitable block.
9. With hub resting on block adjust height of hub sufficiently to fit springs.
10. Locate slipper pads, fit springs and press balls down to be retained by synchro sleeve.
11. Fit baulk ring to hub and sleeve.



12. Invert synchro assembly, carefully, and fit second baulk ring.
13. Press synchro sleeve over hub to locate balls in position.
14. Remove baulk rings.

3rd/4th synchro assembly

1. Repeat operation as for 1st/2nd synchro assembly (omitting the gear end float checks).

NOTE: When reassembling 3rd/4th synchro the large chamfer on synchro sleeve faces the small boss on the hub,

5th gear synchro assembly

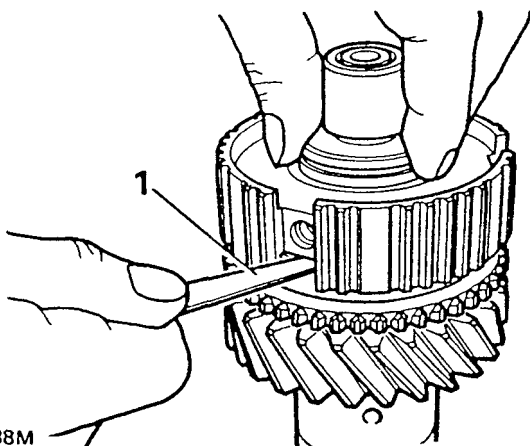
1. Repeat operation as for 1st/2nd synchro assembly.

NOTE: When reassembling 5th gear synchro the chamfer on the hub faces to the rear.

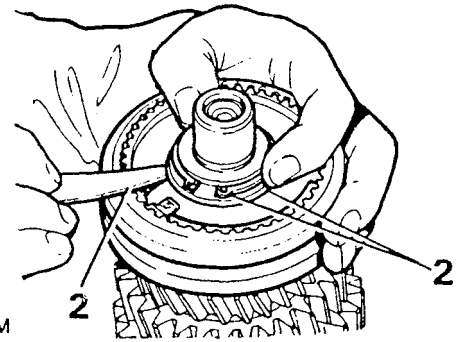
Mainshaft and gear train

3rd gear end float

1. Locate the main shaft in a vertical position as shown. Fit 3rd gear and needle roller bearing to the shaft and replace the 3rd/4th synchro inner member. Press down on the synchro inner member and check the gear running clearance with a feeler gauge, as shown. A clearance in excess of 0,19 mm (.008 in) indicates that the thrust laces 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 0,075 mm and 0,125 mm (.003 in to .005 in).



ST1538M



ST1354M

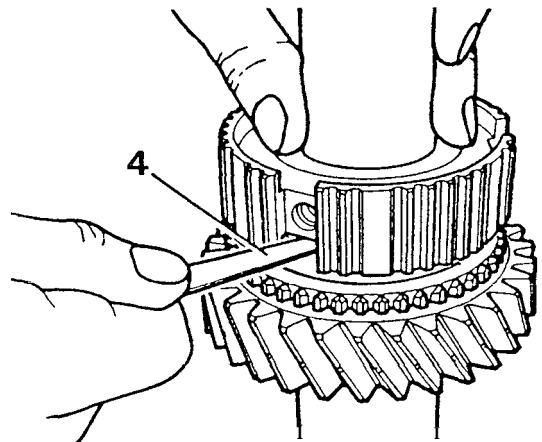
Next fit the original selective washer and retain with the circlip. Check the clearance between the washer and the synchro hub which must not exceed 0,075 mm (.003 in). The condition is ideal when the selective washer can be *just* turned by hand, i.e. minimum end float. Finally secure components with a new circlip.

Oil seal

3. Renew oil seal in the front of the main shaft at this stage then invert the shaft ready for assembly of the rear end.

2nd gear end float

4. Fit 2nd gear needle roller bearing, spacer, 2nd gear and synchromesh inner member with the selector groove towards the rear as shown. Press down on the synchro inner member and check 2nd gear end float tolerance which is identical to 3rd gear previously described.



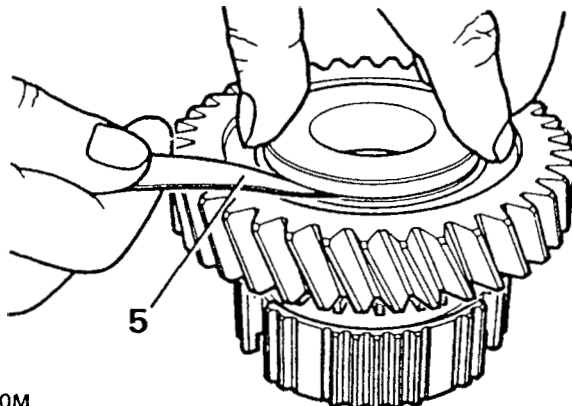
ST1539M

3rd/4th synchro end float

2. Maintain the mainshaft in a vertical position as shown. Fit 3rd gear needle roller bearing, spacer, 3rd gear, baulk ring and synchromesh with the large area thrust face towards 3rd gear and the chamfer on the outer member towards the front.

1st gear to bush end float

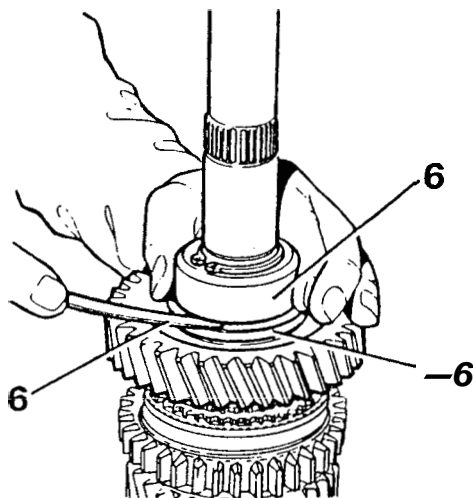
- To carry out 1st gear check, it is not necessary to assemble the components on to the mainshaft. Assemble 1st gear on to the bush and using a suitable straight edge or flat plate (the oil pump back plate is ideal) check the end float of 1st gear on the bush as shown. The tolerance is identical to 3rd and 2nd gear end floats.



ST1540M

1st/2nd synchromesh end float

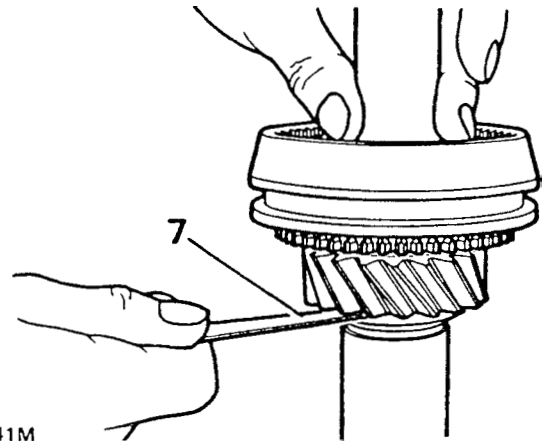
- Next fit the 1st gear baulk ring, 1st gear bush and gear, original selective washer, dummy bearing LST 101 and circlip onto the shaft, then check the end float as shown. Choose a suitable selective shim washer to obtain the correct tolerance which is identical with 3rd/4th synchromesh, i.e. minimum to 0,075 mm (.003 in).



ST1353M

5th gear end float

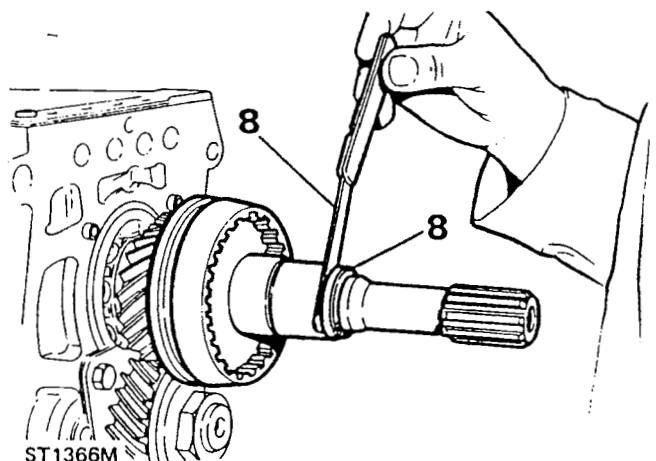
- Fit 5th gear thrust washer, 5th gear, needle bearing and spacer followed by synchromesh unit but leaving out the baulk ring at this stage. Press down on the synchro inner member and check the gear end float as shown; this tolerance, again is identical to 3rd gear.



ST1541M

5th gear synchro end float

- Fit the 5th gear synchromesh backing plate, seal collar, original selective shim washer and circlip. Then check the clearance as shown; select a suitable shim washer to minimise the clearance. This adjustment is identical to the 1st/2nd and 3rd/4th synchromesh units. With all the mainshaft adjustments correct, remove the 5th gear components ready for assembly.



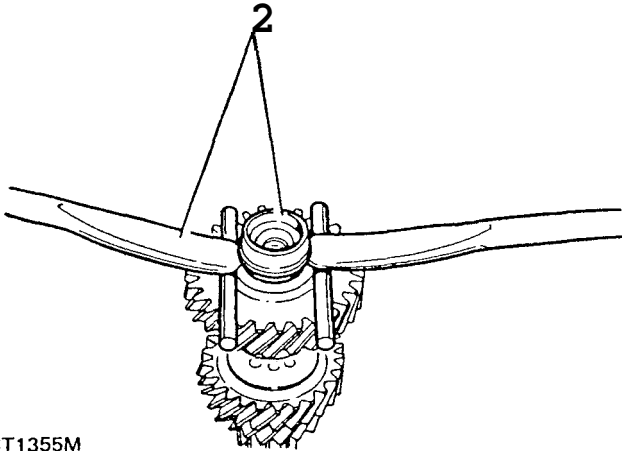
ST1366M

5th gear selector fork and bracket assembly

- Remove slipper pads from selector fork and check for wear.
- If necessary, remove circlips and remove selector fork pivot pins.
- Clean all components and refit in reverse order.

Layshaft

1. Remove layshaft rear bearing inner race.
2. Fit layshaft to vice and lever off front bearing inner track.



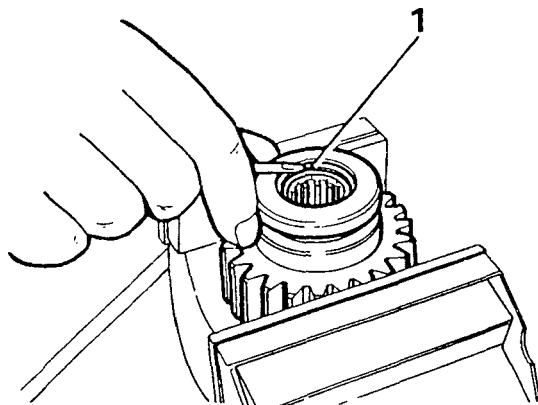
ST1355M

3. Clean layshaft, bearings and tracks and check for wear.
4. Fit layshaft front bearing track.
5. Fit rear bearing race to layshaft, ensuring the identification numbers etc., of the bearing are facing forwards.

NOTE: Inner tracks are offset and the bearings must be fitted with narrow shoulders together.

Reverse idler gear assembly, shaft and lever

- 1 Secure reverse gear in vice and remove circlip retaining bearings

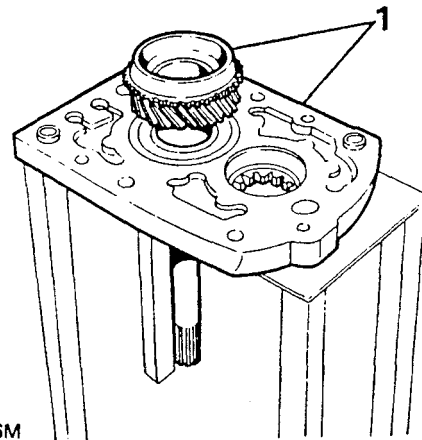


ST1359M

2. Remove upper thrust washer, two needle roller bearings and lower thrust washer.
3. Invert reverse gear and remove second circlip.
4. If necessary, remove split pin and withdraw slipper pads and washer from reverse gear lever.
5. Press out reverse lever cross link operating pin, if necessary.
6. Clean all components and check for wear.
7. Lubricate needle roller bearings and reassemble reverse idler gear assembly and lever in reverse order.

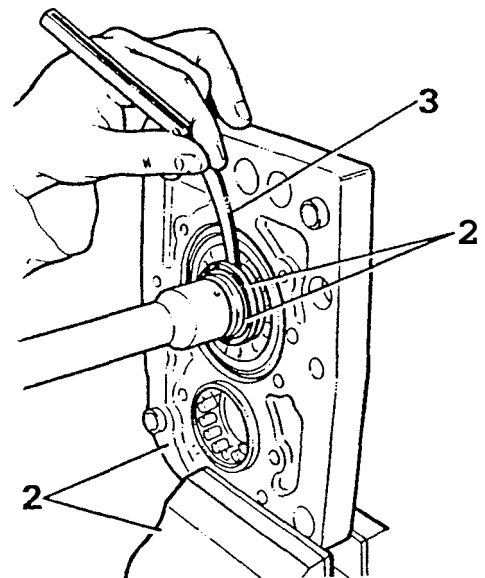
REASSEMBLING GEARBOX**Input shaft, mainshaft and layshaft**

1. Position front bearing plate on suitable stand and fit input shaft into bearing.



ST1356M

2. Secure bearing plate in vice, fit original selective washer and retain with circlip.
3. Measure the clearance between washer and input shaft bearing. If a measurement in excess of 0,075 mm is obtained remove circlip and washer.

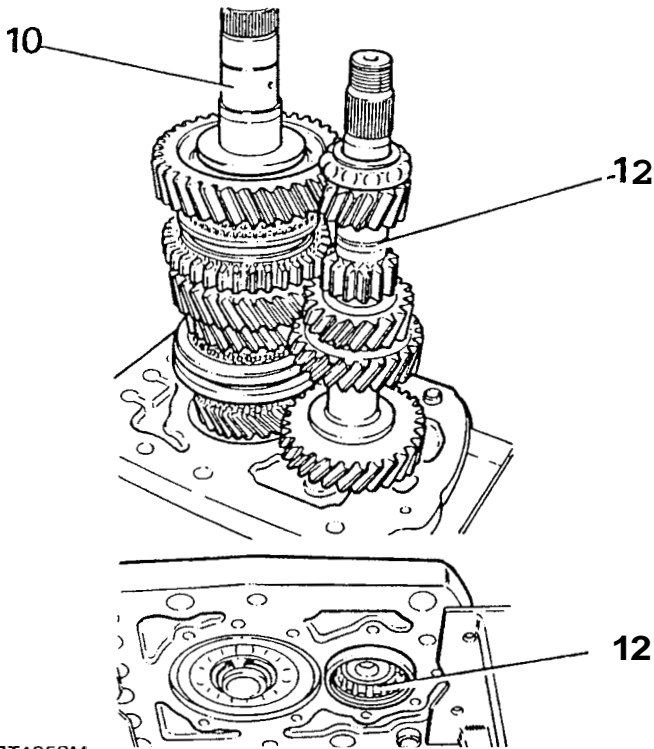


ST1357M

4. Select and measure new washer to take up the excessive running clearance.
5. Fit new selective washer and retain with circlip.
6. Recheck to ensure a running clearance of 0,075 mm is obtained between washer and bearing.
7. Position front bearing plate on suitable stand.
8. Lubricate mainshaft pilot bearing and fit to input shaft.
9. Fit 4th gear baulk ring to input shaft.

10. Lower mainshaft assembly into input shaft at the same time rotating to engage baulk ring slots and lugs.
11. Engage 3rd gear.
12. Fit layshaft assembly to front bearing plate and mesh with mainshaft.

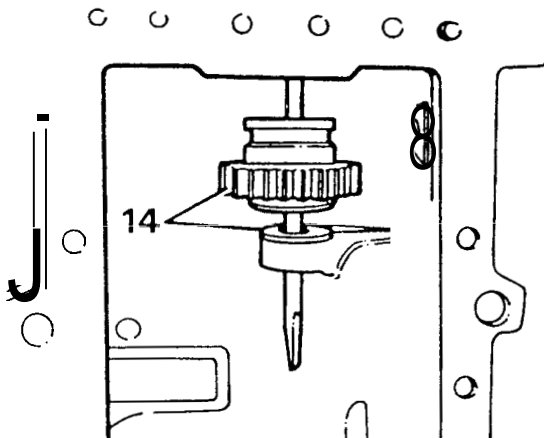
NOTE: Take care to ensure that the front layshaft bearing rollers are not put out of alignment, then return 3rd/4th synchro hub to neutral.



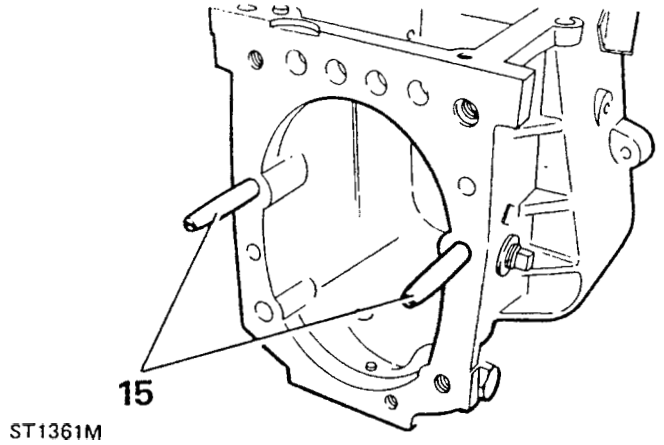
13. Remove the rear bearing circlip and dummy bearing.

Reverse gear

14. Fit thrust washer to reverse gear, chamfer towards gear, locate gear in gearbox case, and retain temporarily in position with a screwdriver, or similar implement.

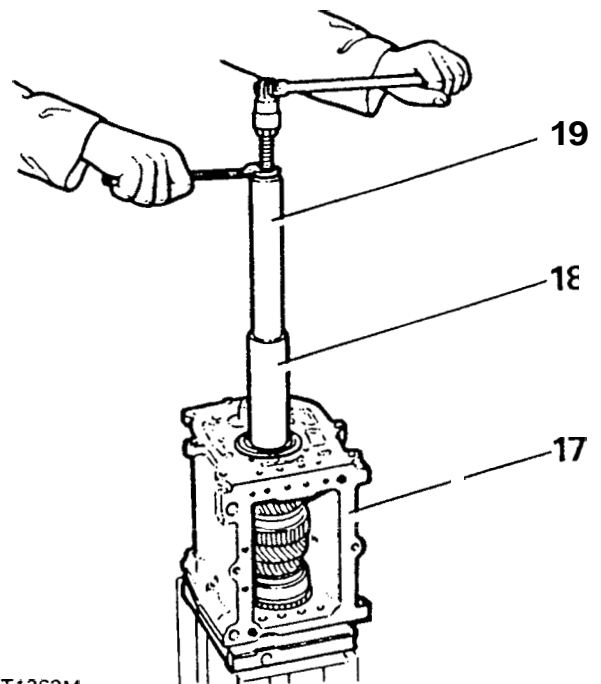


15. Fit guide studs 18G 1294 to gearbox.

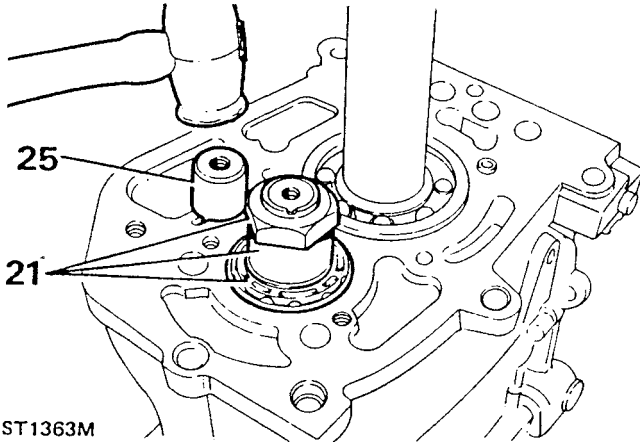


Gearbox case and reverse shaft

16. Fit new gasket on front bearing plate.
17. Lower gearbox case over mainshaft/layshaft assemblies using guide studs to locate front bearing plate.
18. Fit tube, Tool No. LST 1431-1 over mainshaft and locate on rear bearing.
19. Fit Tool No. 18G 1431 over mainshaft and locate on other tool.
20. With assistance, to prevent gearbox and mainshaft rotation, and using above tools, pull gearbox to front bearing plate.

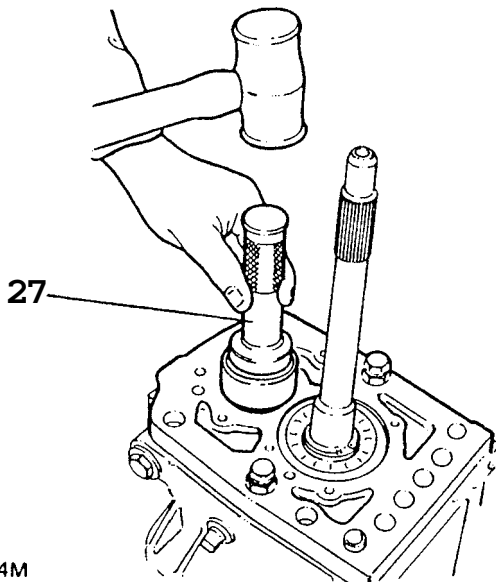


21. Fit layshaft rear bearing (identification numbers to rear) dummy spacer, and retain temporarily with layshaft nut.
22. Remove guide studs 18G 1294.
23. Temporarily fit two bell housing bolts with spacers, to secure front bearing plate to gearbox.
24. Remove Tool Nos. 18G 1431 and LST 1431-1 and then check that the mainshaft is engaged through bearing sufficiently to fit mainshaft bearing circlip.
25. Remove screwdriver from reverse shaft location and fit reverse shaft.



ST1363M

26. Invert gearbox and fit spacer to layshaft front bearing.
27. Using Tool Nos. LST 550-1 and MS 550 locate layshaft front bearing to final position.



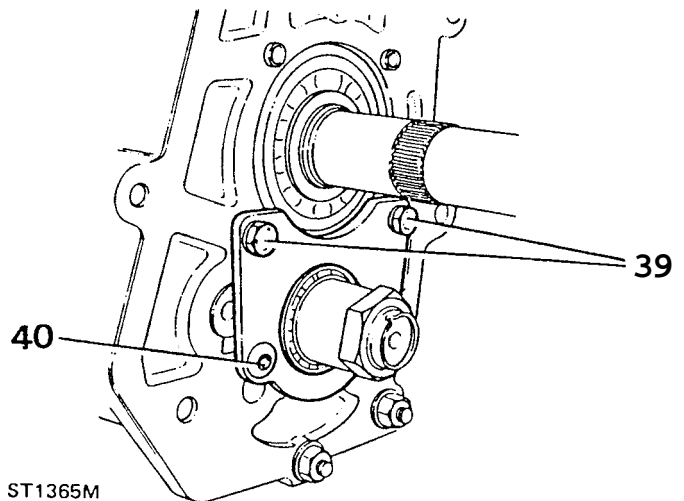
ST1364M

28. Temporarily remove layshaft bearing spacer.
29. Refit gearbox stand (manufactured tool) to underside of gearbox and secure with two bolts, nuts, spring and plain washers. Adjust bolt under filter housing as necessary.
30. Secure gearbox stand in vice.
31. Check that 4th gear baulk ring and all other baulk rings are free.
32. Fit layshaft front bearing spacer.
33. Fit new gasket to front cover.
34. Tape input shaft splines, to prevent damage to front cover oil seal in next operation.

35. Ensure oil pump drive aligns with the square seating in the layshaft and fit front cover to front bearing plate and secure with seven bolts and spring washers.
36. Remove tape from input shaft splines.

Reverse lever, reverse shaft/bearing retaining plate

37. Fit reverse lever to reverse gear.
38. Apply Loctite Stud and Bearing Fit (270) to pivot bolt threads, fit bolt in gearbox and locate in reverse lever pivot boss.
39. Position reverse shaft, layshaft bearing track retaining plate and secure top of plate with two bolts and spring washers.



ST1365M

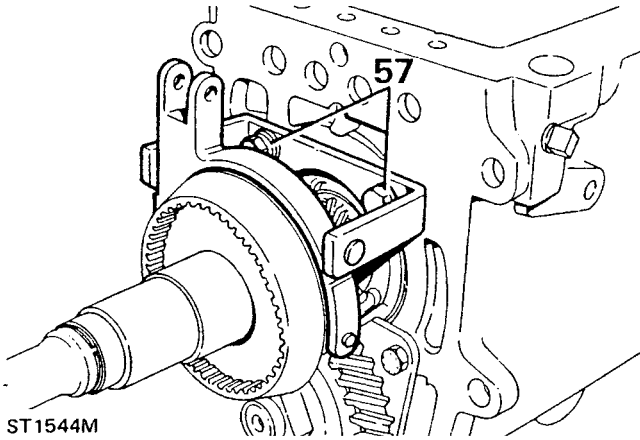
40. Apply Loctite Stud and Bearing Fit (270) to socket head set screws and secure bottom of retaining plate.

5th gear, layshaft and mainshaft

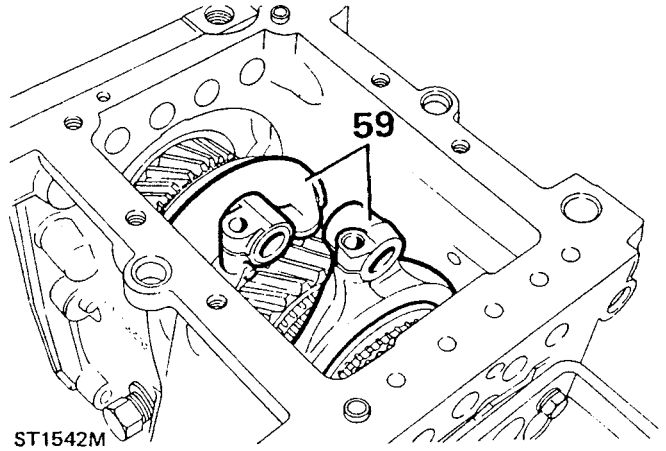
41. Remove nut from layshaft and remove dummy spacer.
42. Fit 5th gear to layshaft with large boss to the rear.
43. Rotate layshaft to give access to stake slot.
44. To facilitate next operation, lock gearbox by engaging 1st and 4th gears.
45. Fit a new 5th gear retaining nut and tighten to the specified torque.
46. Stake retaining nut collar into recess in layshaft.
47. Return 1st and 4th synchros to neutral.
48. Fit mainshaft rear bearing circlip.
49. Fit thrust washer.
50. Lubricate needle roller bearings and fit to mainshaft followed by spacer and 5th gear.
51. Fit 5th gear synchro cone and synchro hub assembly.
52. Tape mainshaft splines and fit 'O' ring to its seating on mainshaft.
53. Fit oil seal collar and locate in peg on hub backing plate.
54. Fit the washer selected during the 5th gear end float check and retain with circlip.
55. Remove tape.

Selector rails and forks

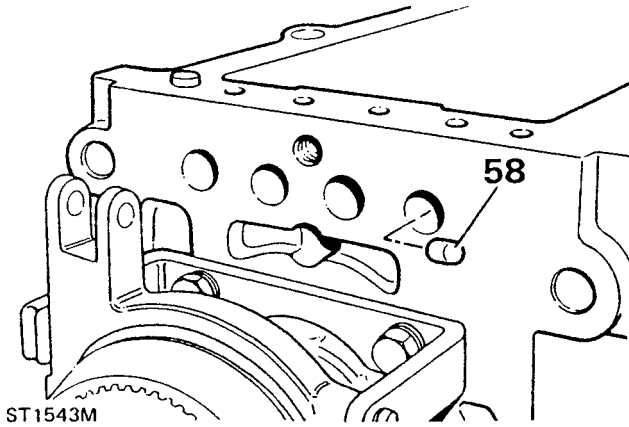
- 56. Locate 5th gear fork and bracket on to synchro hub and gearbox dowels.
- 57. Secure fork bracket to gearbox with two bolts, plain washers and spring washers.



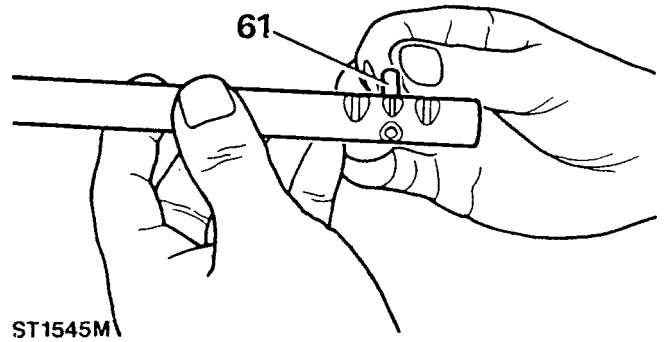
- 59. Fit 1st/2nd and 3rd/4th selector forks.



- 58. Fit selector rail interlock plungers into the cross-drilling in the gearbox case.



- 60. Fit reverse cross-over lever.
- 61. Insert interlock into 1st/2nd selector rail.



62. Push 1st/2nd selector rail through gearbox seating and locate in reverse cross-over lever and selector fork; do not tighten fork clamp bolt.

NOTE: 1st/2nd fork clamp bolt is not a set bolt.

63. Fit 1st/2nd selector jaw to rail and align for roll pin.

64. Using suitable drift, tap in roll pin to secure jaw and rail.

65. Repeat operation for 3rd/4th selector rail and jaw.

66. Push 5th gear selector rail through gearbox scating and locate in reverse cross-over lever.

67. Fit 5th gear selector jaw to rail, align for roll pin.

68. Locate selector rail into 5th gear selector fork and secure with clevis pin, washer, and split pin.

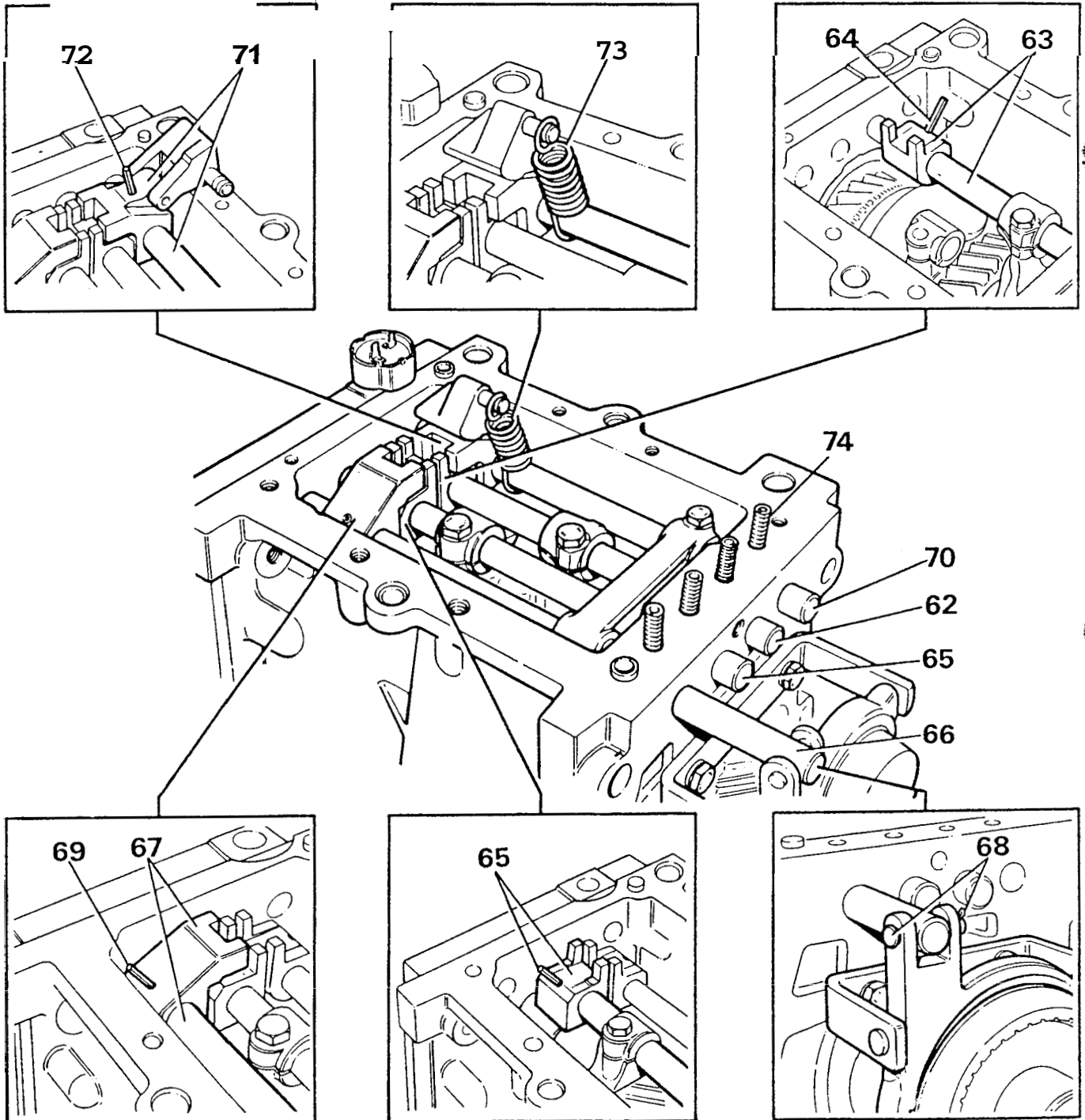
69. Fit roll pin and secure selector rail and jaw.

70. Push reverse selector rail through gearbox scating and locate in reverse cross-over. Do not lighten lever clamp bolt.

71. Fit jaw to rail and align for roll pin.

72. Using a suitable drift, fit roll **pin** to secure selector rail and jaw.

NOTE: The roll pin must be inserted sufficiently to be flush with the underside face of the selector jaw.

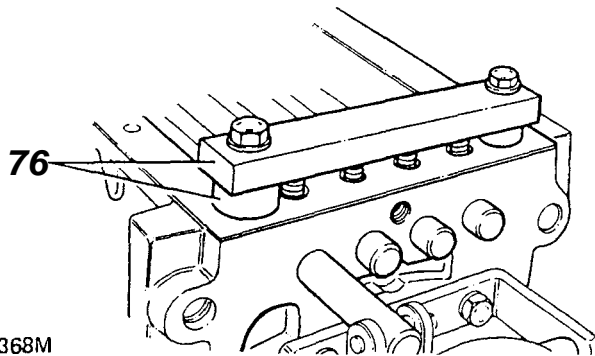


ST1367M

- 73. Fit reverse gate spring to selector rail and knock-over lever.
- 74. Fit detent balls and springs.

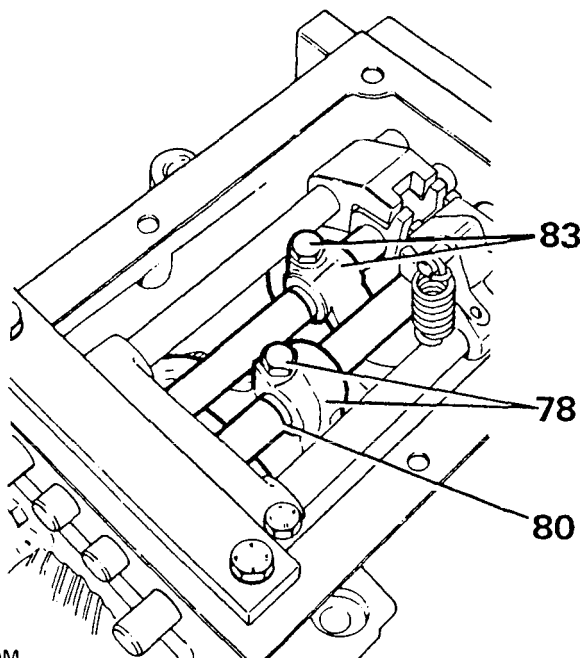
Selector fork adjustment

- 75. Fit top cover gasket.
- 76. Secure detent spring retaining tool and spacers to gearbox using two 8 x 50 mm bolts and plain washers.



ST1368M

- 77. Tighten bolts and compress detent springs until retaining plate contacts the two spacers.
- 78. Ensure that 1st/2nd selector rail and synchro sleeve arc in neutral position. Tighten clamp bolt sufficiently to eliminate any rock in the selector fork and move selector fork rearwards.
- 79. Scribe a pencil line on rail at rear of fork yoke.
- 80. Move fork forwards on rail and scribe line on rail at rear of fork yoke.
- 81. Scribe a line midway between the other lines on the selector shaft.
- 82. Move selector fork to centre line and tighten clamp bolt.
- 83. Repeat operation for 3rd/4th selector fork and rail.

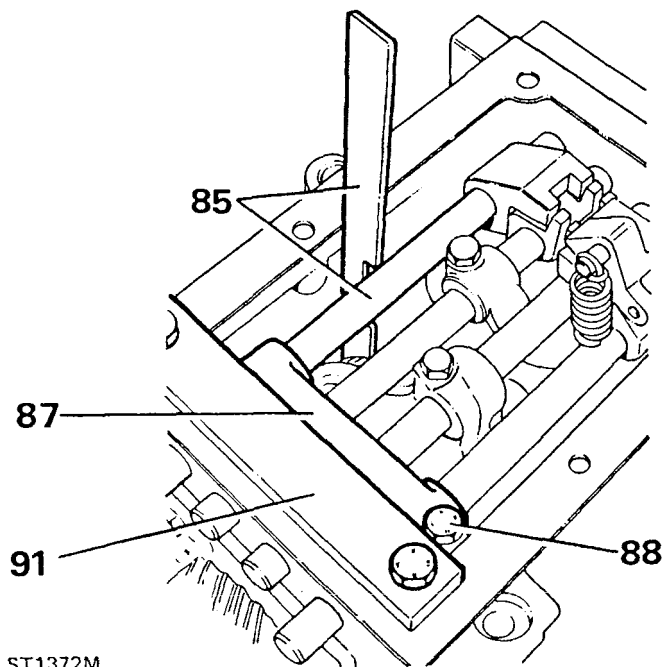


ST1370M

Reverse cross-over lever adjustment

The purpose of the following adjustment is to ensure that when 1st gear is selected the outer member of the 1st/2nd synchro member is not also engaged with the reverse idler.

- 84. Move reverse gear thrust washer fully forward.
- 85. Fit gauge (manufactured tool) to selector shaft.
- 86. Move rail rearwards and select reverse gear.
- 87. Move cross-over lever rearwards to lightly nip gauge between reverse gear and thrust washer.
- 88. Tighten reverse cross-over lever clamp bolt and return rail to neutral. Remove gauge.
- 89. Move 1st/2nd rail rearwards and select first gear. Ensure a minimum clearance of 1,0 mm has been obtained between reverse gear idler and reverse gear on 1st/2nd synchro sleeve. If there is not enough clearance, readjust the reverse cross-over lever.
- 90. Return 1st/2nd rail back to neutral.
- 91. Remove detent spring retaining tool and spacers.



ST1372M

Gearbox top cover

- 92. Fit top cover and locate over detent springs.
- 93. Position breather pipe, locate retaining clips and secure top cover and breather pipe clips with eight bolts and spring washers.
- 94. Fit breather pipe banjo union and fibre washers.
- 95. Fit reverse light switch.
- 96. Place clean rag in top cover to prevent entry of dirt etc.

Bell housing

- 97. Remove bolts and spacers securing front bearing plate to gearbox.
- 98. Fit new bell housing gasket.
- 99. Locate bell housing squarely on dowels and secure housing and front bearing plate to gearbox with six bolts and spring washers.

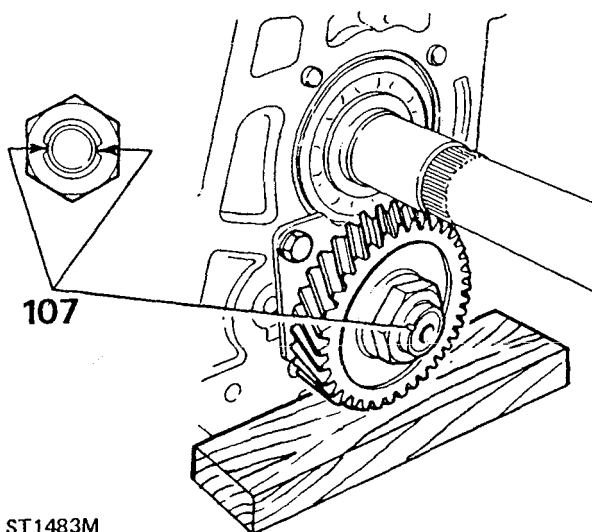
Lower gear lever/bias spring housing

- 100. Remove rag from gearbox top cover.
- 101. Lubricate gear lever ball and lower yoke.
- 102. Fit lower gear lever, nylon cup and grommet.
- 103. Fit new gasket to housing.
- 104. Grease bias springs.
- 105. Carefully fit shims and bias springs, followed by spring housing and secure with four set screws, and spring washers.
- 106. Remove gearbox assembly from vice and detach stand.

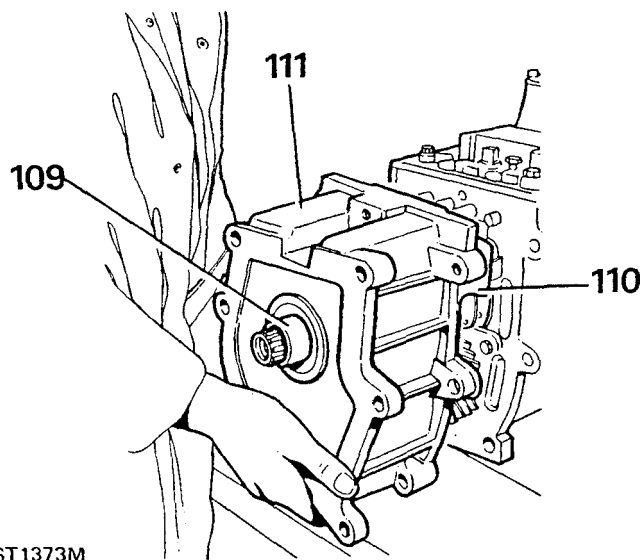
Gearbox extension housing

- 107. The special nut retaining the 5th gear to the layshaft must be secured in position, 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 5th laygear should be supported by a wooden block when the nut is being deformed, to prevent damage to the bearings adjacent to the gear.

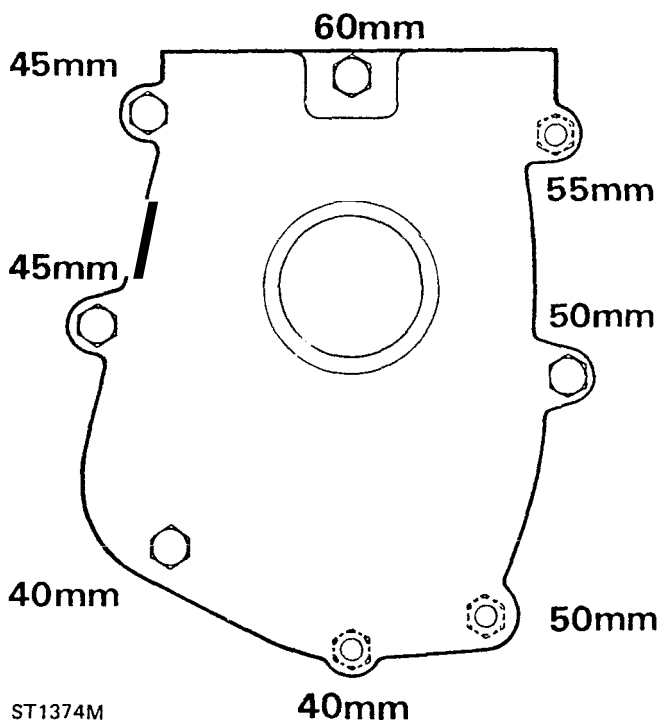


- 108. Support underside of gearbox with wooden block.
- 109. Lubricate oil seal protection sleeve Tool No. LST 102 and fit to oil seal from inside extension housing.
- 110. Fit new gasket to extension housing.
- 111. Carefully manoeuvre extension housing over mainshaft and position squarely on dowels.



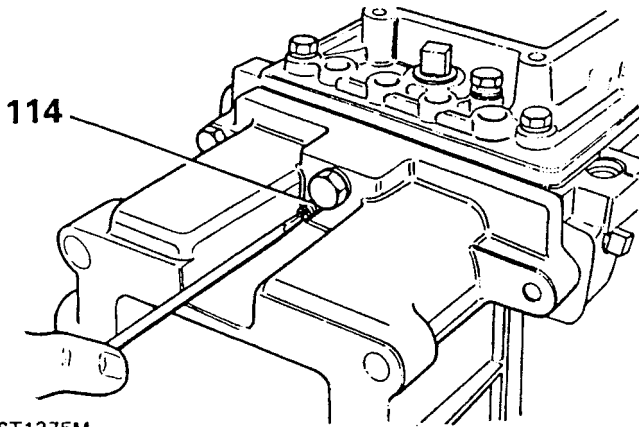
- 112. Remove oil seal protection sleeve.
- 113. Secure extension housing to gearbox with eight bolts, spring washers and single nut.

NOTE: Illustration shows correct bolt lengths and their locations in extension housing.



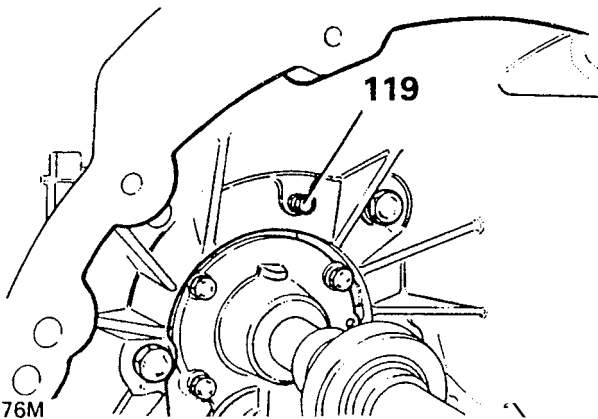
3rd/4th gear selector rail adjustment

114. Slacken 3rd/4th stop screw in extension housing.



ST1375M

- 115. Select 3rd gear.
- 116. Tighten stop screw until it makes contact with 3rd/4th selector rail.
- 117. Turn back stop screw one turn. Retighten locknut.
- 118. Return gear lever to neutral.
- 119. Slacken locknut on 3rd/4th stop bolt inside bell housing.

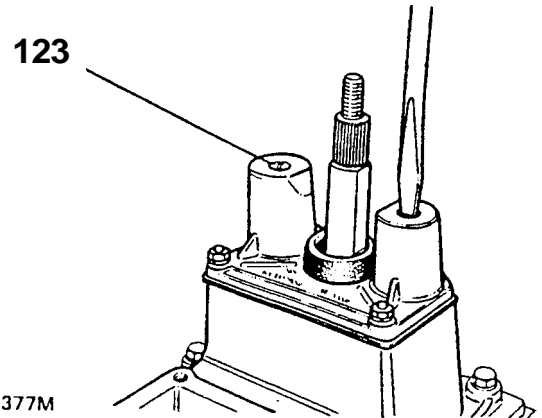


ST1376M

- 120. Unscrew stop bolt.
- 121. Select 4th gear and screw in stop bolt until contact is made with 3rd/4th selector shaft.
- 122. Turn back stop bolt one turn and retighten locknut.
Return gear lever to neutral.

Bias spring adjustment

123. Apply Loctite Stud and Bearing Fit (270) to bias springs screws and tighten up until screw heads are flush with top face of bias spring housing.



ST1377M

Gearbox mounting

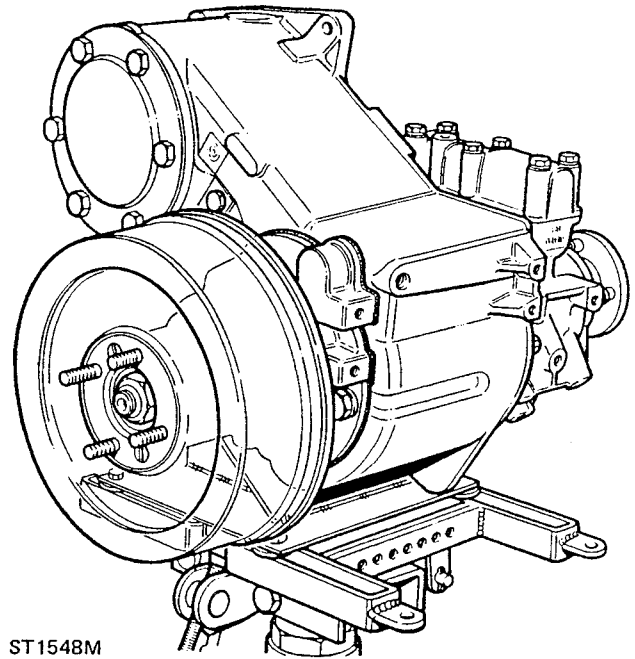
124. Refit mounting to extension housing and secure with four bolts.

REMOVE LT230T TRANSFER GEARBOX FROM THE LT85 GEARBOX

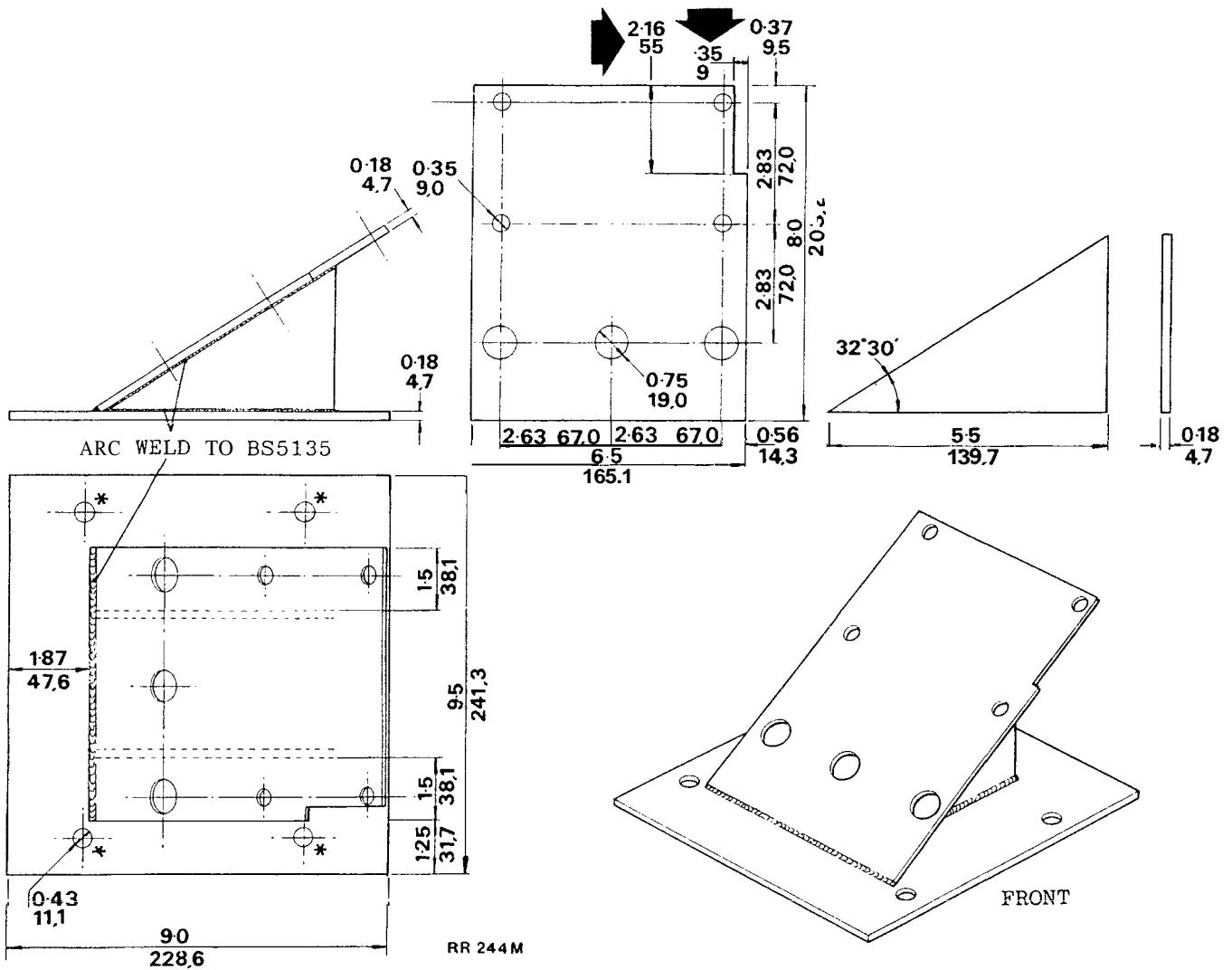
Special tool: 18G 1425 — Guidestuds (3)
 Also, locally manufactured adaptor plate, see below

Adaptor plate for removing transfer gearbox

The transfer gearbox should be removed from underneath the vehicle, using a hydraulic hoist. An adaptor plate for locating the transfer gearbox onto the hoist can be manufactured locally to the drawing below. If a similar adaptor plate was made for the LT230R transfer gearbox, it can be modified to suit both the LT230R and LT230T gearboxes by making the modifications shown by the large arrows.



ST1548M

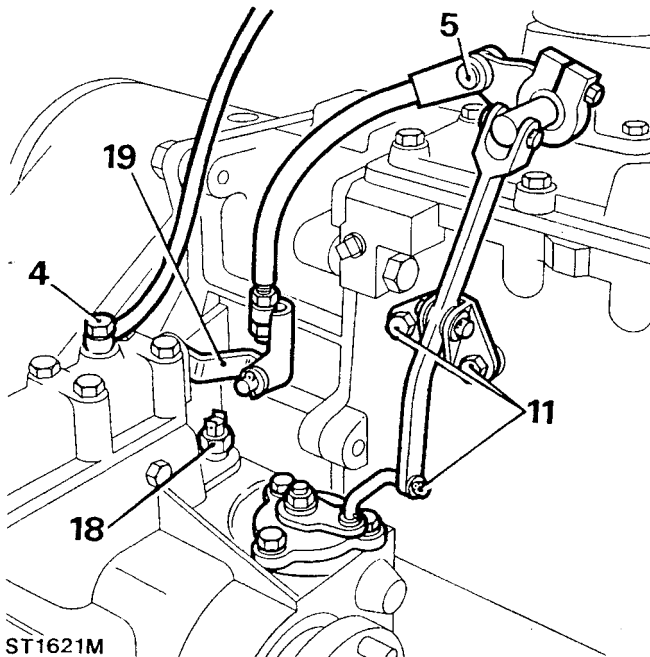


Material. Steel plate BS 1449 Grade 4 or 14
 Holes marked thus * to be drilled to fit hoist being used.

↗ = MODIFICATION

Removing

1. Install the vehicle on a ramp.
2. Disconnect the battery.
3. Remove the cover panel from the right-hand seat base.
4. Remove the breather pipe union from the transfer gearbox high/low cross-shaft housing.
5. Disconnect the high/low lever.

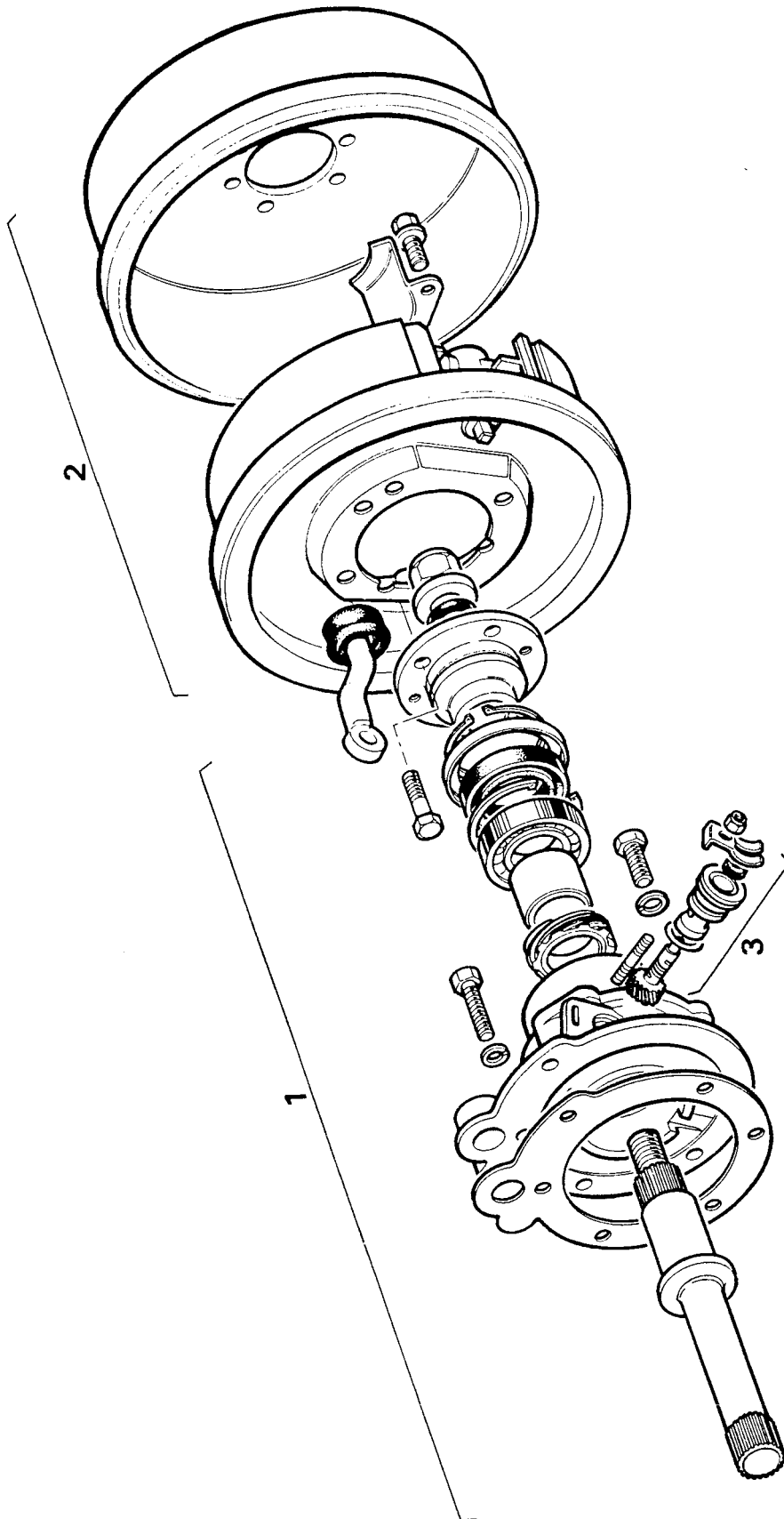


6. Disconnect the transmission brake cable at the clevis joint.
7. Raise the vehicle on the ramp and drain the oil from the transfer box.
8. Remove the centre section of the exhaust system.
9. Disconnect the front and rear propeller shafts from the gearbox and move them aside.
10. Disconnect the speedometer cable from the transfer gearbox.
11. Remove the split pin at the lower end of the pivot arm for the differential **lock** control. Then, remove the two bolts securing the pivot arm to allow the link to be disconnected.
12. Manufacture an adaptor plate in accordance with the drawing, to attach to the gearbox hoist and transfer box to facilitate removal (RR244M).
13. Place four, 30 mm (1.250 in) long spacers between the top of the hoist and the adapter plate at the securing points and secure the adaptor plate to the hoist.
14. Remove the four central bolts from the transfer box bottom cover, move the hoist into position and secure the adaptor plate to the transfer box.
15. Adjust the hoist to take the weight of the transfer box.

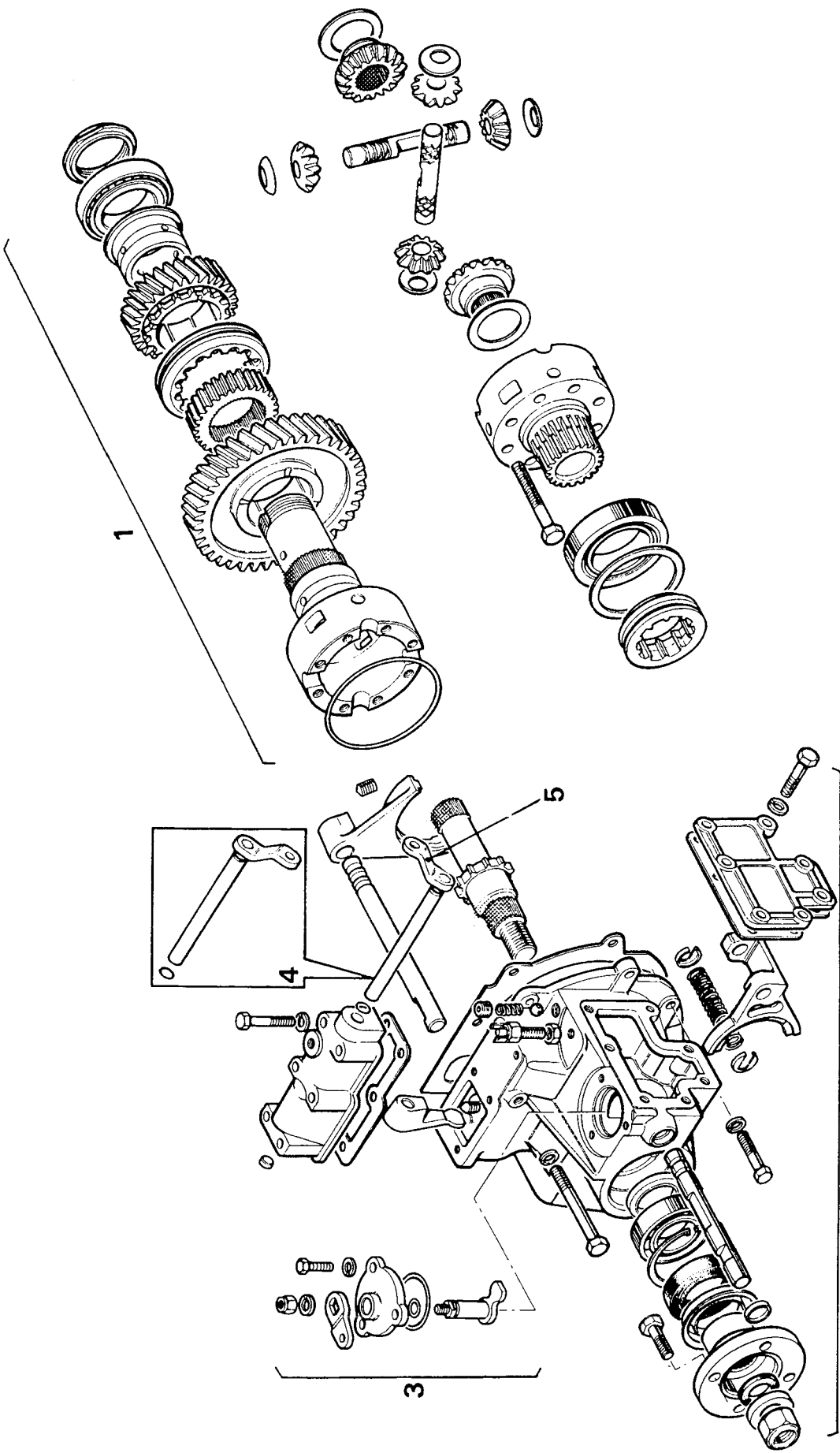
16. Remove three nuts and bolts securing the right-hand gearbox mounting bracket to the chassis, then remove the nut from the rubber mounting and withdraw the bracket.
17. Place a suitable wooden block between the main gearbox and chassis cross-member, then lower the hoist until the gearbox contacts the wooden block.
18. Disconnect the electrical lead from the differential lock switch.
19. Move the small crank lever, for the high/low selector, upward to allow access to the adjacent nut securing the transfer box to the main gearbox extension case.
20. Remove the two nuts and four bolts securing the transfer box to the main gearbox extension case.
21. Fit three guide studs, 18G 1425, through the transfer box bolt holes to support it during removal.
22. Lower the hoist and withdraw the transfer box from the vehicle.

Refitting

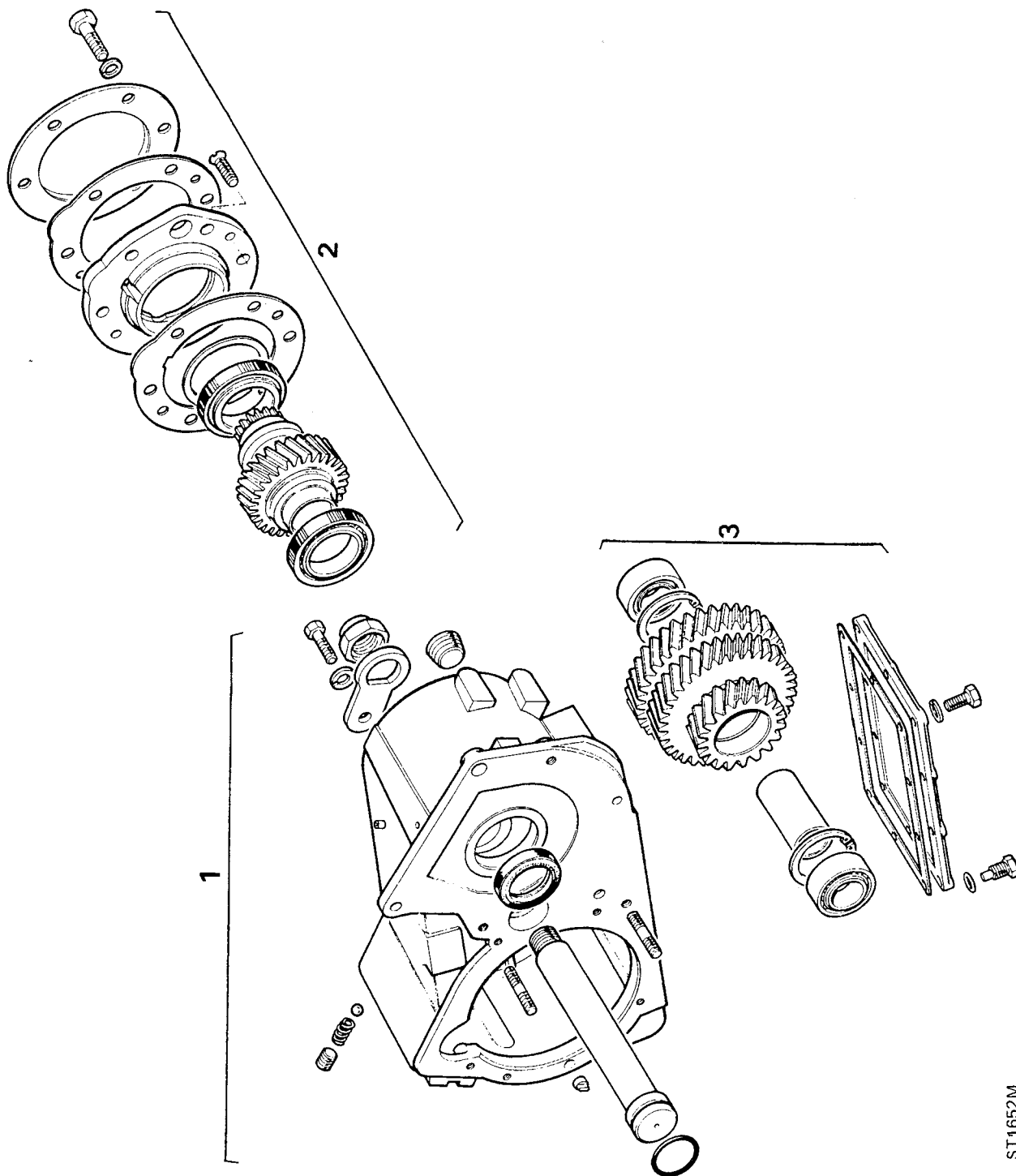
23. Make sure that the joint faces of the transfer box and main gearbox extension case are clean and that the three guide studs, 18G 1425, are fitted to the extension case.
24. Lubricate the oil seal in the joint face of transfer box, secure the transfer box to the adaptor plate on the lifting hoist and raise the hoist until the transfer box can be located over the guide studs.
25. Remove the guide studs and secure the transfer box to the main gearbox extension case. Tighten the nuts and bolts to the correct torque.
26. Complete the refitting procedure by reversing the removal sequence, noting the following important points.
27. After removing the lifting hoist and adaptor plate from the transfer box, clean the threads of the four bolts for the transfer box bottom cover, coat them with Loctite 290, and fit them together with spring washers. Tighten to the correct torque.
28. Refill the transfer box with the correct grade oil to the oil level plug hole.
29. Check, and if necessary top up, the oil level in the main gearbox. Use the correct grade oil.
30. Check the operation of the handbrake and adjust as necessary.



ST1650M



ST1651M



ST1652M

LT230T TRANSFER GEARBOX OVERHAUL

Service Tools:

- 18G47-7 — Input gear cluster bearing cones remover/replacer
- 18G47BB-1 — Adaptor centre differential bearing remover
- 18G47BB-3 — Adaptor centre differential bearing remover button
- 18G257 — Circlip pliers
- 18G1205 — Propflange wrench
- 18G1271 — Oil seal remover

- 1861422 — Mainshaft rear oil seal replacer
- 1861423 — Adaptor/socket centre differential stake nut remover/replacer
- 18G1424 — Centre differential bearing replacer
- MS47 — Handpress
- MS550 — Bearing and oil seal replacer handle
- LST47-1 — Adaptor centre differential bearing remover
- LST104 — Intermediate gear dummy shaft
- LST105 — Input gear mandrel
- LST550-4 — Intermediate gear bearing replacer

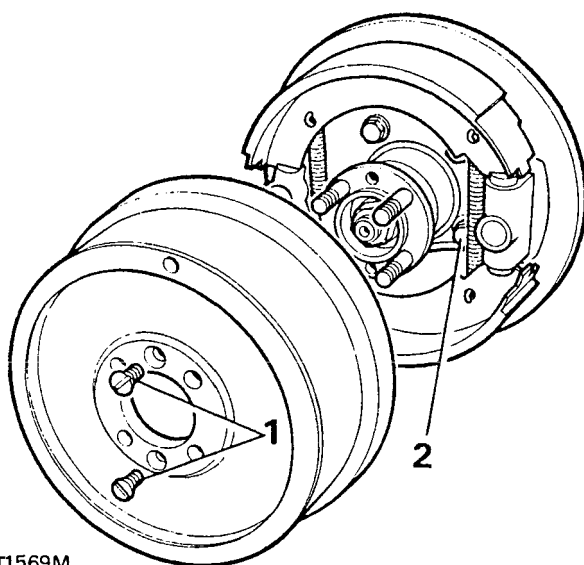
TRANSFER BOX DATA

Front bevel gear end-float	0,025 to 0,075 mm (0.001 to 0.003 in)
Rear bevel gear end-float	0,025 to 0,075 mm (0.001 to 0.003 in)
Rear output housing clearance	1,00 mm (0.039 in)
High range gear end-float	0,05 to 0,15 mm (0.002 to 0.006 in)
Front differential bearing pre-load	1.36 to 4.53 kg (3 to 10 lbs)
Input gear bearing pre-load	2.26 to 6.80 kg (5 to 15 lbs)
Intermediate shaft bearing pre-load	1.81 to 4.53 kg (4 to 10 lbs)

Transmission brake removal (if not previously removed)

1. Remove two countersunk screws and withdraw brake drum.
2. Remove four bolts securing the brake back-plate; the two bottom fixings retain the oil catcher.

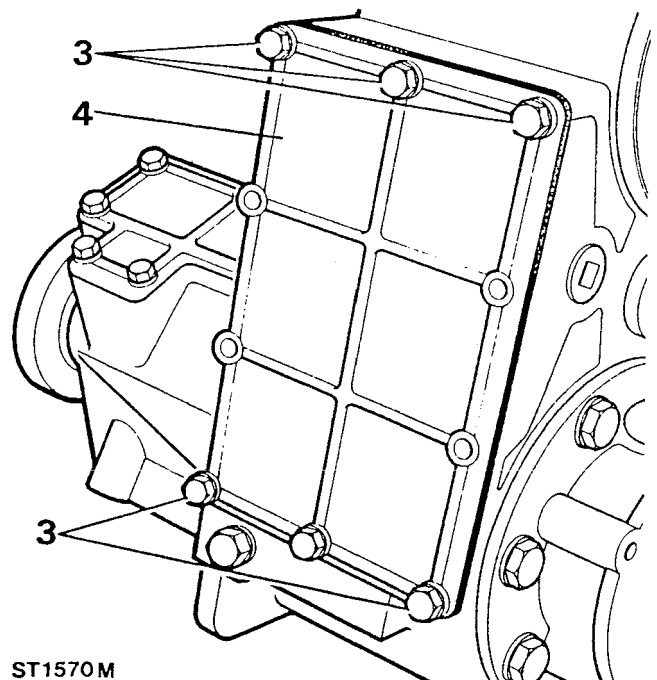
NOTE: An hexagonal type socket should be used for these bolts.



ST1569M

Bottom cover removal

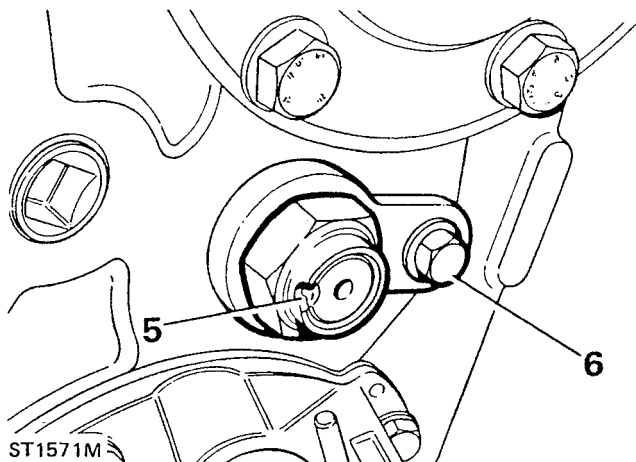
3. Remove the six bolts and washers retaining the bottom cover.
4. Remove the gasket and bottom cover.



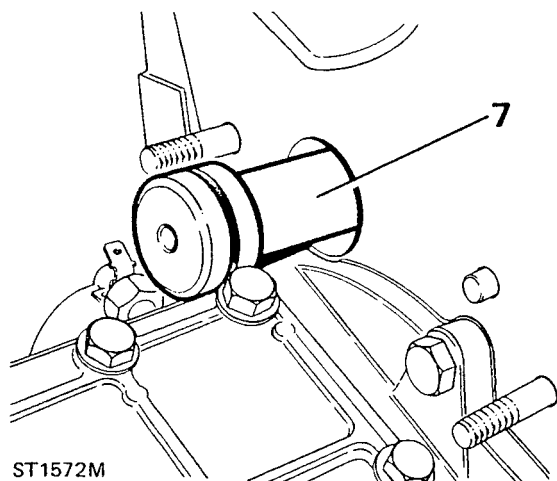
ST1570M

Intermediateshaft and gear cluster removal

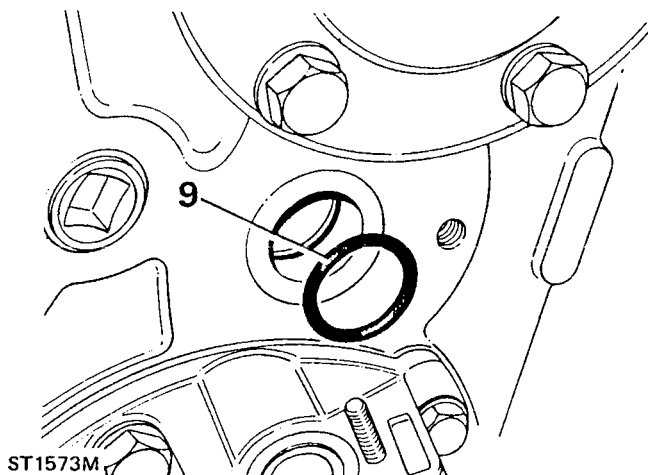
5. Release stake nut from recess in intermediate shaft and remove stake nut and discard.
6. Unscrew the single bolt and remove anti-rotation plate at the rear face of the transfer box.



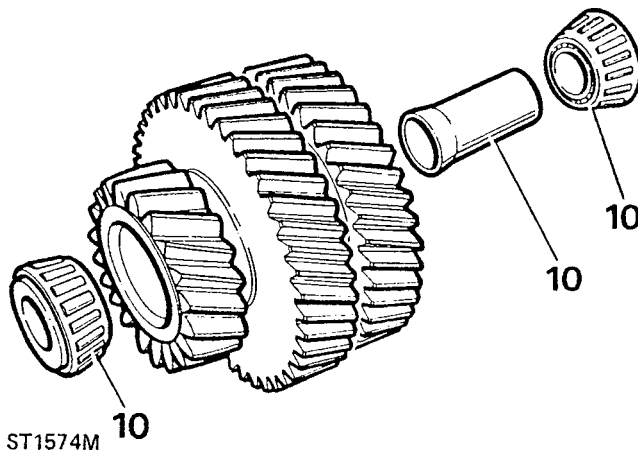
7. Tap the intermediate gear shaft from the transfer box.



8. Lift out the intermediate gear cluster and bearing assembly.
9. Remove the 'O' rings from the intermediate gear shaft and from inside the transfer box.

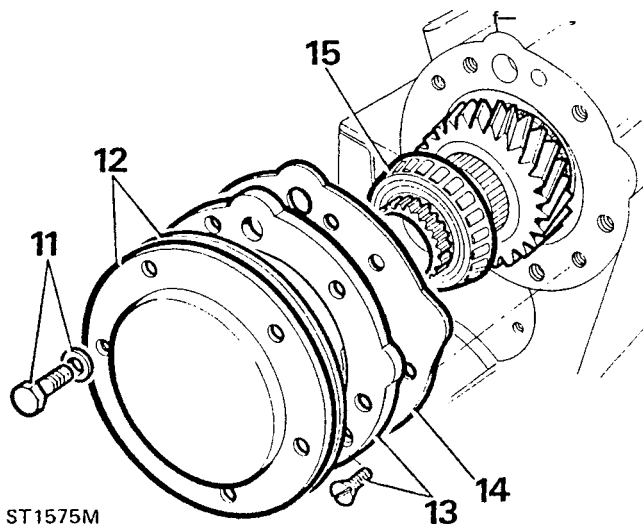


10. Remove taper roller bearings and bearing spacer from the intermediate gear cluster assembly.



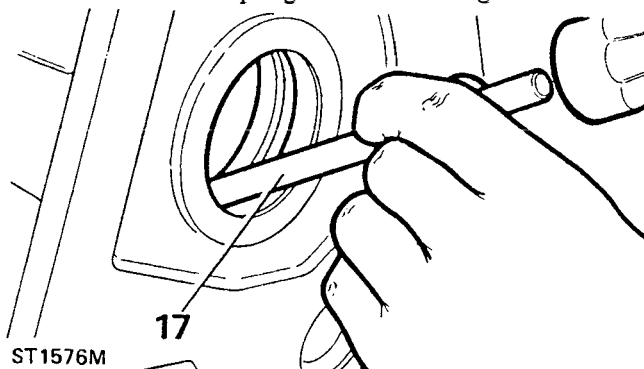
Power take-off cover removal

11. Remove six bolts and washers retaining the take-off cover and speedo cable clips.
12. Remove the gasket and cover.



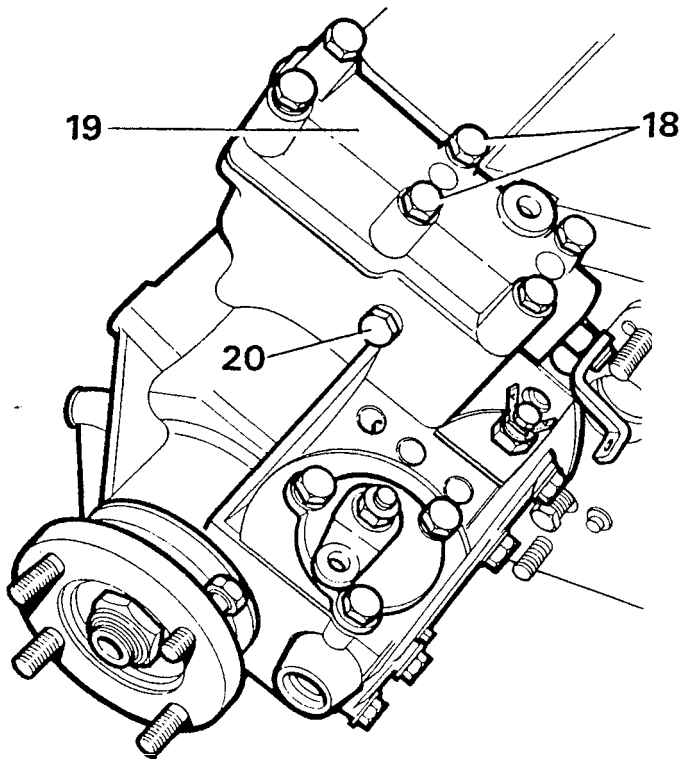
Input gear removal

13. Remove the two countersunk screws and detach the main shaft bearing housing.
14. Remove the gasket.
15. Withdraw the input gear assembly.
16. Prise out and discard the oil seal at the front of the transfer box casing using service tool 18G1271.
17. Drift out the input gear front bearing track.



High/low cross-shaft housing removal

- 18. Remove the six bolts and washers retaining the cross-shaft housing and earth lead.
- 19. Remove the gasket and cross-shaft housing.



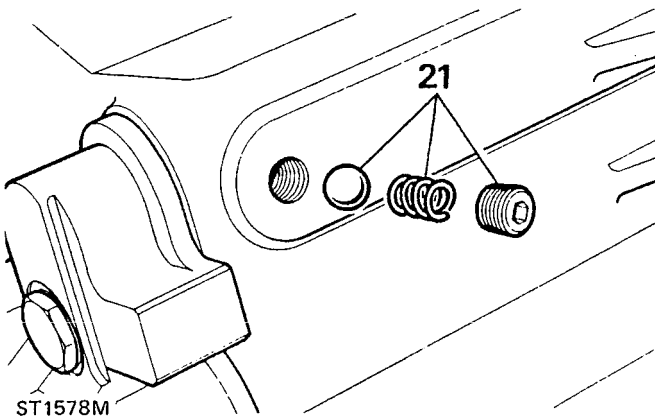
ST1577M

Front output housing removal

- 20. Remove the eight bolts and washers and detach the output housing from the transfer box casing, taking care not to mislay the dowel.

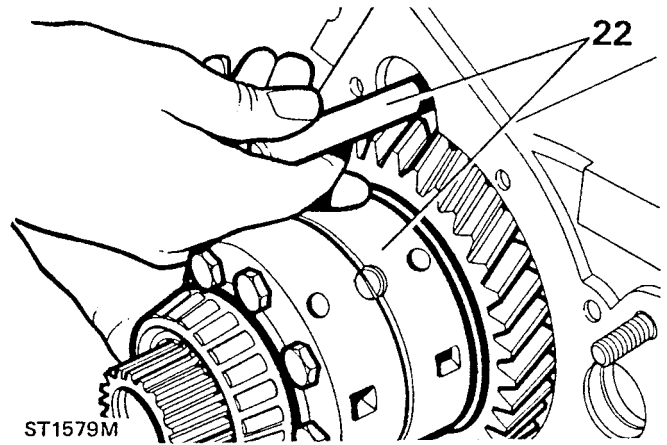
Centre differential removal

- 21. Remove high/low selector shaft detent plug, spring and retrieve the ball with a suitable magnet.



ST1578M

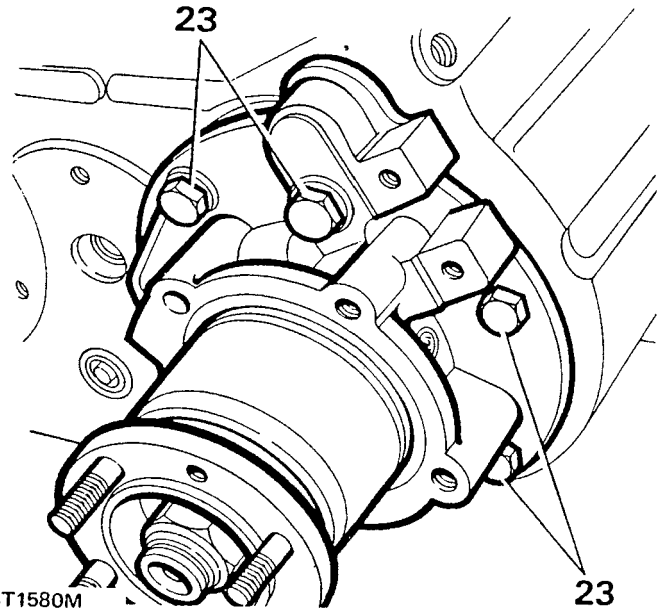
- 22. Withdraw the centre differential and selector shaft/fork assembly.



ST1579M

Rear output housing removal

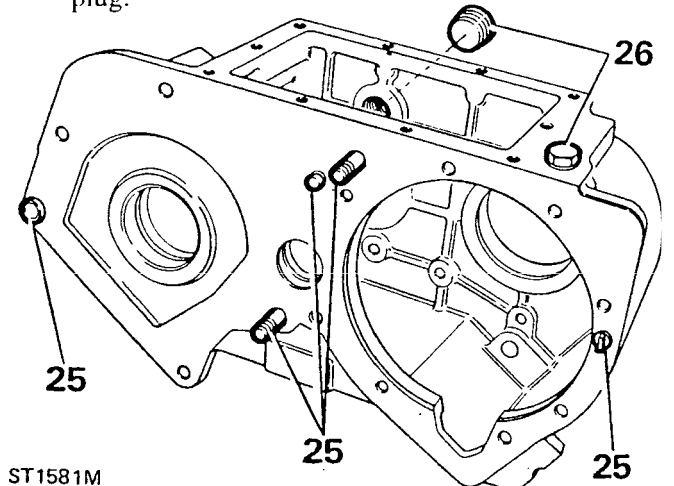
- 23. Remove six bolts and washers and detach the rear output housing and shaft assembly from the transfer casing.
- 24. Remove the gasket.



ST1580M

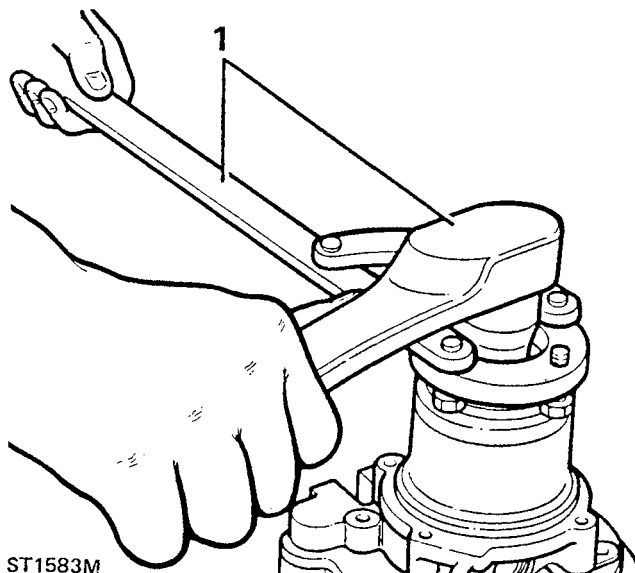
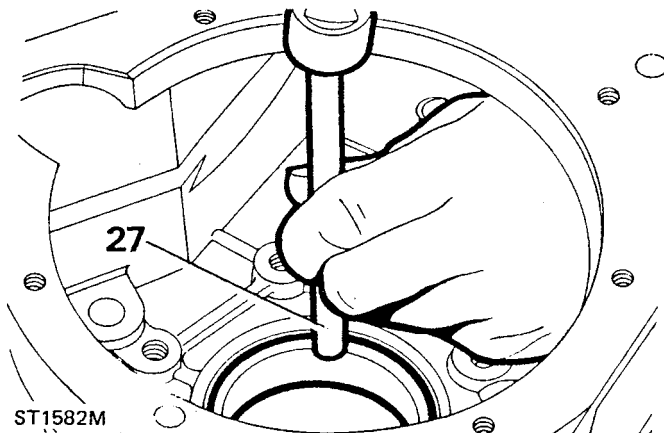
Transfer case overhaul — dismantling

- 25. Remove the studs and dowels.
- 26. Remove the magnetic drain plug and filler/level plug.



ST1581M

27. Drift out differential rear bearing track.
28. Clean all areas of the transfer casing ensuring all traces of "Loctite" are removed from faces and threads.

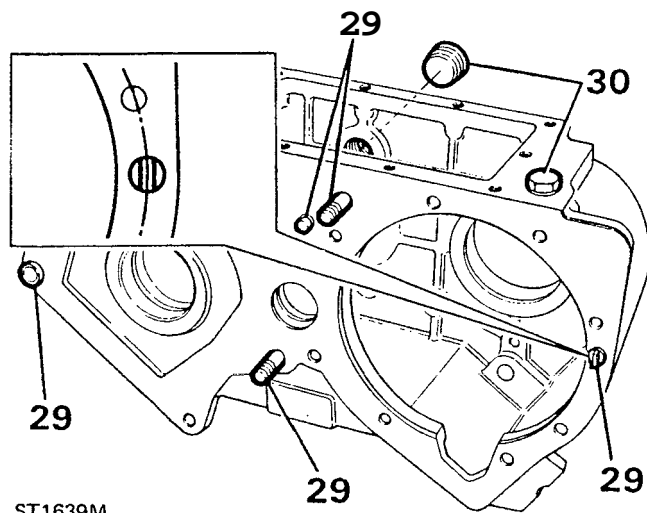


Transfer case overhaul — re-assembling

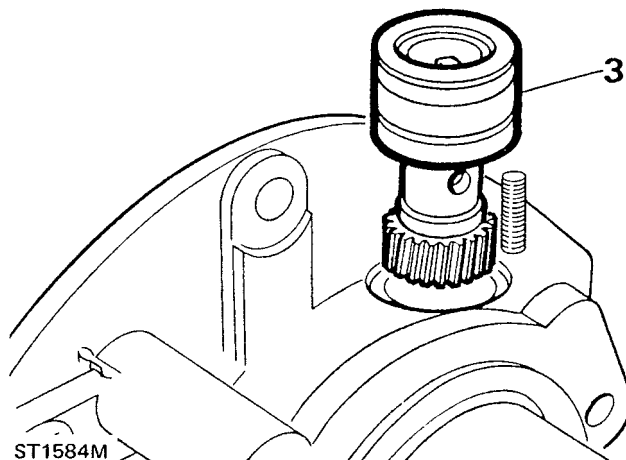
29. Fit studs and dowels to front face of the transfer casing.

NOTE: The position of the radial dowel blade is set in line with the circle which is formed by the front output housing fixing holes.

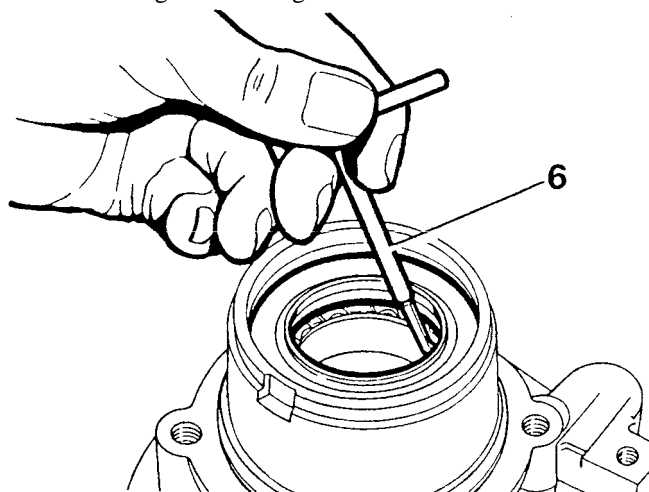
30. Refit magnetic drain plug with new copper washer and tighten to the specified torque, loosely fit the filler/level plug.



3. Remove speedo-drive housing. This can be prised out with a screwdriver.
4. Remove housing from the vice and drift out the output shaft, by striking the flange end of the shaft.
5. Carefully prise off the oil catch ring using a screwdriver in the slot provided.



6. Prise out and discard the seal from the output housing using tool 18G1271.
7. Using circlip pliers 18G257, remove the circlip retaining the bearing.

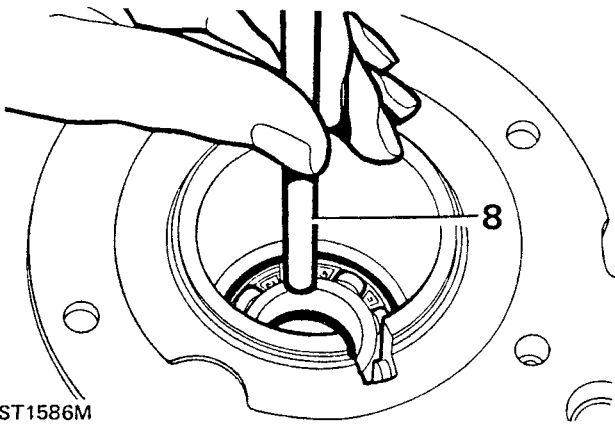


Rear output housing overhaul — dismantling

1. Using flange wrench 1861205 and socket spanner, remove the flange nut, steel and felt washers. Ensure flange bolts are fully engaged in the wrench.
2. Remove output flange with circlips attached. If necessary, use a two-legged puller.

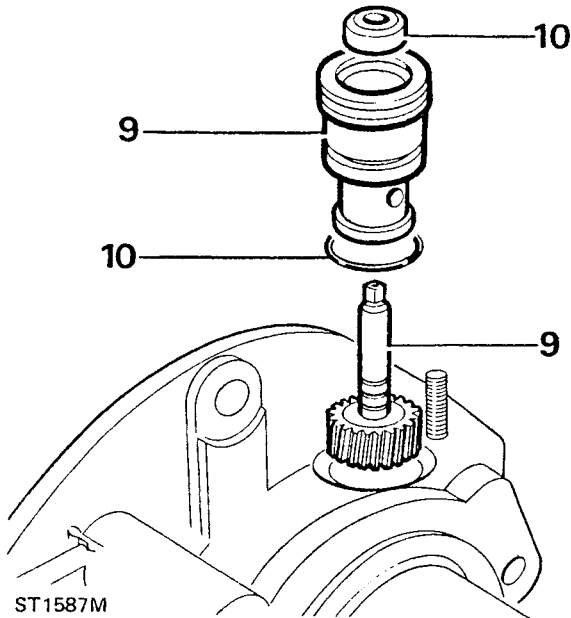
NOTE: The circlip need only be released if the flange bolts are to be renewed.

- Drift out the bearing from the rear of the housing.



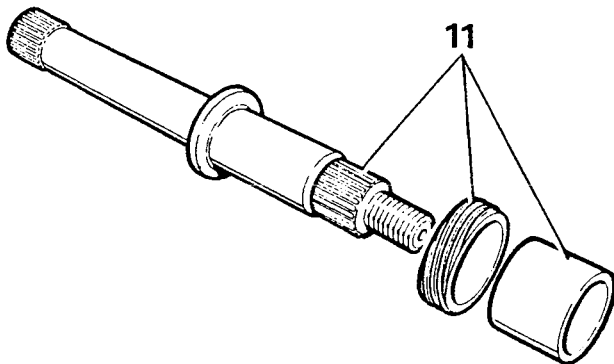
ST1586M

- Remove speedometer gear (driven) from its housing.
- Remove the 'O' ring and oil seal and discard.



ST1587M

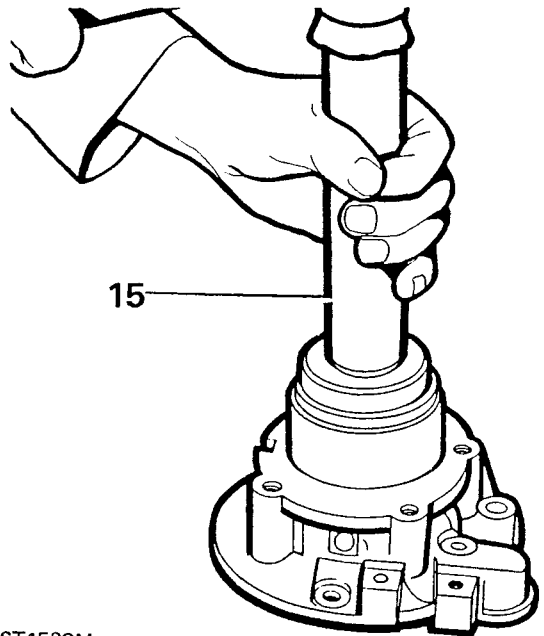
- Slide off spacer and speedometer drive gear from output shaft.
- Clean all parts, renew the 'O' ring, oil seals, felt seal and flange nut. Examine all other parts for wear or damage and renew, if necessary.



ST1588M

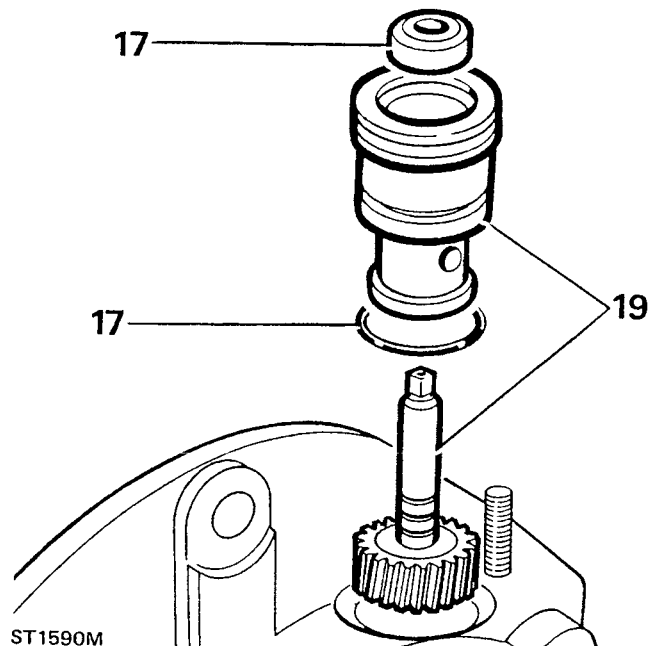
Reassembling

- Press output bearing into the housing. Do not use excessive force. To facilitate fitting the bearing, heat the output housing case. (This is not to exceed 100°C).
- Retain bearing with circlip, using circlip pliers 18G257.
- Fit new seal (open side inwards) using tool 18G1422. The seal should just make contact with the bearing circlip.
- Carefully charge the lips of the seal with clean grease and refit oil catch ring on to output housing.



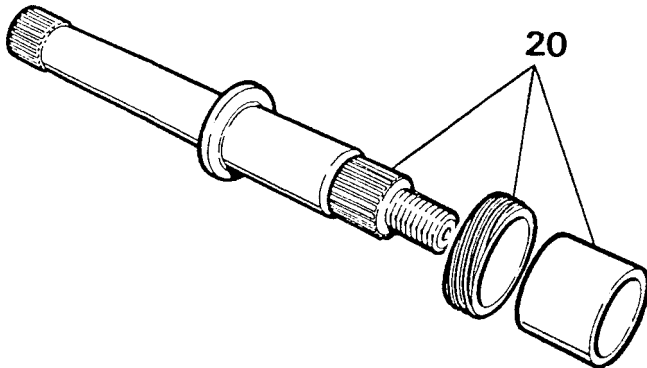
ST1589M

- Fit the 'O' ring and oil seal (open side inwards) to speedometer housing.
- Lubricate the 'O' ring and seal with oil.
- Locate speedometer gear (driven) in housing and press into position.



ST1590M

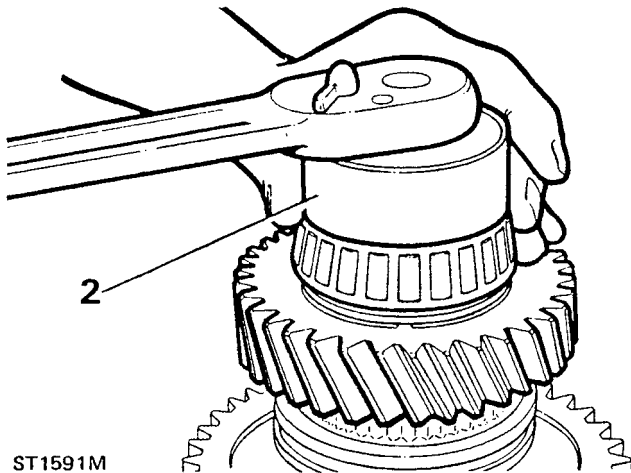
20. Slide drive gear and spacer on to the output shaft.
21. Locate output shaft into the bearing in the housing and drift into position.
22. Locate speedometer gear (driven) housing assembly into the output housing and press in until flush with the housing face.



ST1640M

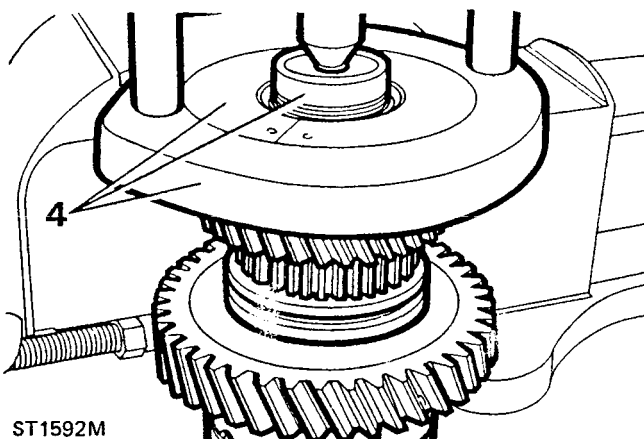
Centre differential unit overhaul — dismantling

1. Secure centre differential unit to a vice fitted with soft jaws, and release stake nut from recess.
2. Remove stake nut using tool 18G1423 and suitable socket wrench.
3. Remove the differential unit from the vice.



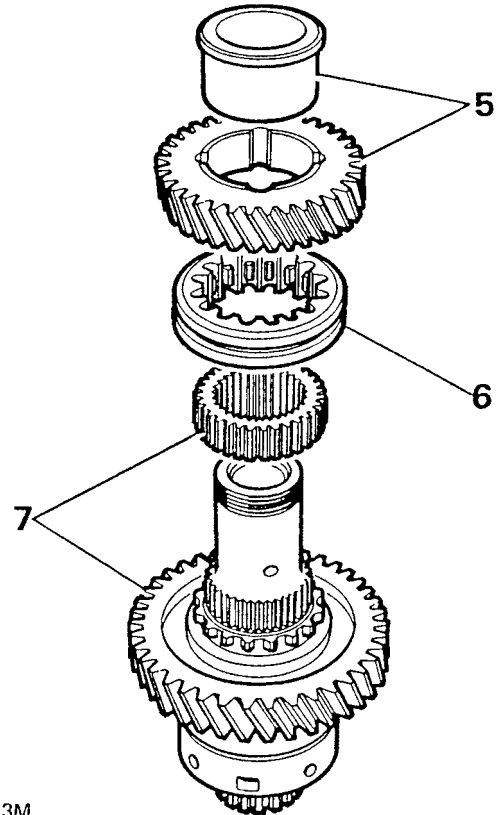
ST1591M

4. Secure hand press MS47 in vice with collars 18G47BB and using button 1847BB/3 remove the rear taper bearing and collars.



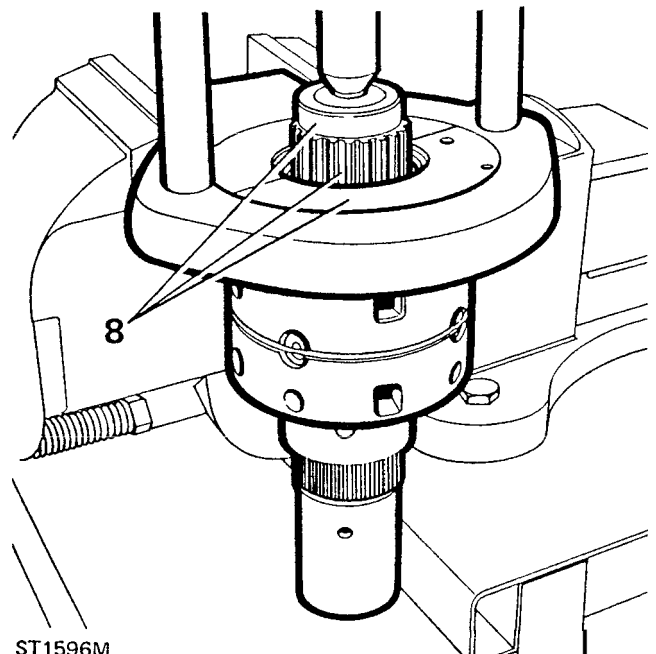
ST1592M

5. Remove the high range gear and bush, taking care not to disturb the high/low sleeve.
6. **Mark** the relationship of the high/low sleeve to the hub and then remove the sleeve.
7. Using a suitable press behind the low range gear carefully remove the high/low hub and low range gear.



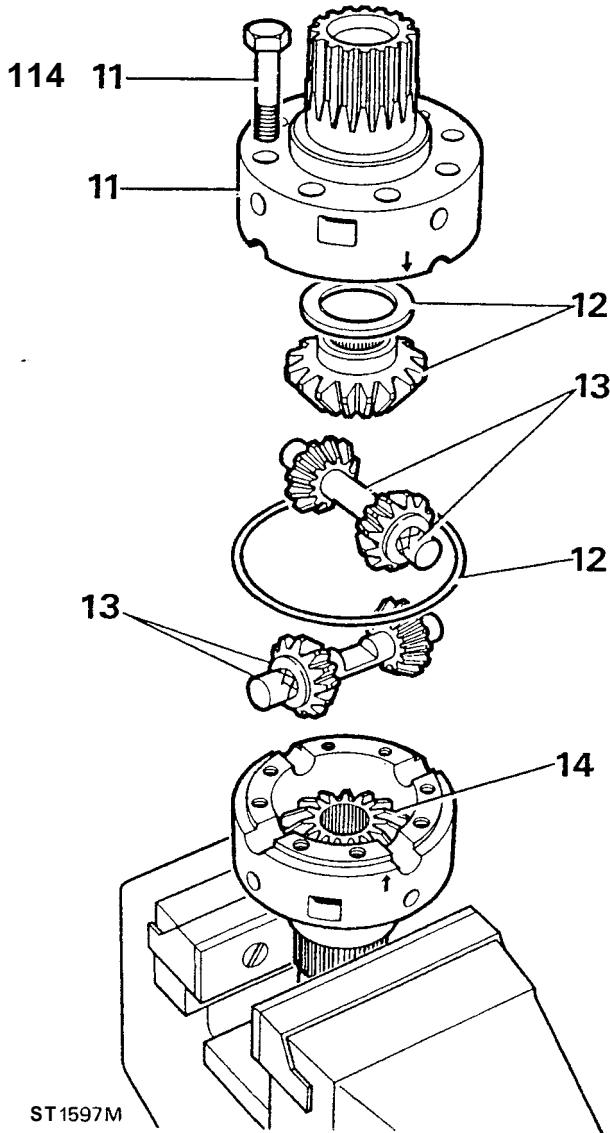
ST1593M

8. Substituting collar LST47-1 remove front taper roller bearing.
9. Remove hand press from the vice.
10. Using soft jaws secure the differential unit in the vice by gripping the hub splines.

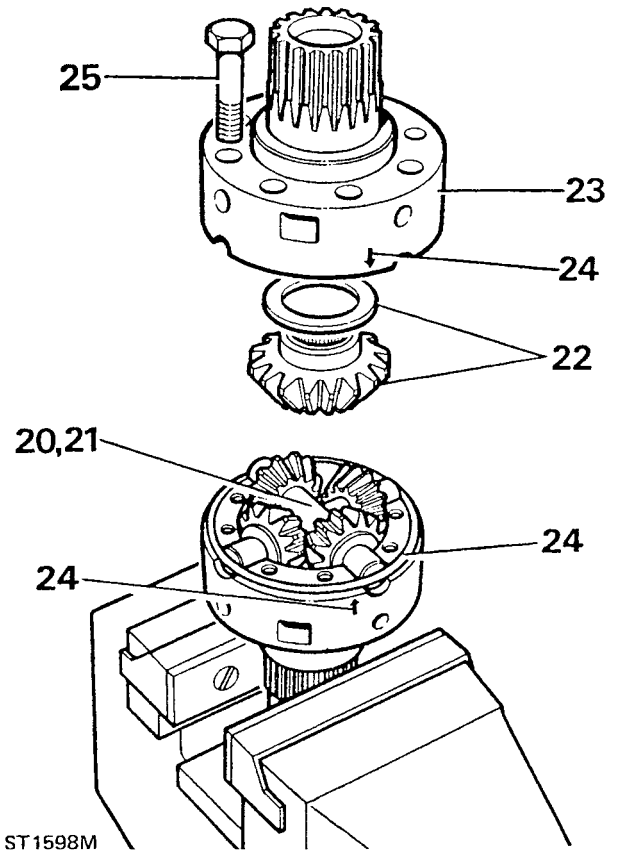


ST1596M

11. Remove the eight retaining bolts and lift off the front part of the differential unit.
12. Release the retaining ring and remove front upper bevel gear and thrust washer.
13. Remove the pinion gears and dished washers along with the cross shafts.
14. Remove the rear lower bevel gear and thrust washer from the rear part of the differential unit.

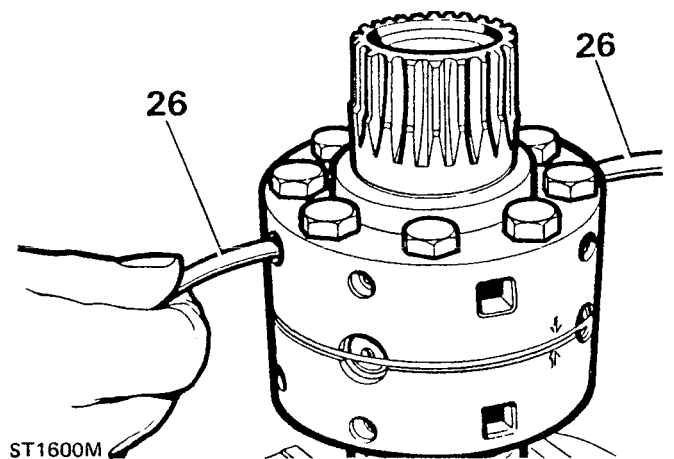


22. Measure the front upper bevel gear thrust washer and note the thickness.
23. Fit the thrust washer and bevel gear to the front unit.
24. Refit the retaining ring and front differential unit, aligning the two engraved arrows marked on both halves of the unit.
25. Fit four bolts equi-spaced and torque to the correct figure.



15. Remove the rear differential unit from the vice and clean all components; examine for wear or damage and renew if necessary.
16. Clean all components; examine for wear or damage and renew if necessary.
17. Using soft jaws secure the rear differential unit in the vice by gripping the hub splines.
18. Ensure that all differential components are dry to assist in checking end-float.
19. Using a micrometer, measure one of the bevel gear thrust washers and note the thickness.
20. Fit the thrust washer and bevel gear to the rear lower differential unit.
21. Assemble both pinion assemblies and dished washers on to their respective shafts and fit to the rear differential unit.

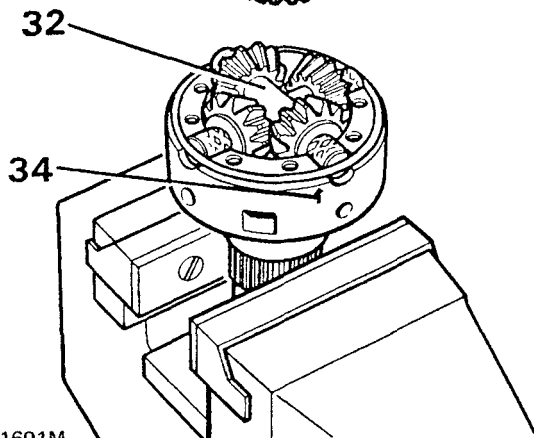
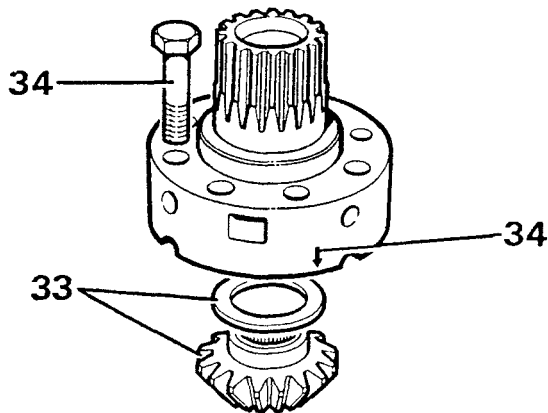
26. Measure the front bevel gear end-float with feeler gauges through the slots provided in the front differential unit. The end-float must be 0,025 to 0,075 mm (0.001 to 0.003 in) maximum. When measuring use two sets of feeler gauges, one on each side of the front differential unit. This will give a true reading of the end-float.



27. Invert the differential unit and repeat operation 26 for the rear bevel gear end-float.
28. Invert the differential unit and secure in vice and remove the four bolts and lift off the front differential unit.
29. Remove the retaining ring, bevel gear and the washer and both pinion assemblies.
30. Select the correct thrust washers required for final assembly.

Reassembling

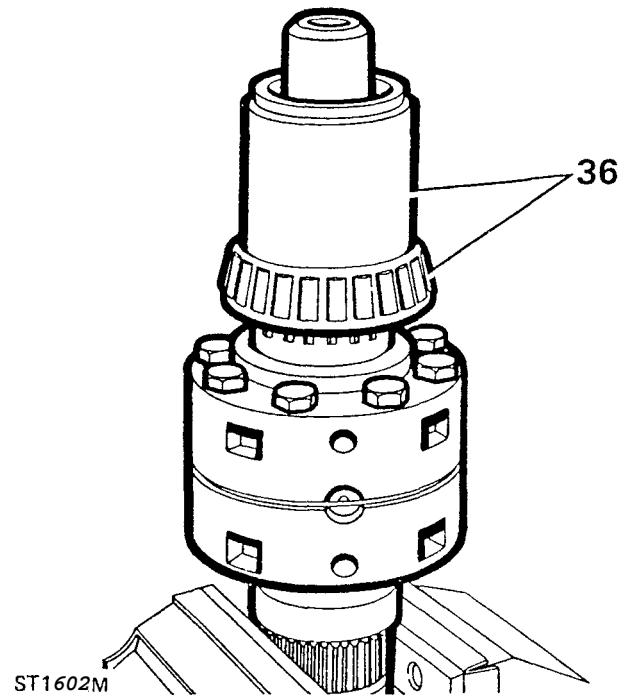
31. Fit the selected thrust washer and bevel gear into the rear lower differential unit.
32. Assemble both pinion assemblies and dished washers on to their respective shafts and fit the rear differential unit. Secure the assemblies with the retaining ring.
33. Lubricate all the components.
34. Fit the selected thrust washer and bevel gear into the front upper differential unit.



ST1601M

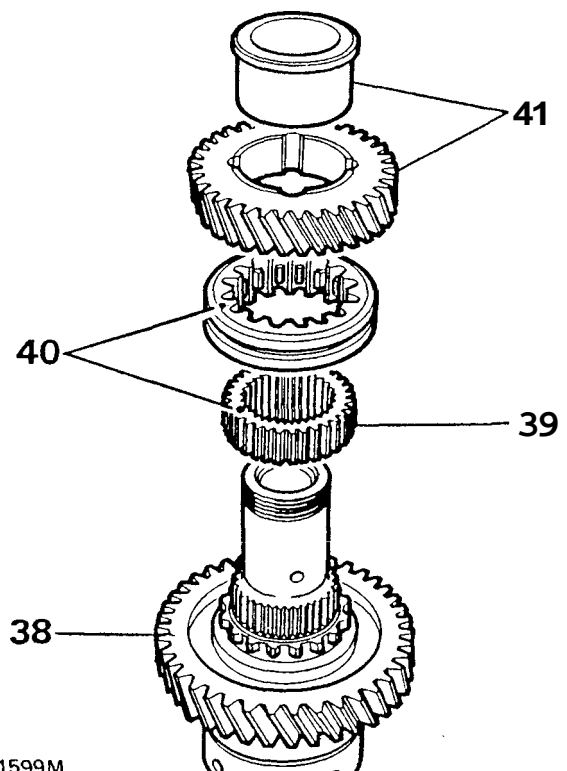
35. **Align** both units as previously described and secure with the eight bolts to the specified torque.
36. Finally check that the differential gears rotate freely. Locate the front differential bearing onto the front, upper differential shaft and press into position using larger end of tool 1861424 as shown.
37. Invert the differential unit and secure in the vice.

NOTE: During the following sequences all parts should be lubricated as they are fitted.



ST1602M

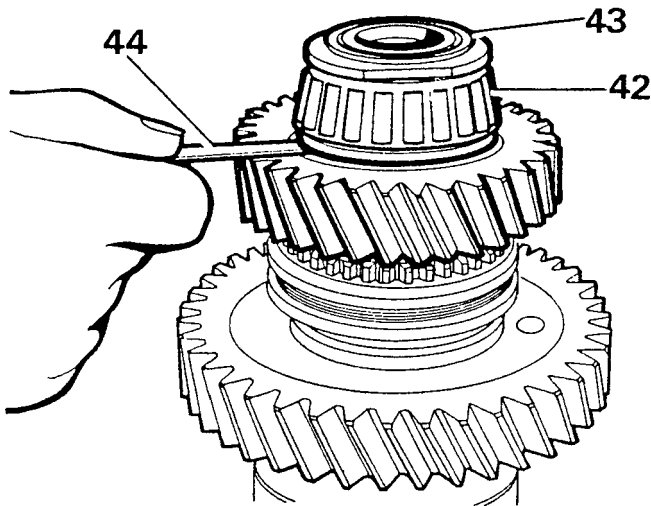
38. Fit the low range gear, with its dog teeth uppermost to the differential assembly.
39. Press the high/low hub on to the differential splines.
40. Slide the high/low selector sleeve on to the high/low hub ensuring that the alignment marks are opposite each other.
41. Fit the bush into the high range gear so that the flange is fitted on the opposite side of the gear to the dog teeth. Slide the bushed gear on to the differential assembly with the dog teeth down.



ST1599M

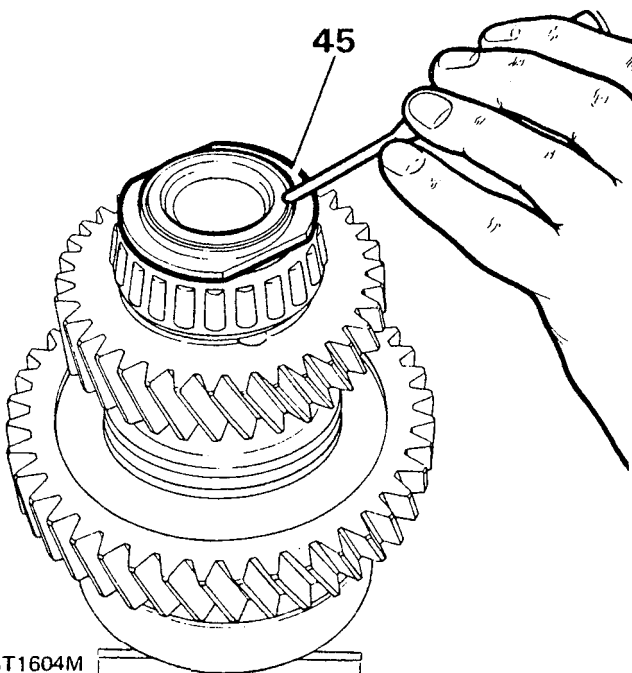
42. Locate the rear differential bearing on to the hub and press it into position using the smaller end of tool 18G1424.
43. Fit the stake nut and tighten to the specified torque using tool 18G1423.
44. Check the end float of the high and low range gears 0,05 to 0,15 mm (0.002 to 0.005 in).

NOTE: If the clearances vary from those specified in the data, the assembly must be rebuilt using the relevant new parts.



ST1603M

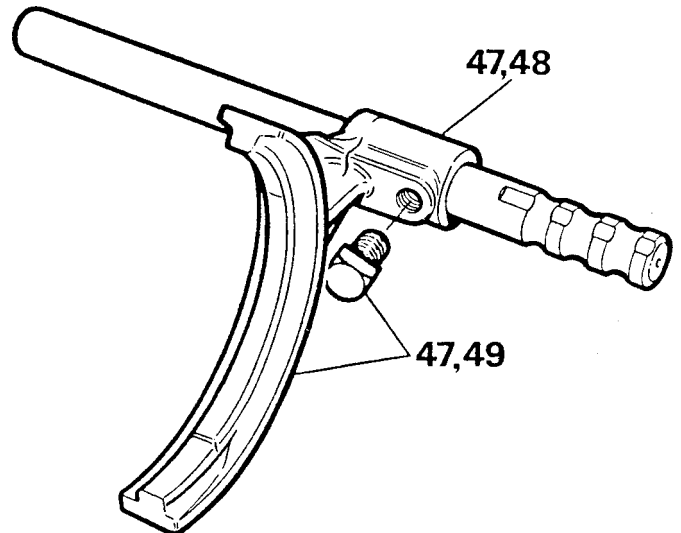
45. Peen the stake nut collar by carefully forming the collar of the nut into the slot as illustrated.
- CAUTION: A round nose tool must be used for this operation to avoid splitting the collar of the nut.**



ST1604M

46. Clean and check high/low selector fork assembly for wear and renew if necessary.
47. To renew the selector fork remove the square set screw and slide the fork from the shaft.

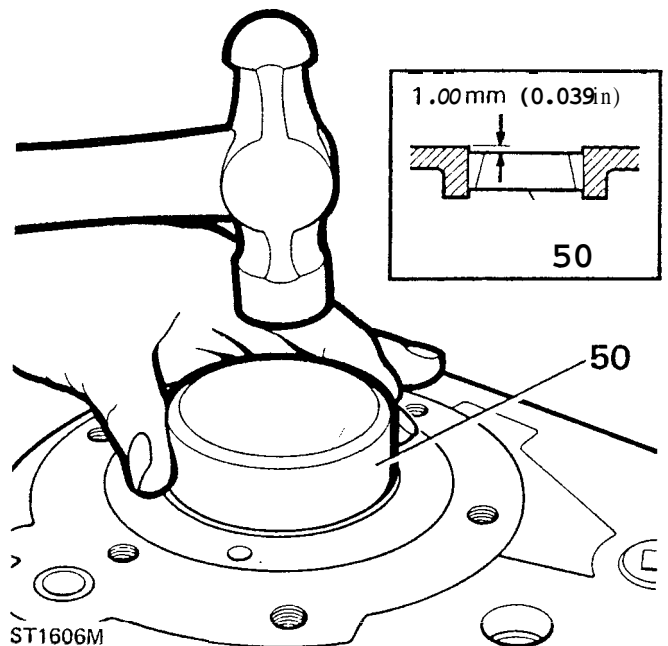
48. Fit the new selector fork with its boss towards the three detent grooves. Align the tapped hole in the fork boss with the indent in the shaft nearest to the detent grooves.
49. Apply Loctite 290 to the set screw threads and fit the set screw and tighten to the specified torque.



ST1605M

Centre differential rear bearing track

50. Fit the differential rear bearing track 1,00 mm (0.039 in) below the outer face of casing using a suitable tool as shown.

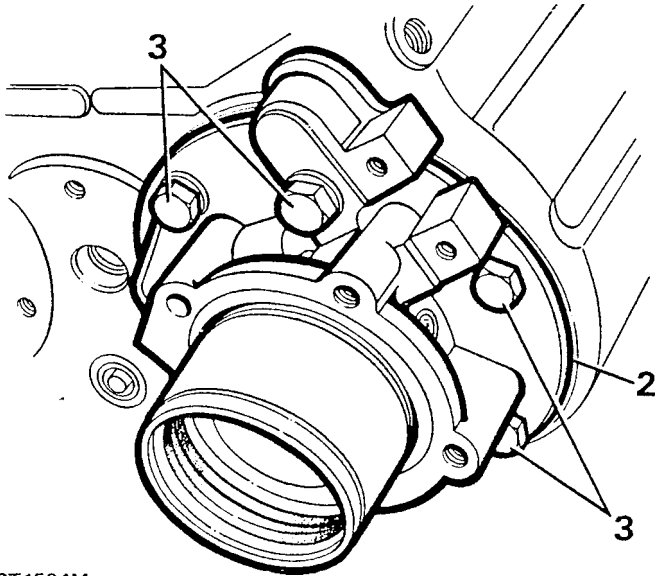


ST1606M

Rear output housing — refit

1. Grease output housing gasket and position on to the rear face of the transfer box casing.

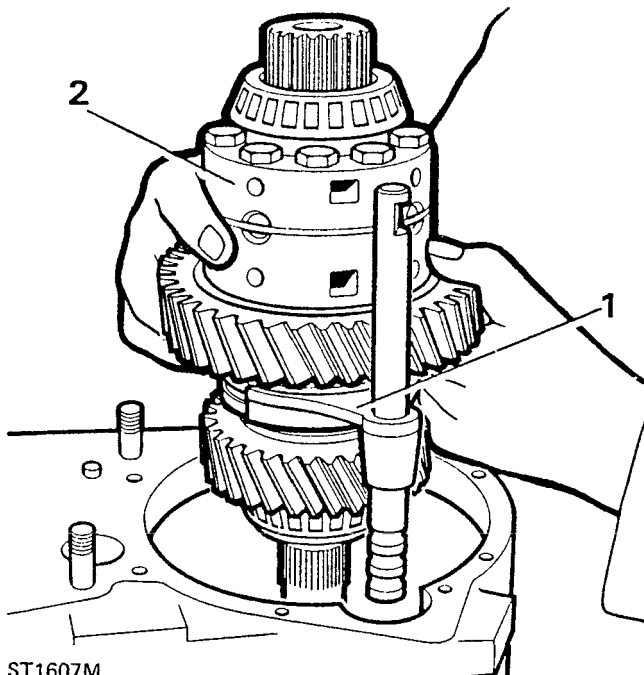
2. Fit output housing and ensure clearance of 1.00mm (0.039 in) between housing face and gasket.
3. Fit the six output housing bolts with Loctite 290 on the threads, with washers and tighten evenly to the correct torque, which will pull the rear bearing into position.



ST1594M

Centre differential unit refit

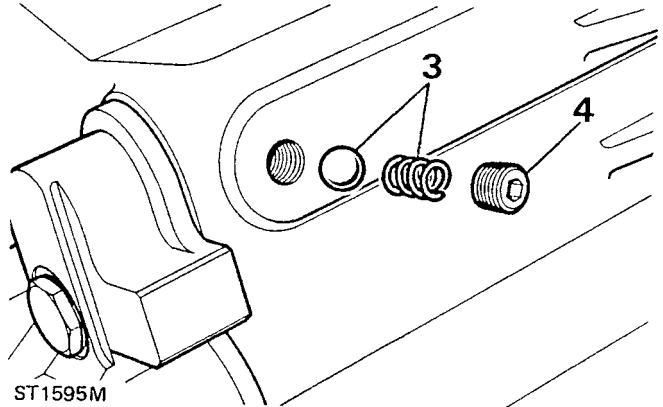
1. Fit the selector fork/shaft assembly to the high/low selector sleeve on the differential assembly, with detent groove to the rear of the differential assembly.
2. Locate the differential assembly complete with selector fork into the transfer box casing. It may be necessary to rotate the output shaft to ease fitment, and engage selector shaft into its hole.



ST1607M

3. Fit selector shaft ball and spring through the side of the transfer box casing.

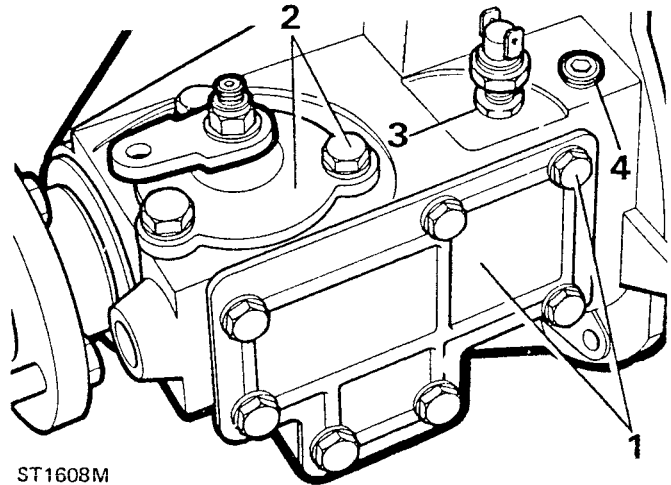
4. Apply Loctite 290 to decant plug; fit and locate, by screwing gently fully home and then unscrewing two turns.



ST1595M

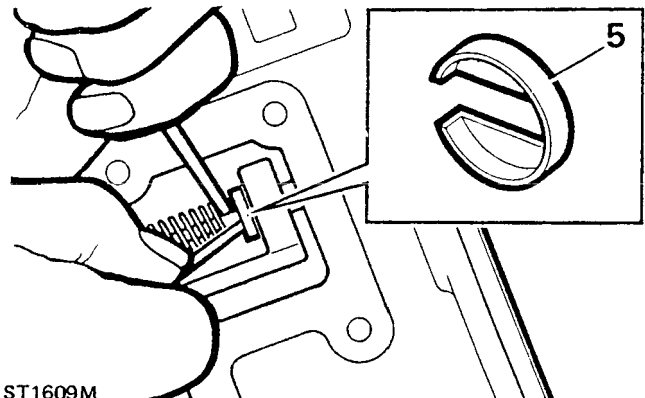
Front output housing overhaul — dismantling

1. Unscrew seven retaining bolts and washers and remove the differential lock selector side cover and gasket.
2. Unscrew three retaining bolts and washers and lift the differential lock finger housing and actuator assembly from the front output housing.
3. Slacken the locknut and unscrew the differential lock warning light switch.
4. Remove selector shaft detent plug, spring and ball using a suitable magnet.



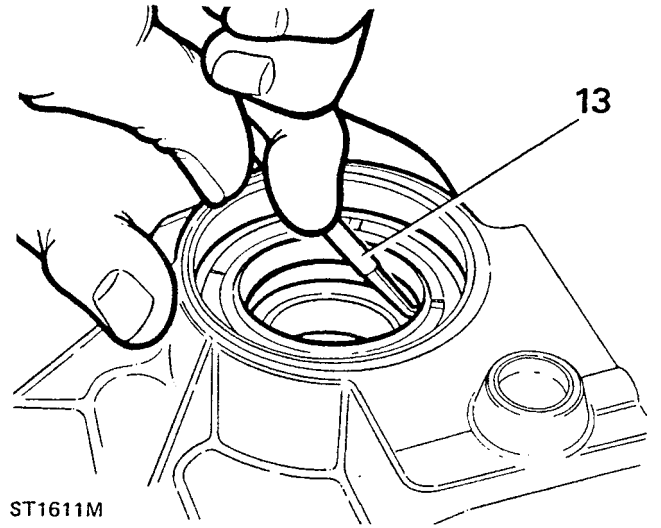
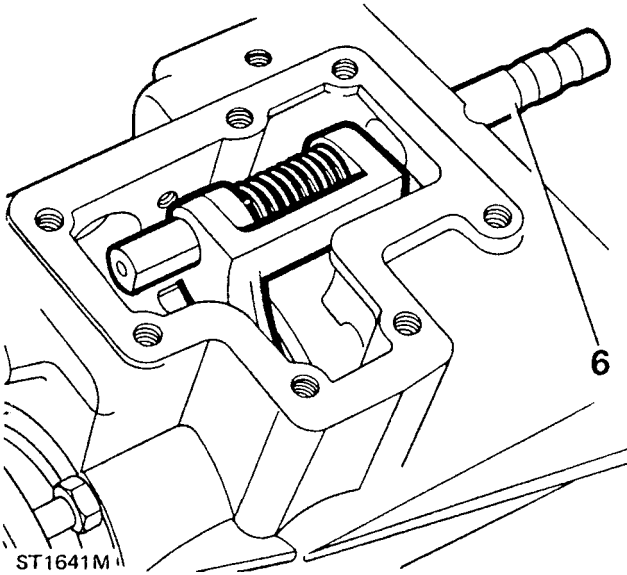
ST1608M

5. Compress the selector fork spring and remove the two spring retaining caps.

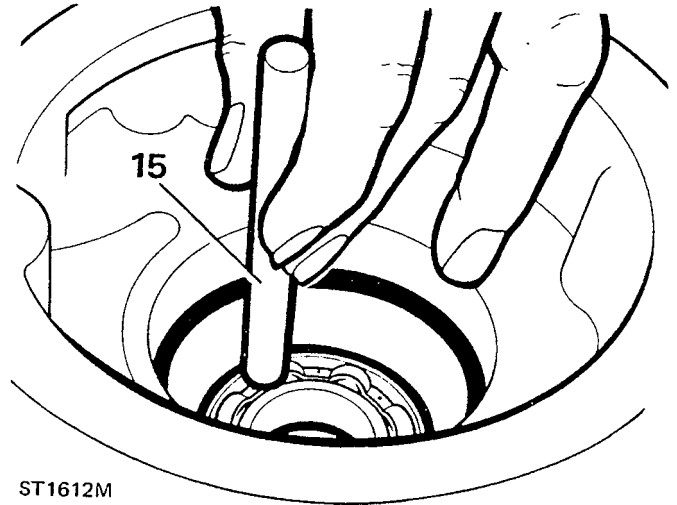


ST1609M

6. Withdraw the selector shaft from the rear of the output housing.
7. Remove the selector fork and spring through the side cover aperture.
8. Remove lock-up sleeve from the rear of the output housing.



15. Invert housing and drift out bearing from inside the case as shown.



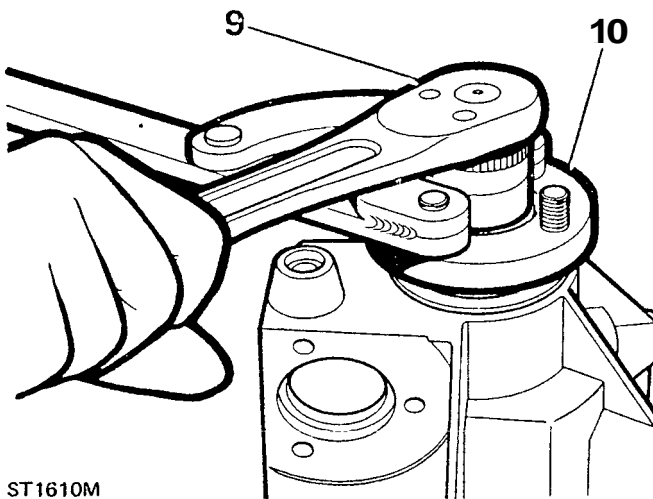
9. Using flange wrench 18G1205 and socket wrench, remove the flange nut, steel and felt washers.

NOTE: Ensure that flange bolts are fully engaged in the wrench

10. Remove the output flange with oil seal shield.

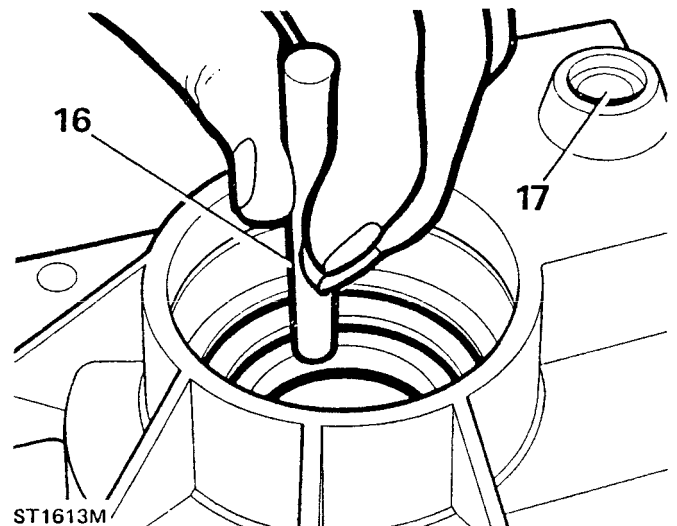
NOTE: These parts need not be separated unless the flange bolts are to be renewed.

11. Drift output shaft rearwards from housing using a soft headed mallet.
12. Slide off the collar from the output shaft



16. Drift out centre differential front taper roller bearing track and shim.
17. Drift out selector shaft cup plug from housing.
18. Clean all components ensuring all traces of "Loctite" are removed from faces and threads.
19. Examine components for wear or damage and renew if necessary.

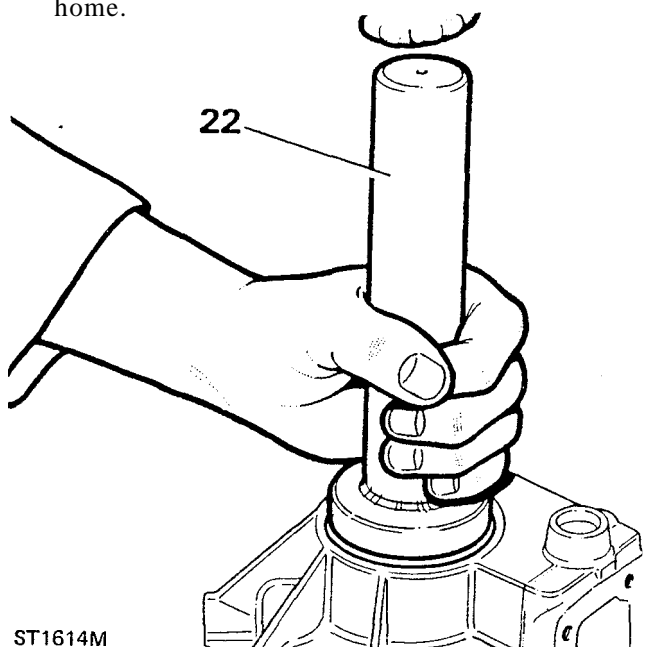
NOTE: Renew oil seal and felt seal and flange nut.



13. Prise out and discard oil seal from output housing using service tool 1861271.
14. Remove circlip with circlip pliers 186257.

Reassembling

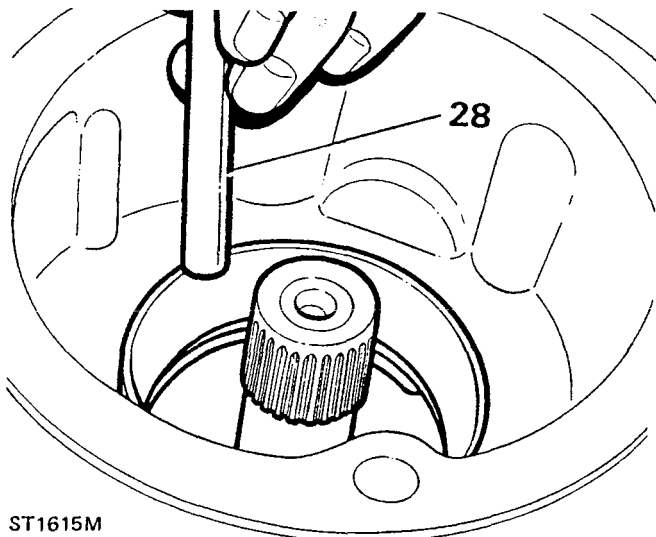
20. Press the bearing into the housing; do not use excessive force. To facilitate fitting the bearing, heat the front output housing. (This is not to exceed 100°C).
21. Using circlip pliers 186257, fit the bearing retaining clips.
22. Fit a new oil seal (open side inwards) using replacer tool 18G1422, until the seal just makes contact with the circlip.
23. Carefully charge the lips of the seal with clean grease.
24. Slide collar on to the output shaft, with its chamfered edge towards the dog teeth.
25. Fit the output shaft through the bearing and drift home.



ST1614M

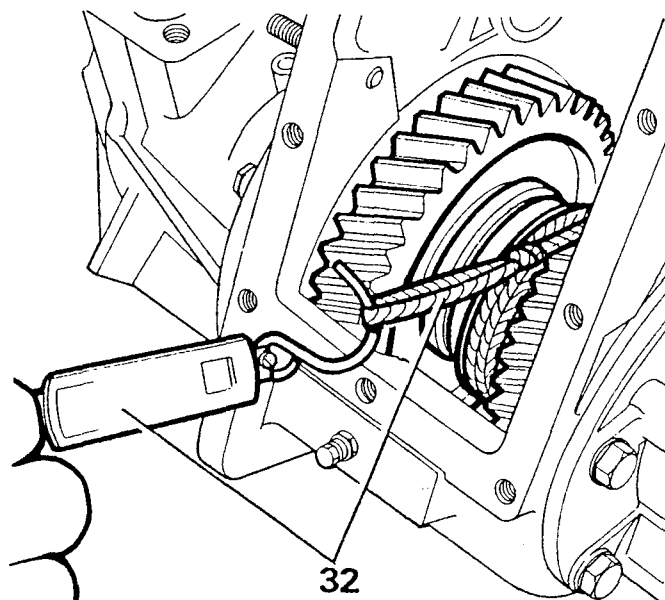
Adjusting front differential bearing pre-load

26. Measure original differential front bearing track shim.
27. Refit original shim into input housing.
28. Drift differential front bearing track into the housing.



ST1615M

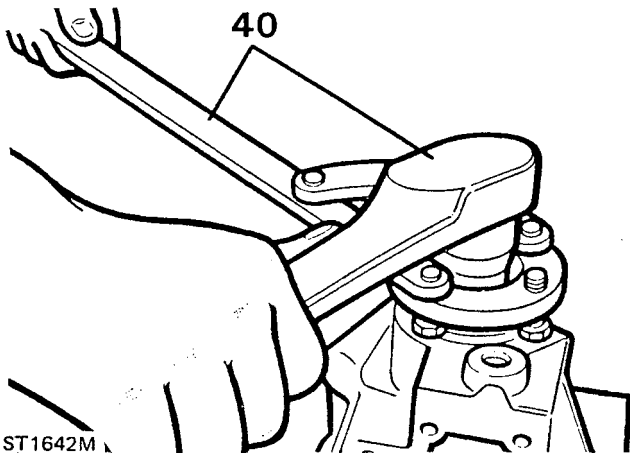
29. Grease and fit new gasket and locate the front output housing on the transfer box casing.
30. Secure housing with the eight retaining bolts and washers, the upper middle bolt being longer than the rest. Do not tighten the bolts at this stage.
31. Engage high or low gear.
32. Check the rolling resistance of the differential using a spring balance and a length of string wound around the exposed splines of the high/low hub.
33. With the correct shim fitted the load to turn should be 1.36 kg to 4.53 kg (3 lbs to 10 lbs). This applies to new or used bearings. (New bearings will register at the top end and used bearings will register at the low end.
34. If the reading is in excess of the above measurements, remove the front output housing assembly from the transfer box casing.
35. Using a suitable extractor, withdraw the centre differential bearing track and change the shim for one of a suitable thickness. (A thinner shim will reduce the rolling resistance).
36. Fit the new shim and drift the differential bearing track back into its housing until fully home.
37. Having obtained the load to turn, prop-up the transfer box casing on the bench with the front face uppermost.



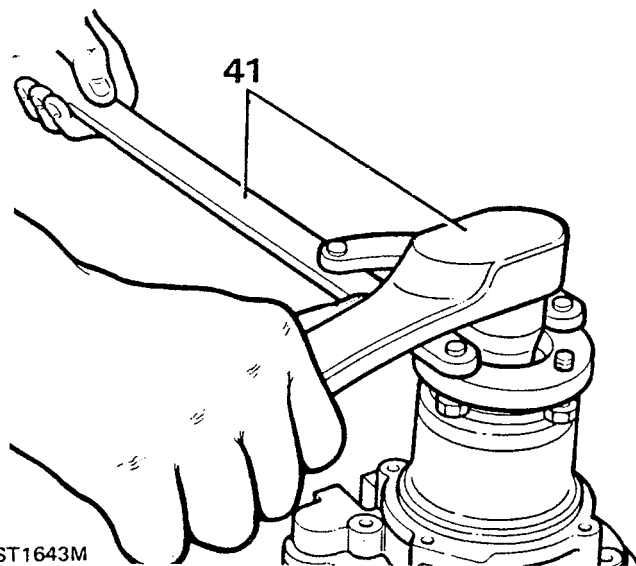
ST1616M

38. Apply Loctite 290 to the threads of the housing retaining bolts and fit the eight bolts and washers into the front output housing and secure to transfer box casing.
39. Fit front output flange, felt washers, steel washers and flange nut.
40. Using flange wrench 1861205 and torque wrench pull the output shaft up to the correct position. Check that the oil seal shield does not foul the housing.

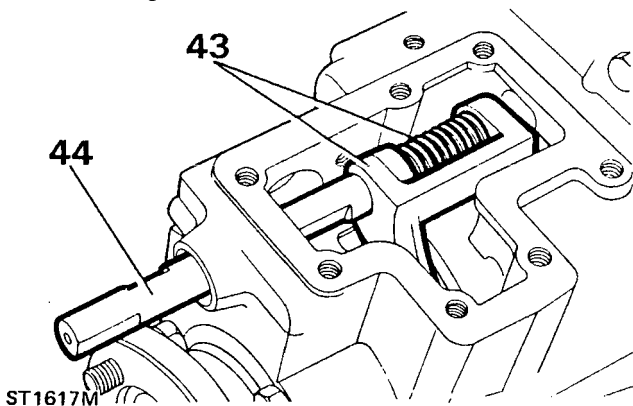
NOTE: Ensure that the flange bolts are fully engaged in the wrench.



40. Repeat the above operation for the rear output flange.

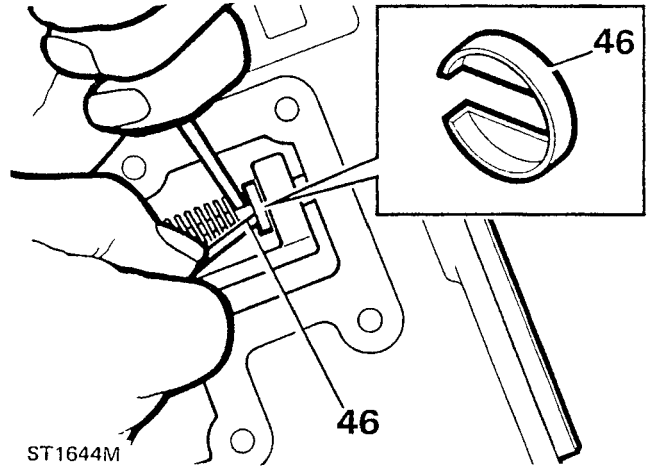


- 41. Compress the selector shaft spring and fit to the selector fork.
- 42. Locate selector fork through front output housing side cover aperture, ensuring that the fork engages in the groove of the lock-up sleeve.
- 43. Fit selector shaft through the aperture in the front of the output housing and pass it through the selector fork lugs and spring into the rear part of the housing.
- 44. Rotate the selector shaft until the two flats for the spring retaining caps are at right angles to the side cover plate face.



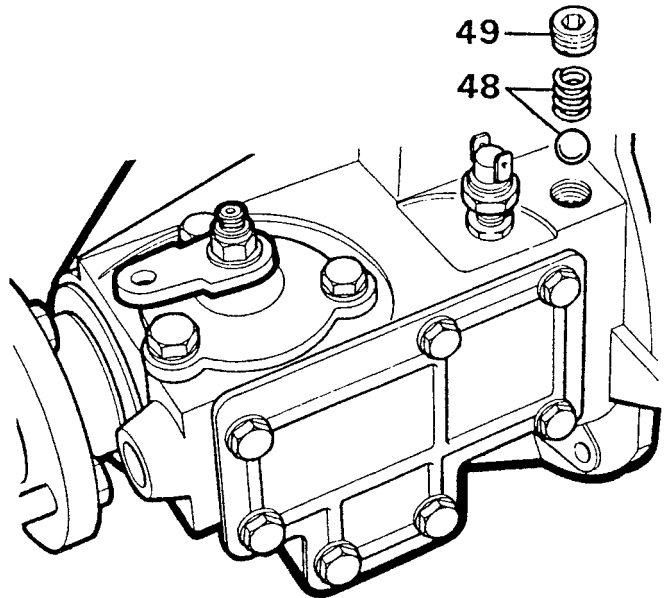
45. Compress the spring between the fork lugs and slide the retaining caps on to the shaft ensuring the spring is captured with the “cupped” side of the caps.

46. Drift selector shaft sea! cup into position.



47. Fit selector shaft detent ball and spring in the tapped hole on top of the output housing.

48. Apply Loctite 290 to detent plug threads. Screw detent plug gently home and then unscrew two turns.



ST1645M

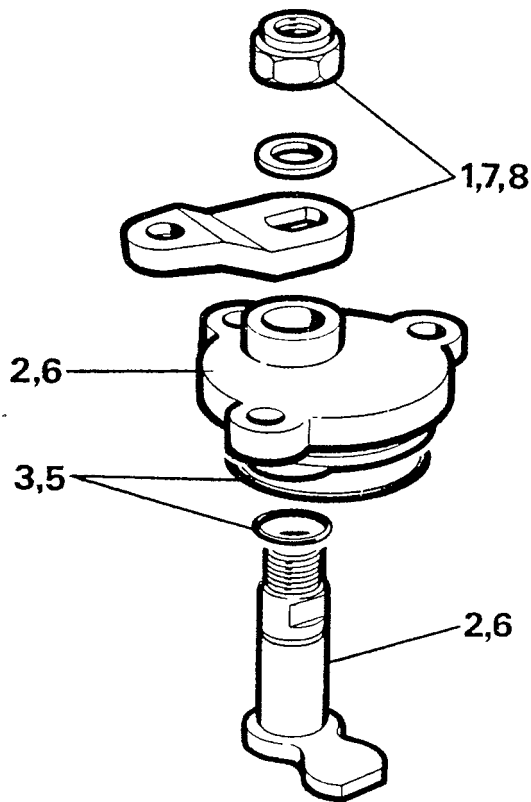
Differential lock finger housing overhaul — dismantling

- 1. Unscrew and discard the “nyloc” nut and remove the operating lever and washer.
- 2. Remove the pivot shaft from lock finger housing.
- 3. Remove the ‘O’ rings from the pivot shaft and housing and discard.
- 4. Clean all components; examine for wear or damage and renew if necessary.

Reassembling

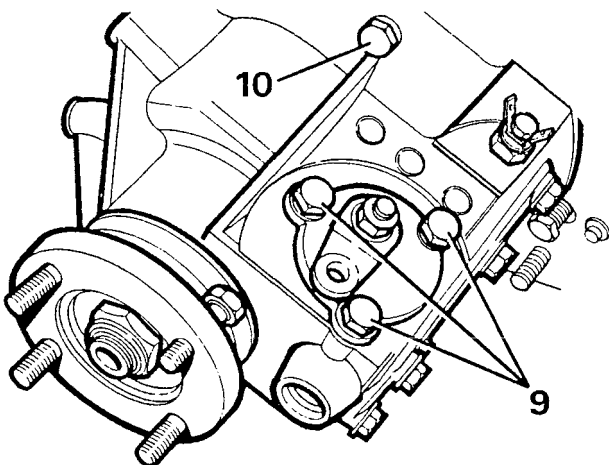
- 5. Fit new ‘O’ rings on to pivot shaft and lock finger housing and lubricate with oil.
- 6. Locate the pivot shaft in the housing.

7. Fit the differential lock lever over the pivot shaft so that the lever will face forward with the bend upwards. This lever is then in the correct operating position.
8. Retain the lever with a plain washer and new nyloc nut.



ST1618M

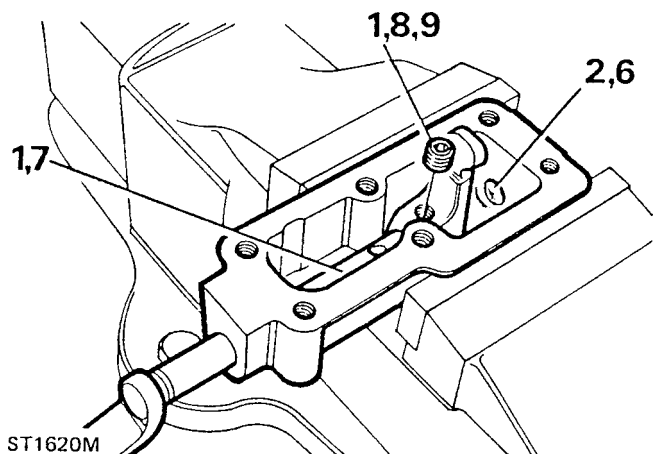
9. Fit the differential lock finger housing into its seating on the front output housing, ensuring that the selector finger is located in the flat of the selector shaft.
10. Apply Loctite 290 to the bolt threads and retain the lock finger housing with the three bolts and washers to the specified torque.



ST1619M

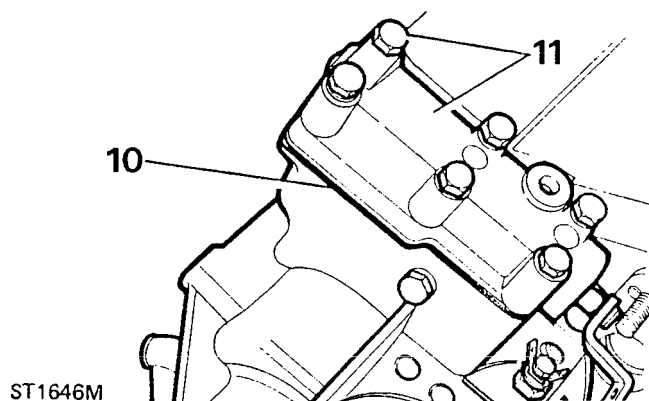
High/low cross-shaft housing overhaul

1. Remove the selector finger grub screw and withdraw the cross-shaft from the cross-shaft housing and remove the selector finger.
2. Remove the 'O' ring from the cross-shaft.
3. Drift out selector housing cup plug if necessary.
4. Clean all the components and check for damage or wear, replace if necessary.
5. Apply sealant to a new cup plug and fit so that the cup is just below the chamfer for the cross-shaft bore.
6. Fit new 'O' ring to cross-shaft.
7. Lubricate the shaft and insert into the cross-shaft housing.
8. Fit selector finger ensuring that it aligns with the recess in the cross-shaft.
9. Apply Loctite 290 to the grub screw and secure the selector finger to the cross-shaft and fully tighten to the specified torque.



ST1620M

10. Grease and fit the high/low selector housing gasket on the front output housing.
11. Fit high/low cross-shaft housing, ensuring that the selector finger locates in the slot of the selector shaft, and secure with six bolts and washers to the specified torque.

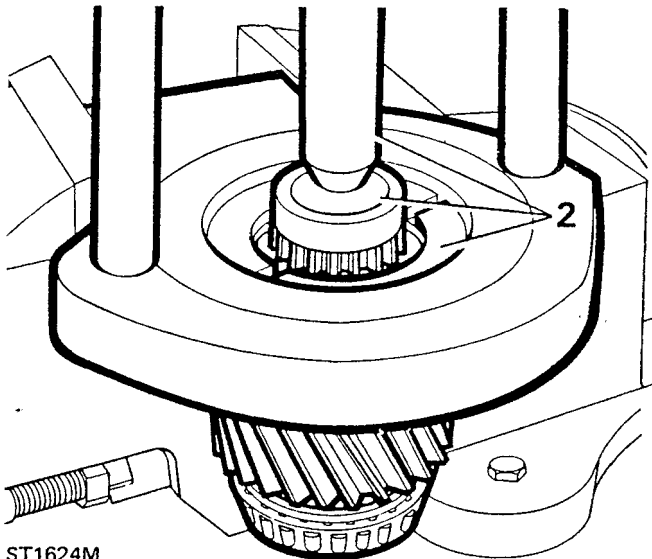


ST1646M

Input gear overhaul — dismantling

1. Clean the input gear assembly and examine for wear or damage. Remove the bearings only if they are to be renewed.

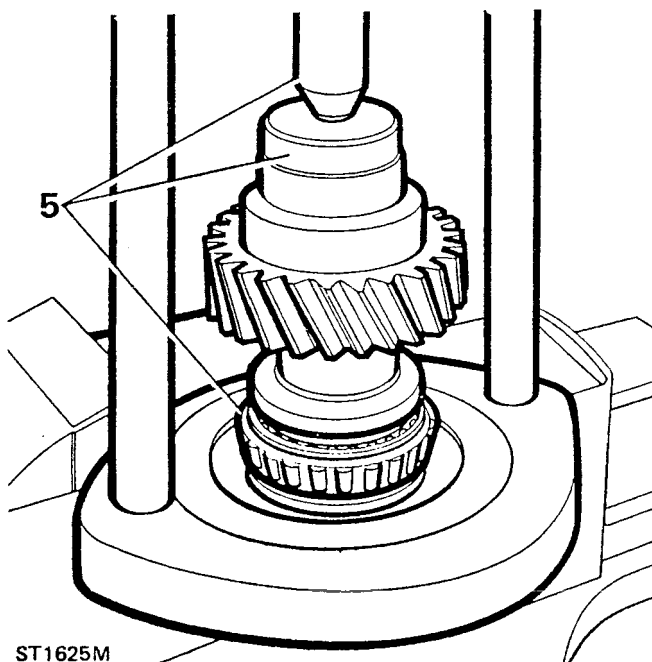
2. Secure hand press MS47 in the vice and using collars 18G47-7 and button 18G47-BB/3, remove rear taper roller bearing from input gear assembly.
3. Invert input gear assembly in hand press and remove front taper roller bearing.
4. Clean input gear.



ST1624M

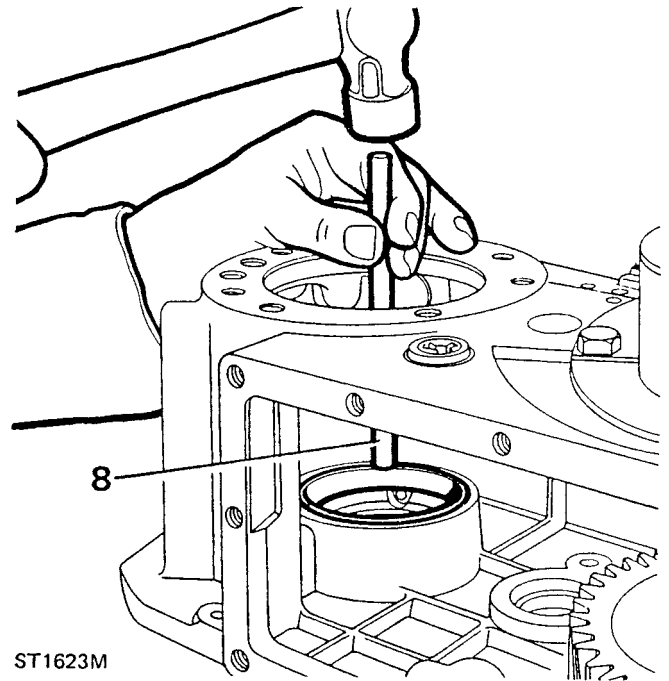
Reassembling

5. Position rear taper roller bearing on input gear and using hand press MS47 and collars 18G47-7 press the bearing fully home.
6. Invert input gear and fit the front taper roller bearing using the press and collars.



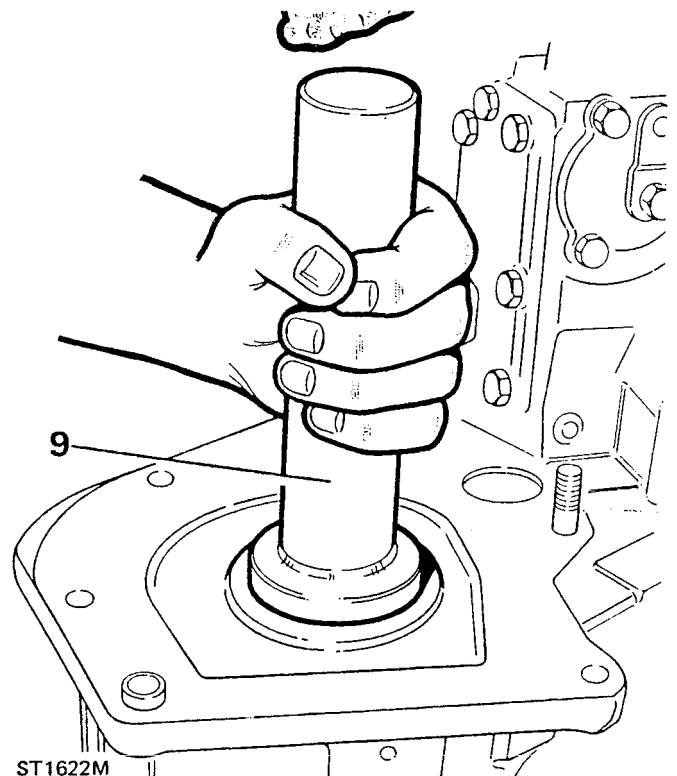
ST1625M

7. Prop up the transfer box casing on the bench with the rear face uppermost.
8. Drift in the front taper bearing track.



ST1623M

9. Reposition transfer box casing so the front face is uppermost and fit oil seal (open side inwards) using replacer tool 18G1422.

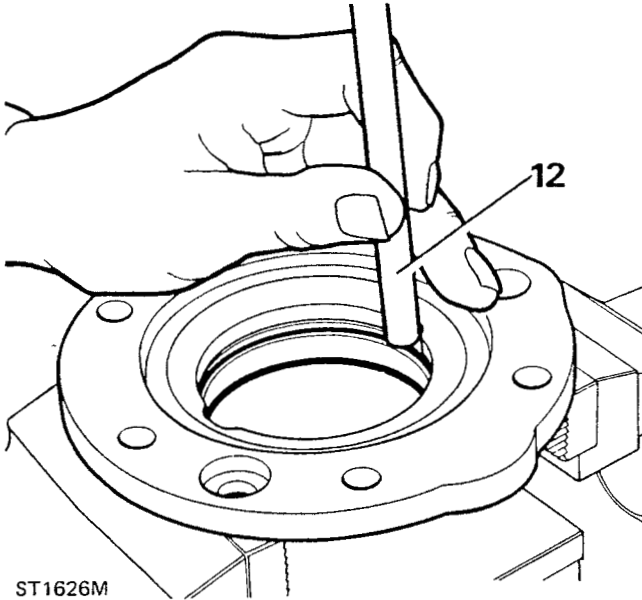


ST1622M

10. Lubricate both bearings with clean oil.
11. Fit the input gear assembly into the transfer box casing with the dog teeth uppermost.

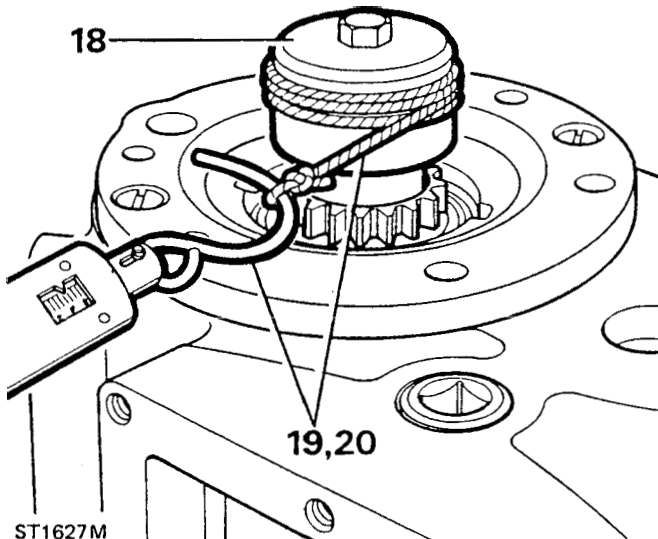
Checking input gear bearing pre-load

12. Secure bearing support plate in the vice. Drift out input gear bearing track, and remove shim.
13. Clean bearing support plate and shim. Measure original shim and note its thickness.
14. Fit the original shim to the support plate.
15. Locate the bearing track in the support plate and press fully home.



ST1626M

16. Apply grease to the gasket and fit on to the transfer box casing.
17. Fit the bearing support plate on to the transfer box casing and secure with the six bolts, but do not tighten.
18. Fit the service tool LST105 to input gear and engage the spline.
19. Tie a length of string to the split pin and fit it to the service tool as shown.
20. Attach a spring balance to the string and carefully tension the spring until a load to turn the input gear is obtained. A pull of 2.26 kg to 6.80 kg (5 lb to 15 lbs) is required.
21. If the reading obtained is outside the above limits, the original shim must be changed.

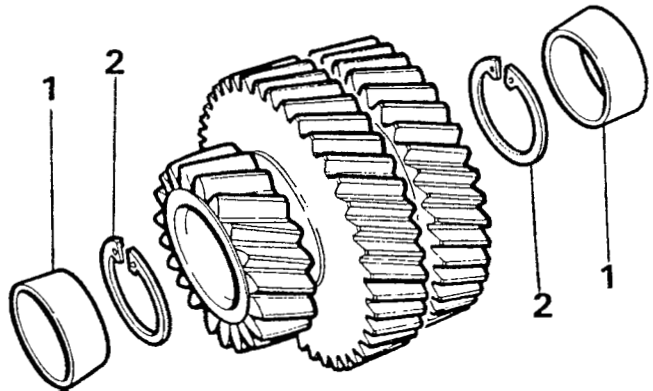


ST1627M

22. Remove the spring balance, string and service tool.
23. Remove the six bolts and the bearing support plate.
24. Drift out the input gear bearing track from the support plate and discard original shim.
25. Select the correct size shim to obtain a load to turn of 2.26 kg to 6.80 kg (5 lb to 15 lbs).
26. Fit shim to support plate, locate bearing track and press home.
27. Fit bearing support plate and secure to transfer box casing with the six bolts (do not tighten).
28. Repeat the rolling resistance check as previously described, and note the value obtained.

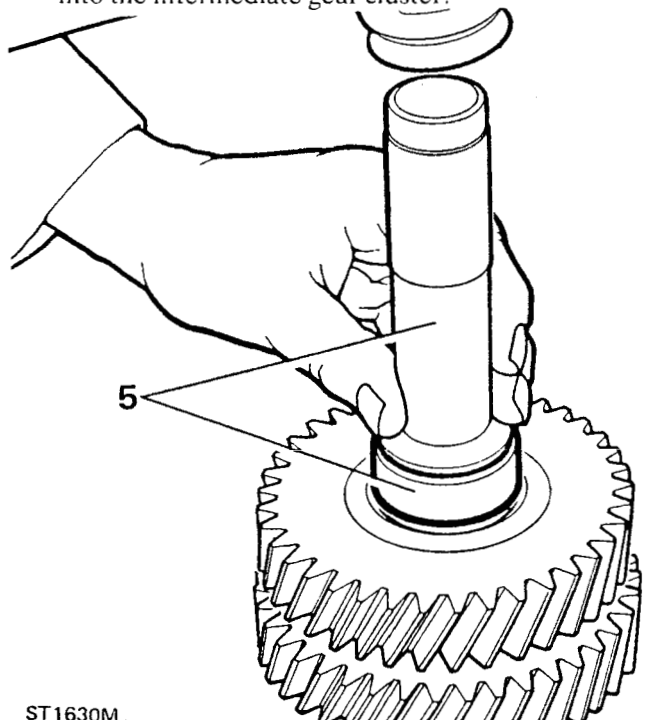
Intermediate gear assembly overhaul

1. Drift out intermediate gear bearing tracks
2. Remove circlips.



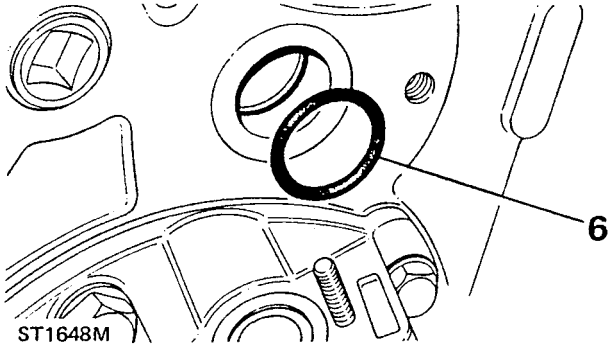
ST1628M

3. Clean all intermediate gear components and lock plate. Check for damage or wear and replace as necessary.
4. Fit new circlips into the intermediate gear cluster.
5. Using tools LST550-4 and MS550 fit bearing tracks into the intermediate gear cluster.



ST1630M

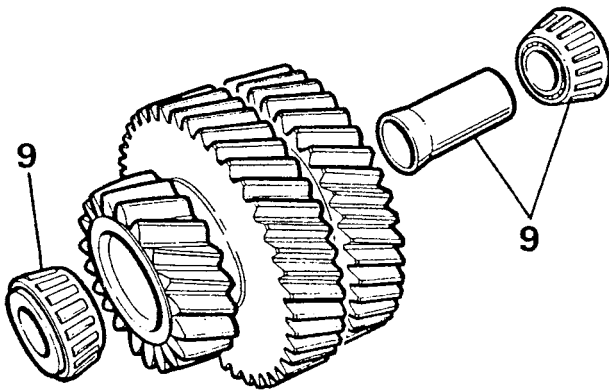
6. Fit the 'O' rings to the intermediate shaft and into the intermediate shaft bore at the front of the transfer box casing.



ST1648M

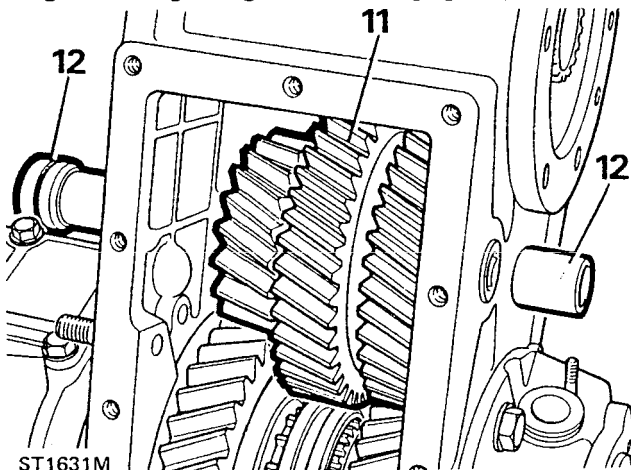
Intermediate gear reassembly

7. Check for damage to the intermediate shaft thread and if necessary clean up with a fine file or stone.
8. Lubricate the taper roller bearings and intermediate gear shaft.
9. Insert new bearing spacer to gear assembly, followed by the taper roller bearings.



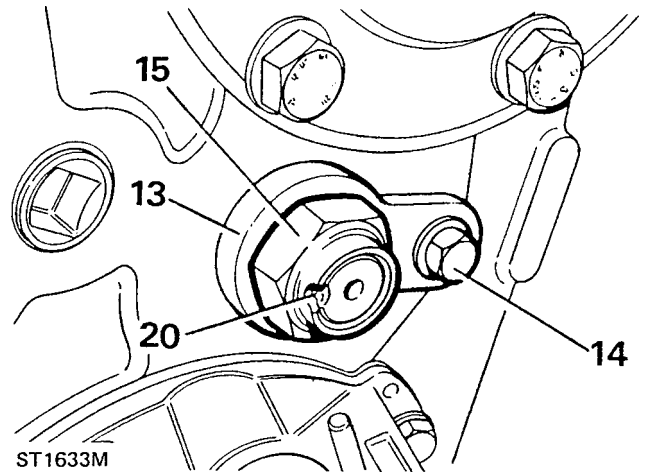
ST1649M

10. Fit dummy shaft LST104 into the intermediate gear cluster.
11. Locate the gear assembly into the transfer box casing from the bottom cover aperture.
12. Insert intermediate shaft from the front of the transfer box casing, pushing the dummy shaft right through as shown and remove. (Making sure that the intermediate gear cluster meshes with the input gear and high range and low range gears).



ST1631M

13. Turn the intermediate shaft to allow fitting of retaining plate.
14. Fit retaining plate and secure with retaining bolt and washer.
15. Fit the intermediate gear shaft retaining stake nut.

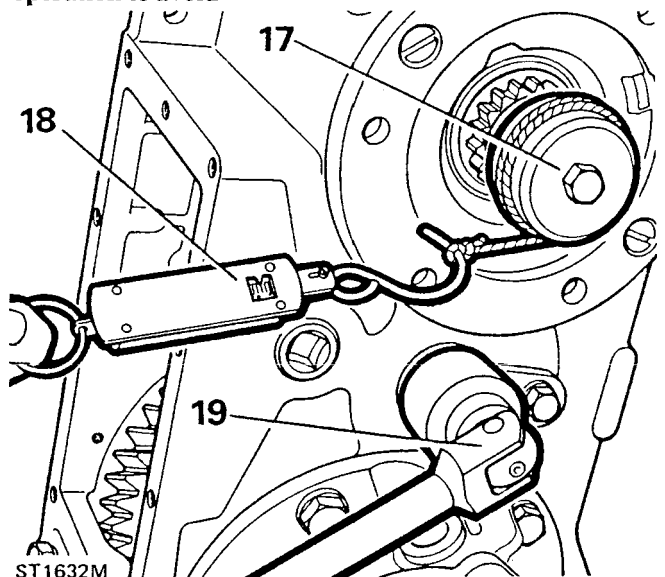


ST1633M

Adjusting intermediate gear torque-to-turn

16. Select neutral.
17. Fit service tool LST105 to input gear and engage spline.
18. Tie a length of string to a split pin and fit to the service tool as shown. Attach the spring balance to the string.
19. To obtain the correct figures and to collapse the spacer within the intermediate gear cluster, tighten the intermediate shaft nut until the load-to-turn has increased by 3.7 kg (7 lbs) ± 1.63 kg (± 3 lbs) on that noted when checking input shaft load-to-turn. The torque to tighten the retaining nut will be approximately 203 Nm (150 lb ft).
20. Peen the stake nut by carefully forming the collar of the nut into the intermediate shaft recess, as illustrated.

CAUTION: A round nose tool must be used for this operation to avoid splitting the collar of the nut.



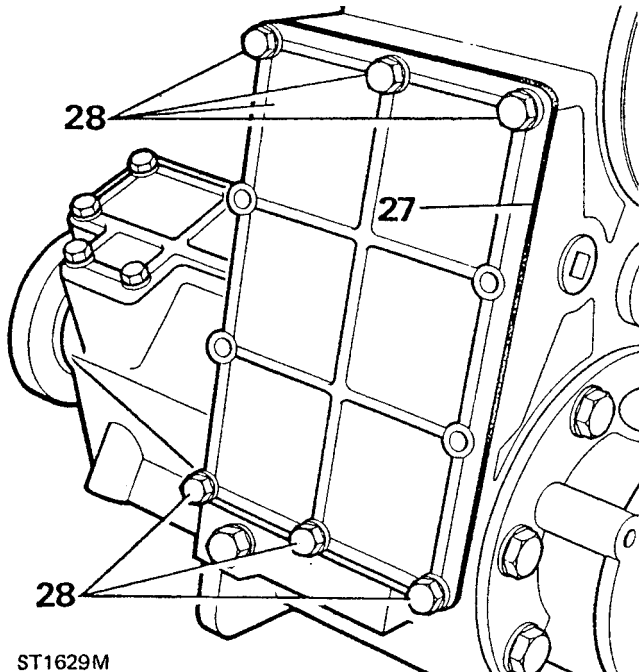
ST1632M

Power take-off cover — reassemble

21. Clean power take-off cover and gasket face.
22. Fit the two countersunk screws and tighten.
23. Remove the six bolts from the bearing support plate.
24. Apply sealant to the cover plate gasket and fit it to the bearing support plate.
25. Apply Loctite 290 to bolt threads and secure the power take-off cover with the six bolts and washers.

Bottom cover — reassemble

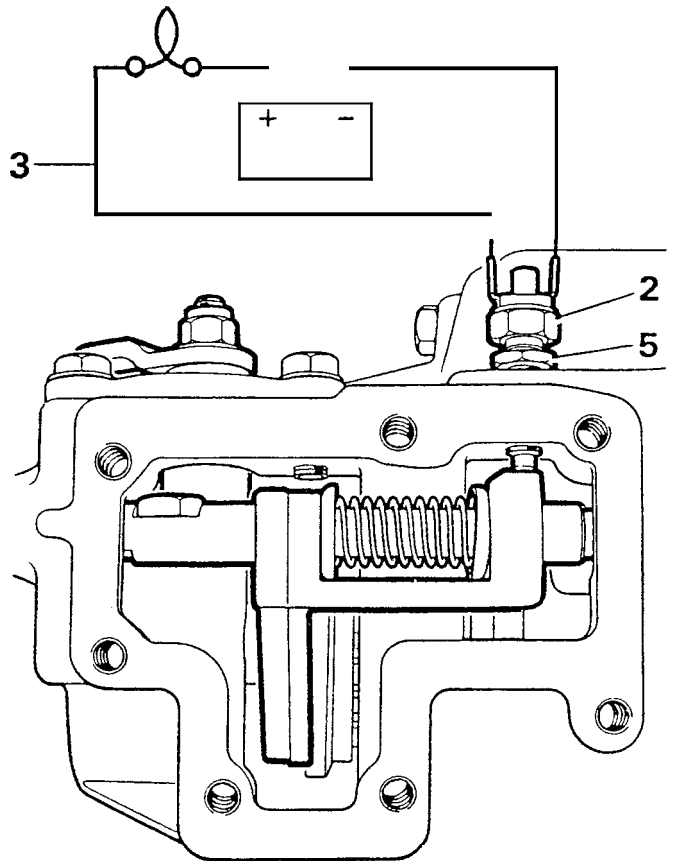
26. Clean bottom cover and gasket face.
27. Apply sealant to cover gasket and fit to transfer box casing.
28. Apply Loctite 290 to bolt threads and secure the bottom cover with six bolts and washers.



ST1629M

Differential lock switch adjustment

1. Select differential locked position by moving the lock taper towards the right side of the transfer box casing.
2. Apply sealant to the differential lock warning light switch and fit to the top of the front output housing.
3. Connect a test lamp circuit to the differential lock switch.
4. Screw in the lock switch until the bulb is illuminated.
5. Turn in the switch another half a turn and tighten with the locknut against the housing.



ST1634M

6. Disconnect the battery and move the differential lock lever to the left to disengage differential lock.
7. Clean the front output housing side cover.
8. Grease and fit side cover gasket.
9. Apply Loctite 290 to bolt threads, fit side cover and secure with seven bolts and washers.

Transmission brake — reassemble

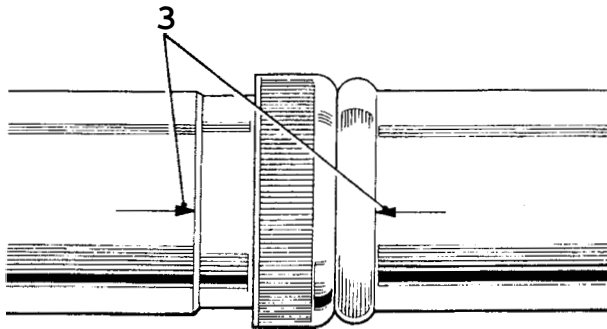
NOTE: Under certain circumstances it is better to fit the transmission brake assembly after being installed in the vehicle.

1. Clean brake backplate and oil catcher and apply sealant to the catcher joint face.
2. Locate brake backplate on the rear output housing with the brake operating lever on the right side of the transfer box casing.
3. Secure the backplate (including the oil catcher) with the four special bolts and tighten using a hexagonal socket to the specified torque.
4. Clean and fit brake drum and secure with two countersunk screws.

OVERHAUL PROPELLER SHAFTS

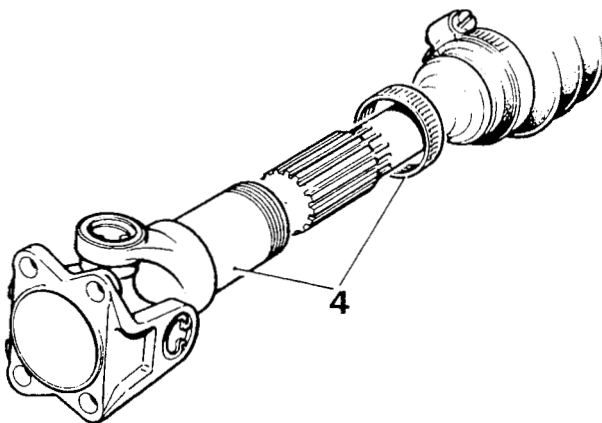
Dismantle

1. Remove the propeller shaft from the vehicle
2. If a gaiter encloses the sliding member release the two securing clips. Slide the gaiter along the shaft to expose the sliding member.
3. Note the alignment markings on the sliding member and the propeller shaft. See note following instruction 22.



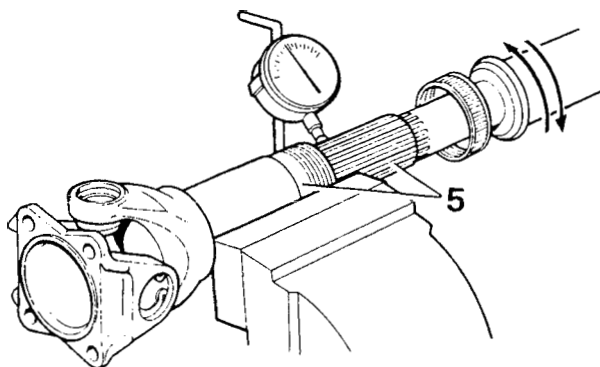
ST1000M

4. Unscrew the dust cap and withdraw the sliding member.



ST1001M

5. Clean and examine the splines for wear. Worn splines or excessive back-lash will necessitate propeller shaft renewal.

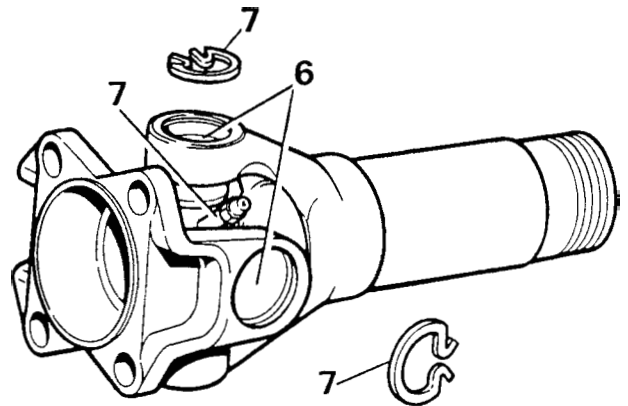


ST1002M

6. Remove paint, rust, etc. from the vicinity of the universal joint bearing cups and circlips.

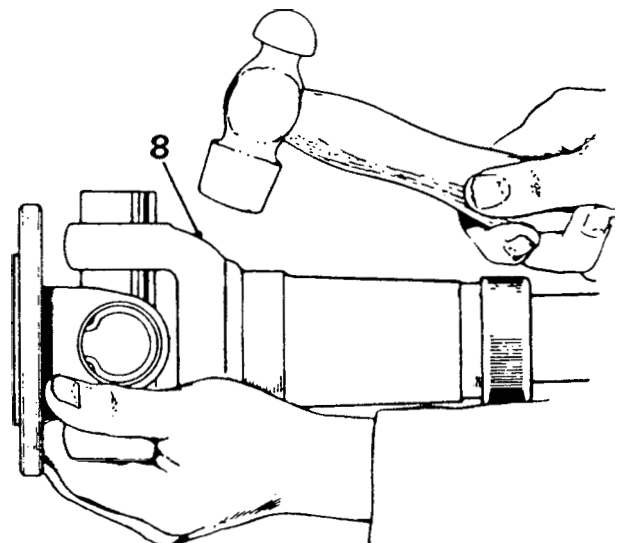
NOTE: Before dismantling the propeller shaft joint, mark the position of the spider pin lubricator relative to the journal yoke ears to ensure that the grease nipple boss is re-assembled in the correct running position to reduce the possibility of imbalance.

7. Remove the circlips, and grease nipple.



ST1003M

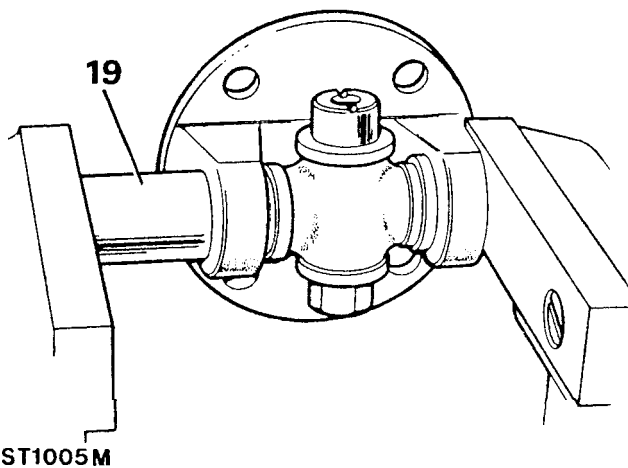
8. Tap the yokes to eject the bearing cups.
9. Withdraw the bearing cups and spider and discard.
10. Repeat instructions 5 to 8 at opposite end of propeller shaft.
11. Thoroughly clean the yokes and bearing cup locations.



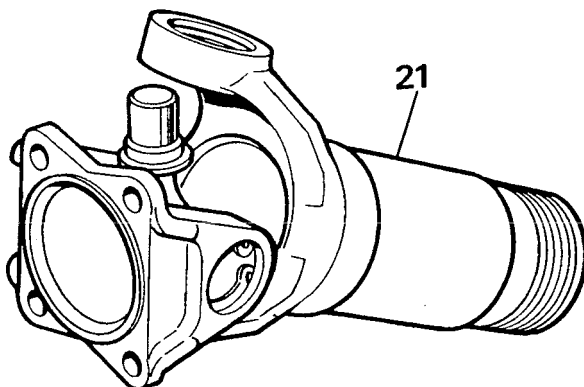
ST1004M

Assemble

12. Remove the bearing cups from the new spider.
13. Check that all needle rollers are present and are properly positioned in the bearing cups.
14. Ensure bearing cups are one third full of fresh lubricant. See Lubrication chart.
15. Enter the new spider complete with seals into the yokes of the sliding member flange. Ensure that the grease nipple hole faces away from the flange.
16. Partially insert one bearing cup into a flange yoke and enter the spider trunnion into the bearing cup taking care not to dislodge the needle rollers.
17. Insert the opposite bearing cup into the flange yoke. Using a vice, carefully press both cups into place taking care to engage the spider trunnion without dislodging the needle rollers.
18. Remove the flange and spider from the vice.
19. Using a flat faced adaptor of slightly smaller diameter than the bearing cups press each cup into its respective yoke until they reach the lower land of the circlip grooves. Do not press the bearing cups below this point or damage may be caused to the cups and seals.



20. Fit the circlips.
21. Engage the spider in the yokes of the sliding member. Fit the bearing cups and circlips as described in instructions 15 to 20.

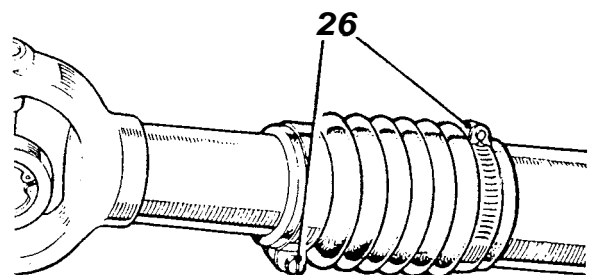


ST1006M

22. Lubricate the sliding member spines and fit the sliding member to the propeller shaft ensuring that the markings on both the sliding member and propeller shaft align.

NOTE. The Universal joints on the front propeller shaft are, by design, not assembled in-line with one another. Nevertheless, the alignment marks on the sliding member and propeller shaft must coincide when assembling.

23. Fit and tighten the dust cap.
24. Fit the grease nipples to the spider and the sliding member and lubricate.
25. Slide the gaiter (if fitted) over the sliding member.
26. Locate the sliding member in the mid-position of its travel and secure the gaiter clips. Note that the gaiter clips must be positioned at 180° to each other so that they will not influence propeller shaft balance.



ST1007M

27. Apply instructions 15 to 20 to the opposite end of the propeller shaft.
28. Fit the grease nipple and lubricate.
29. Fit the propeller shaft to the vehicle.

OVERHAUL REAR AXLE DIFFERENTIAL ASSEMBLY — Land Rover Ninety Heavy Duty (option)

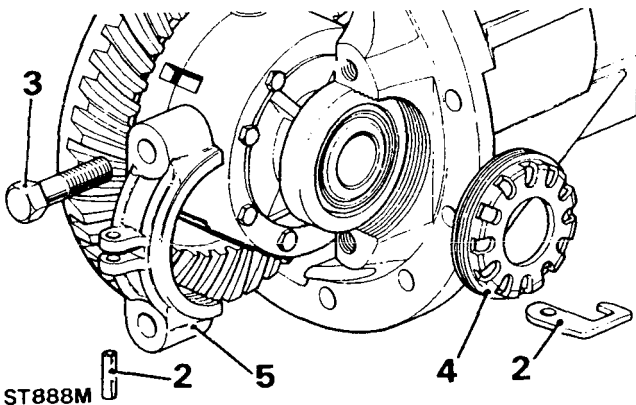
Service tools:

- 18G 1205 flange holder tool;
- 18G 191 pinion height setting gauge;
- 18G 191-4 universal setting block;
- 18G 47-6 pinion head bearing remover/replacer;
- 18G 1382 oil seal replacer;
- RO 262757A extractor for pinion bearing caps;
- RO 262757-1 replacer — use with RO 262757A;
- RO 262757-2 adaptor tail bearing cap replacer;
- RO 530105 spanner — differential flange and carrier bearing nuts;
- RO 530106 bracket for dial gauge and indicator;
- MS 47 press

DISMANTLE

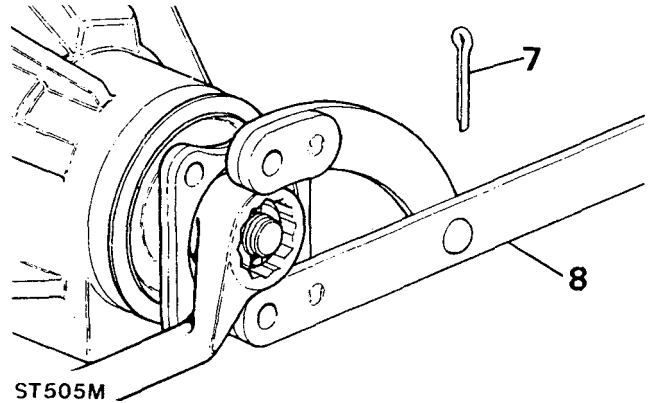
It is essential that differential components are marked in their original positions and relative to other components so that, if refitted, their initial setting is maintained. Note that the bearing caps **must not** be interchanged.

1. Remove the differential assembly from the axle.
2. Drift out the roll pin securing the bearing nut locking fingers to the bearing caps. Remove the locking fingers.
3. Slacken the bearing cap bolts and mark the caps for reassembly.
4. Using service tool RO 530105, remove the bearing adjusting nuts.
5. Remove the bearing cap bolts and bearing caps.
6. Lift out the crown wheel, differential unit and bearings.



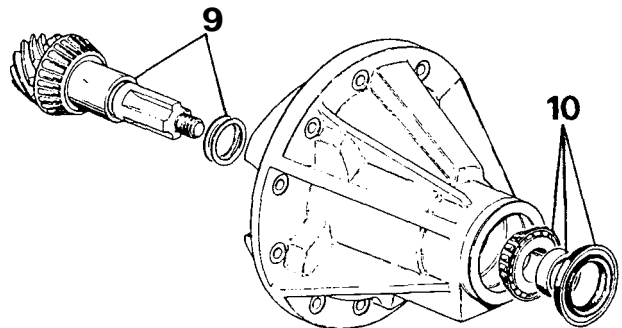
ST888M

7. Remove the split pin securing the pinion flange nut.
8. Remove the pinion flange nut using service tool 18G 1205, to restrain the flange.



ST505M

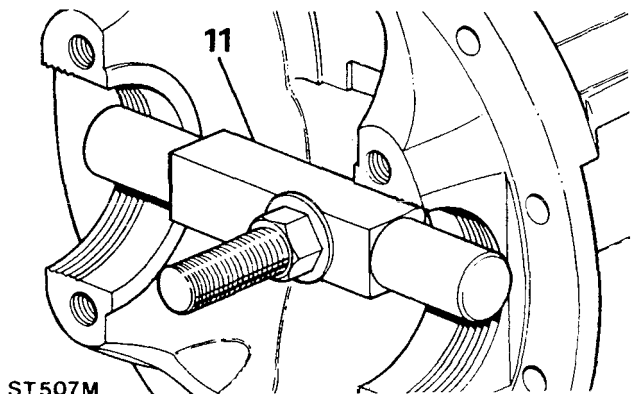
9. Withdraw the pinion complete with pinion head bearing and outer bearing shims. Withdraw the shims.
10. Remove the pinion flange oil seal, spacer and bearing. Discard the oil seal.



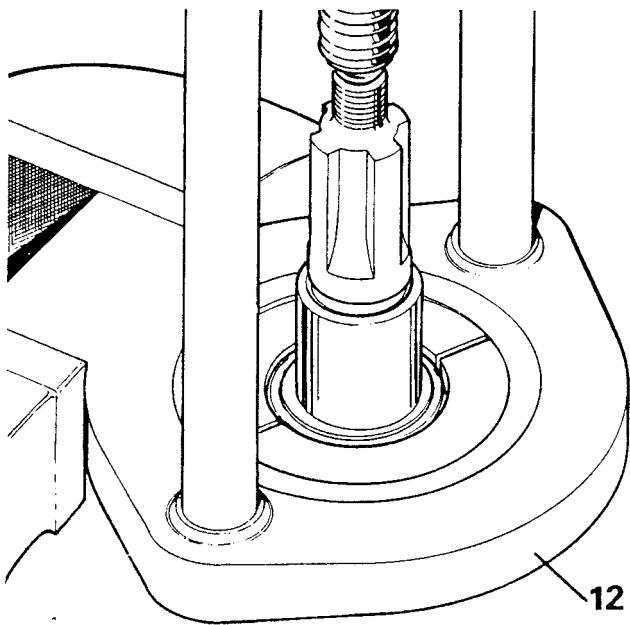
ST506M

11. Using service tool RO 262757A remove the pinion head bearing track and shim and drift out the outer bearing track from the differential housing.

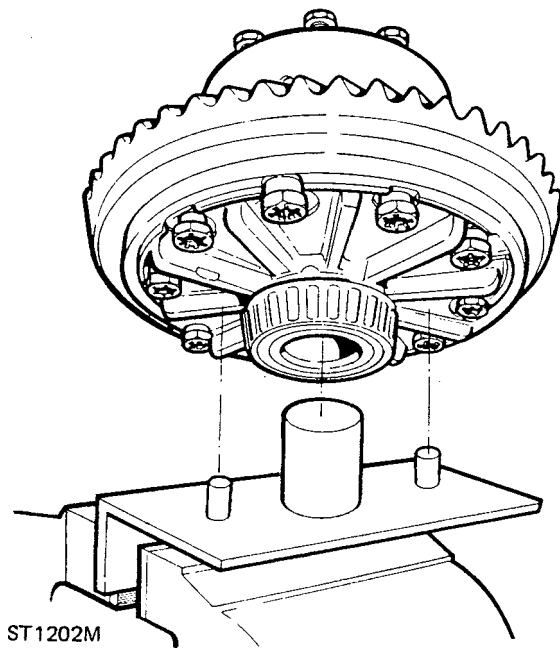
continued



ST507M



ST508M



ST1202M

- 12. Remove the pinion head bearing with service tool MS 47 and adaptor 18G 47-6.
- 13. For reassembly purposes, add alignment marks to the crown wheel and differential case halves.

- 18. Dismantle the pinions and crosspin assembly, noting the relevant positions of all components.
- 19. If required, extract the roller bearings and place them in their relative outer tracks.

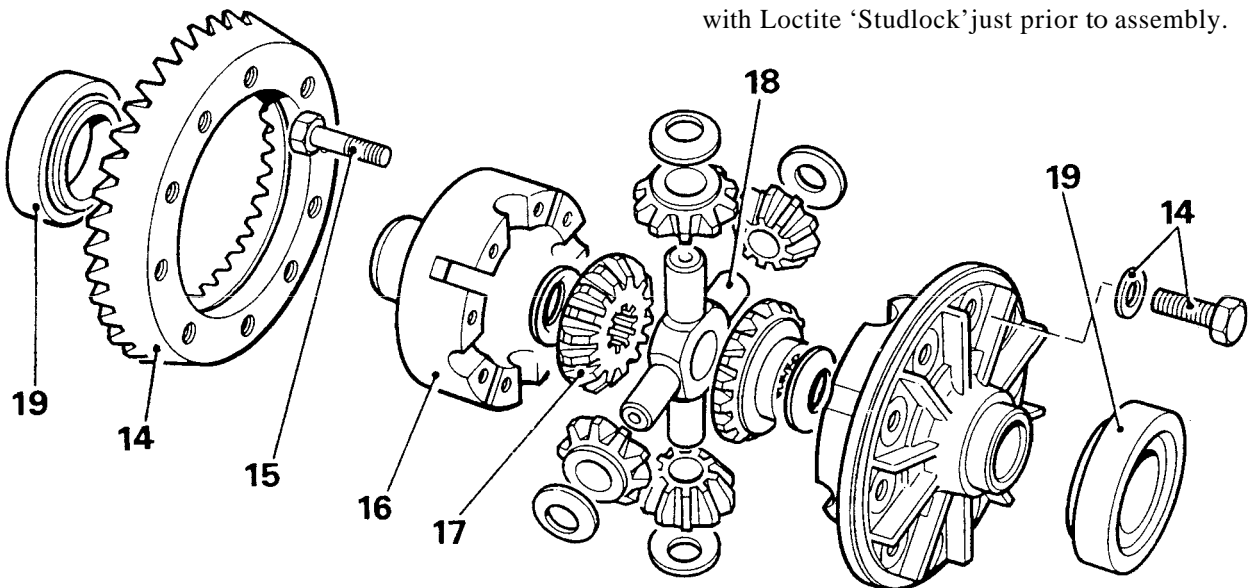
WARNING: To avoid personal injury, the differential assembly must be very securely retained while removing the bolts from the crown wheel and case halves, as these bolts are Loctited and may be difficult to remove.

INSPECTING

A retaining fixture can be made from angle iron with a tube and two bolts welded to it, as illustrated, so that when the fixture is clamped in a vice, the differential assembly can be located over the tube with the fixture bolts between the case webs.

- 20. Examine all components for obvious wear or damage.
- 21. All bearings must be press fit, except the flange end pinion bearing, which must be a slide fit on the shaft.
- 22. The crown wheel and pinion are only supplied as a matched set and must not be interchanged separately.
- 23. Bevel pinion housing and bearing caps are matched sets and must not be interchanged separately.
- 24. The differential case halves are a matched set and must not be interchanged separately. New screws for securing the case halves are already coated with a dry locking compound and do not require the application of Loctite. If the old screws are being reused, the threads must be cleaned and coated with Loctite 'Studlock' just prior to assembly.

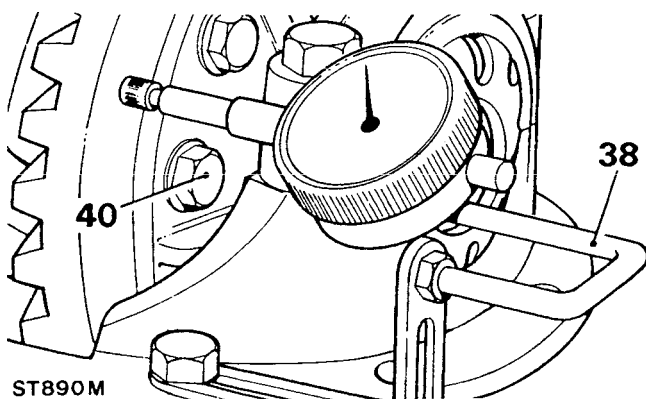
- 14. Remove the crown wheel.
- 15. Remove the screws holding the case halves together.
- 16. Withdraw the upper half of the casing.
- 17. Withdraw the upper side gear. Note that there may be thrust washers fitted to the side gears.



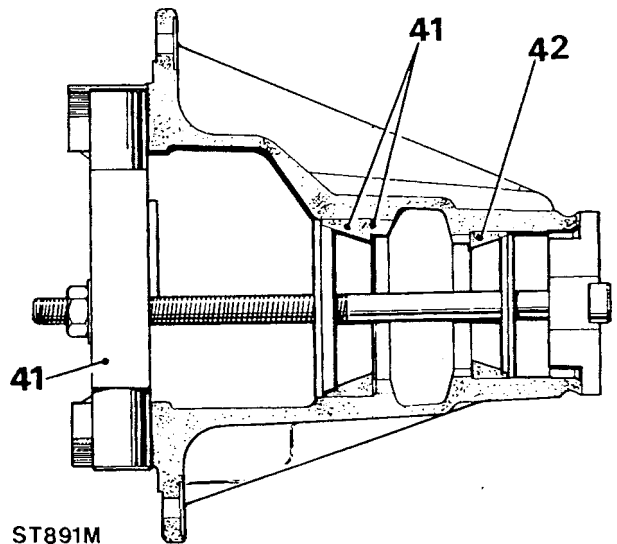
ASSEMBLY

NOTE: If thrust washers were removed from the side gears during dismantling, the washers must be lubricated with EP90 oil and refitted during the following procedure. DO NOT allow oil to contact any holes or bolts that are to be Loctited.

25. Position the smaller case half with the open side uppermost and fit the side gear into the case.
26. Assemble the crosspins, pinions and thrust washers, lubricate the thrust washers with EP90 oil.
27. Fit the crosspin assembly on to the side gear already contained in the differential case half, ensuring that the gears locate correctly.
28. Fit the other side gear to the crosspin assembly ensuring that all the gears locate correctly.
29. Fit the two case halves together, maintaining the alignment marking and ensuring correct gear mating.
30. Fit the correct (high grade) screws and tighten them evenly to a torque of 3,0 to 3,7 kgf m (22 to 27 lbf ft) (30 to 36 Nm).
31. Check that the serial number marked on the pinion end face matches that marked on the crown wheel.
32. Ensure that the differential housing flange and crown wheel are thoroughly clean. Align the crown wheel with the differential case, fit the bolts and washers and tighten evenly.
33. If removed, press on the differential roller bearings.
34. Place the differential housing complete with crown wheel and bearings in the pinion housing.
35. Fit the bearing caps and bolts. Do not fully tighten the bolts.
36. Fit the bearing adjusting nuts and adjust to obtain zero end-float.
37. Tighten the bearing cap bolts.
38. Using a dial gauge check the crown wheel for run-out. This should not exceed 0,10 mm (0.004 in). If excessive run-out is recorded remove the crown wheel and examine crown wheel and mounting flange for burrs, grit, etc. Refit the crown wheel and recheck. Run-out, attributable to a buckled or damaged differential housing flange can be corrected only by renewing the differential gear housing.
39. When satisfied that run-out is within the specified limits remove the differential housing from the pinion housing.



40. Remove the crown wheel bolts and refit them using Loctite 'Studlock'. Evenly tighten the bolts to 5,5 to 6,3 kgf m (40 to 45 lbf ft).



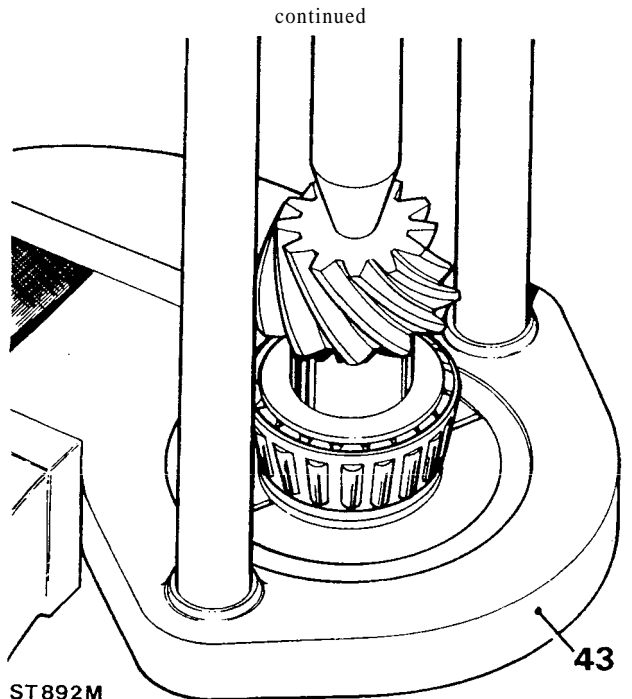
ST891M

Drive pinion

41. Fit the pinion head bearing track and the original shim to the pinion housing using service tools RO 262757A and RO 262757-1. If the original shim was damaged or mislaid use a new shim of at least 1,27 mm (0.050 in) thickness.
42. Fit the pinion outer bearing track to the pinion housing with service tool RO 262757A and RO 262757-2.

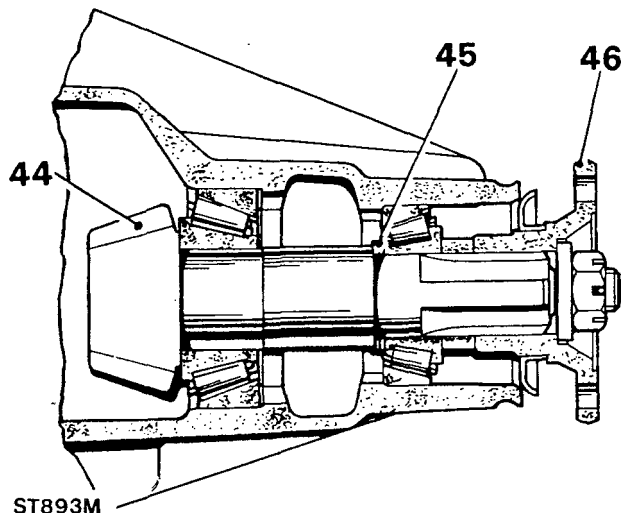
NOTE: Instructions 41 and 42 are carried out in one operation as illustrated.

43. Fit the pinion head bearing to the pinion using service tool 18G 47-6.



ST892M

- 44. Enter the pinion in its location in the pinion housing. Do not fit the shims for bearing pre-load at this stage.
- 45. Fit the outer bearing and spacer.
- 46. Fit the driving flange, washer and nut.



- 51. The nominal setting dimension is represented by the setting gauge block 18G 191-4 which is referenced from the pinion end face to the bottom radius of the differential bearing bore.

Drive pinion adjustment

- 52. Ensure that the pinion end face is free of raised burrs around the etched markings.
- 53. Remove the keep disc from the magnetised base of dial gauge tool 18G 191.
- 54. Place the dial gauge and setting block on a flat surface and zero the dial gauge stylus on the setting block.

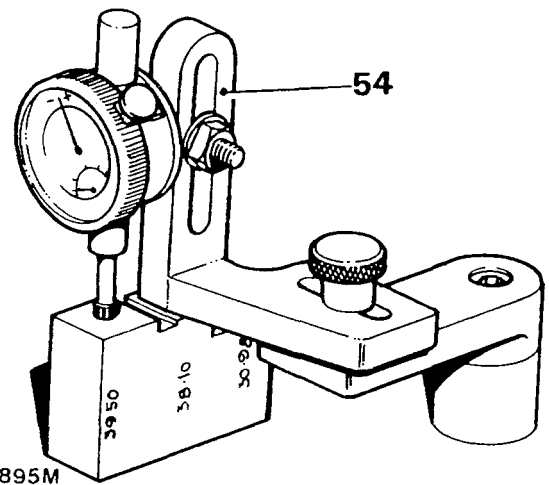
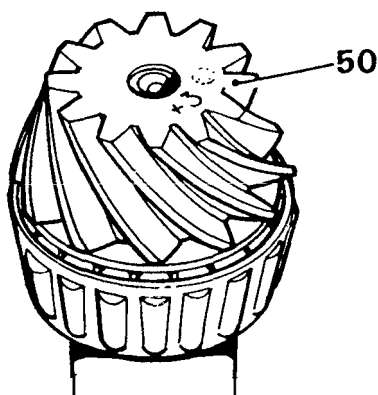
NOTE: The setting block has three setting heights as follows:
 39.50 mm Rationalised axle
 38.10 mm Pre-Rationalised axle
 30.93 mm Salisbury axle
 Ensure that the height marked 39.50 mm is used for this differential.

- 47. Do not fit the oil seal at this stage.
- 48. Tighten the pinion flange nut slowly until the force required to rotate the pinion is 23 to 40,5 kgf cm (20 to 35 lbf in). This will pre-load the bearings in order to check the pinion height dimension.

NOTE: If using original bearings, which are bedded in, the pre-load figure is 11,5 to 17,25 kgf cm (10 to 15 in lb).

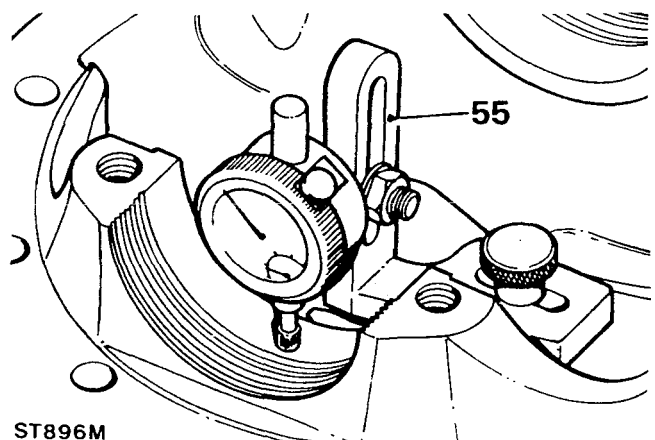
Drive pinion markings

- 49. The markings on the end face adjacent to the serial number are of no significance during servicing.
- 50. The figure marked on the end face opposite to the serial number indicates, in thousandths of an inch, the deviation from nominal required to correctly set the pinion. A pinion marked plus (+) must be set below nominal, a minus (-) pinion must be set above nominal. An unmarked pinion must be set at nominal.



- 55. Position the dial gauge centrally on the pinion end face with the stylus registering on the lowest point on one differential bearing bore. Note the dial gauge deviation from the zeroed setting.

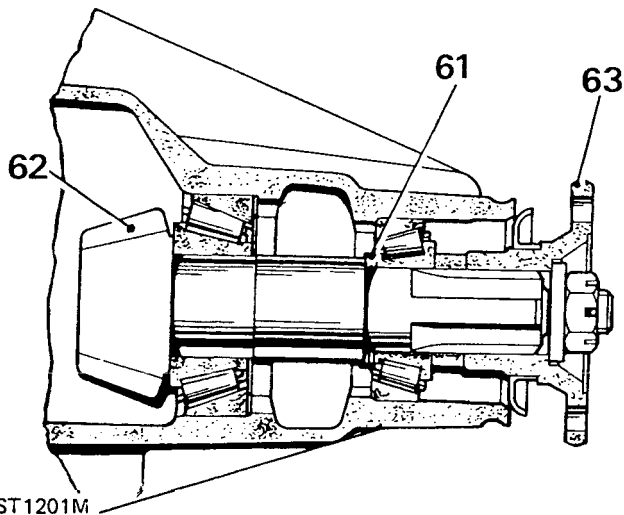
continued



56. Repeat on the other bearing bore. Add together the readings then halve the sum to obtain the mean reading. Note whether the stylus has moved up or down from the zeroed setting.
 - a. Where the stylus has moved down, the amount is equivalent to the thickness of shims that must be removed from under the pinion inner track to bring the pinion down to the nominal position.
 - b. Where the stylus has moved up, the amount is equivalent to the additional thickness of shims required to bring the pinion up to the nominal position.
57. Before adjusting the shim thickness, check the pinion face marking and if it has a plus (+) figure, subtract that amount in thousandths of an inch from the shim thickness figure obtained in the previous item.
58. Alternatively, if the pinion has a minus (-) figure, add the amount to the shim thickness figure.
 - Adjust the shim thickness under the pinion head bearing track as necessary.
59. Recheck the pinion height setting. If the setting is correct, the mean reading on the dial gauge will agree with the figure marked on the pinion end face. For example, with an end face marking of +3, the dial gauge reading should indicate that the pinion is +0.003 ins.

Bearing pre-load adjustment

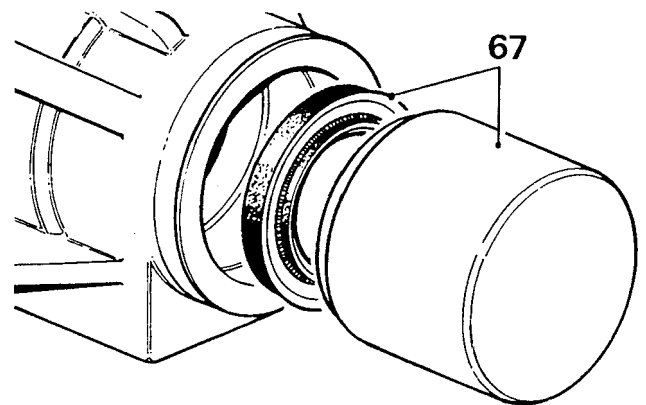
60. Remove the pinion flange, pinion, outer bearing and spacer.
61. Slide new shims, of the same thickness as the originals (bearing pre-load) into position on the pinion shaft. If the original shim was damaged or mislaid use a new shim of at least 4,06 mm (0.160 in) thickness.
62. Enter the pinion in its location in the pinion housing and fit the outer bearing and spacer.
63. Fit the driving flange, washer and nut.
64. Do not fit the oil seal at this stage.



65. With the pinion flange nut tightened to a torque of 9,6 to 16,5 kgf m (70 to 120 lbf ft) (95 to 163 Nm) the force required to rotate the pinion shaft should be within 23 to 40,25 kgf cm (20 to 35 lbf ins) when initial inertia has been overcome. Change the bearing pre-load shim as necessary to obtain this requirement. A thicker shim will reduce pre-load; a thinner shim will increase pre-load.

NOTE: If using original bearings, which are bedded in, the pre-load figure is 11,5 to 17,5 kgf.cm (10 to 15 in lb).

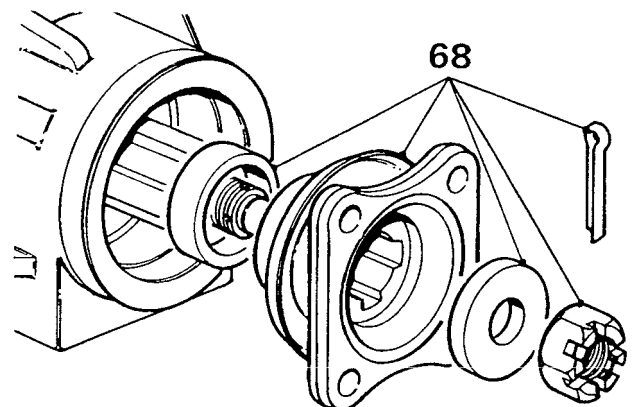
66. Remove the pinion flange.
67. Fit the oil seal (seal lips towards the pinion), using service tool 18G 1382 oil seal replacer.



ST897M

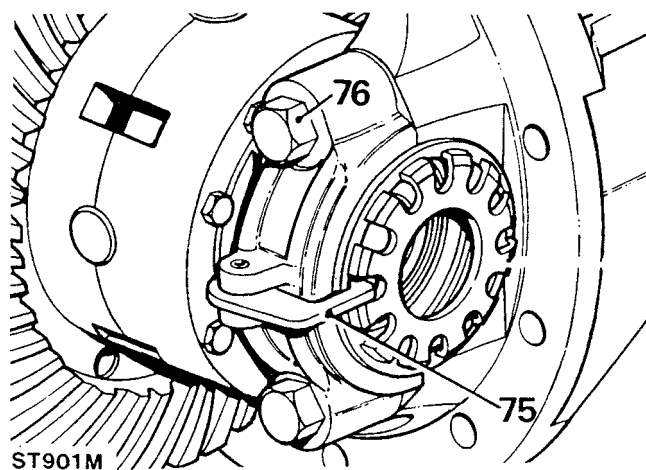
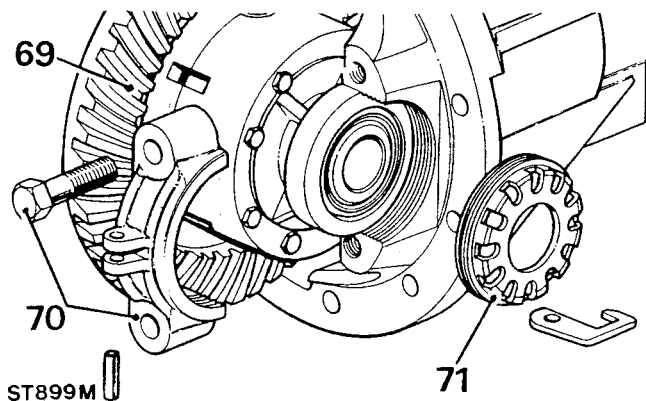
68. Lubricate the seal lips with EP90 oil. Fit the distance piece and flange and secure with washer and nut. Tighten the nut to 9,6 to 16,5 kgf m (70 to 120 lbf ft) (95 to 163 Nm). Fit a new split pin.

continued



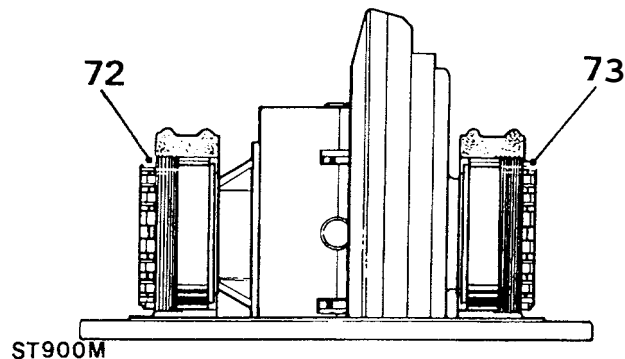
ST898M

- 69. Place the differential housing in the pinion housing.
- 70. Fit the bearing caps and bolts. Do not fully tighten the bolts.
- 71. Fit the bearing adjusting nuts.



- 76. Evenly tighten the bearing cap bolts torque 8,3 kgf m (60 lbf ft) (82 Nm).
- 77. Recheck crown wheel/pinion backlash.
- 78. Lubricate the bearings and gears.

- 72. Using service tool RO530105, slacken the left hand bearing adjustment nut (as illustrated) to produce end float.



- 73. Tighten the right hand nut until crown wheel/pinion backlash is just removed.
- 74. Tighten the left hand nut slowly until the crown wheel/pinion backlash is 0,10 to 0,17 mm (0.004 to 0.007 in).
- 75. Fit the locking fingers and roll pins. If necessary, tighten the adjustment nuts slightly to align the locking finger with a slot.

DATA

Pinion bearing pre-load	23 to 40,25 kgf cm (20 to 35 lbf in)
Crown wheel run-out	0,10 mm (0.004 in)
Crown wheel/pinion backlash	0,10 to 0,17 mm (0.004 to 0.007 in)

OVERHAUL REAR AXLE DIFFERENTIAL ASSEMBLY (SALISBURY) LAND ROVER ONE TEN MODELS

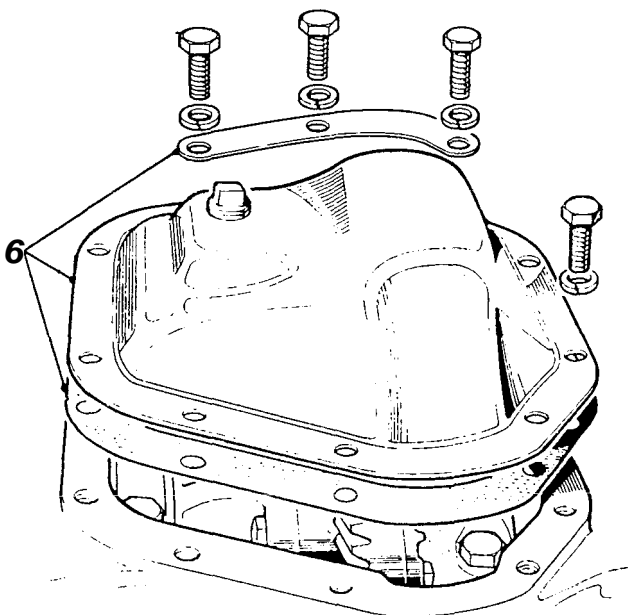
Service tools:

- 47 screw press;
- 18G 131 C axle spreader or axle compressor GKN 131;
- 18G 191 dial gauge, bracket and base;
- 18G 1122 screw press;
- 18G 1205 spanner for drive coupling;
- S 123 A pinion bearing cup remover;
- 18G 47 BK pinion bearing cone remover/replacer;
- 18G 47 BL differential bearing remover;
- 18G 1122 G pinion bearing cup replacer;
- 18G 134 DP differential bearing replacer;
- 18G 191 P setting gauge for pinion height or 18G 191-4 universal setting block;
- 18G 131 F pegs for axle spreader;
- RO 1008 oil seal replacer

DISMANTLE

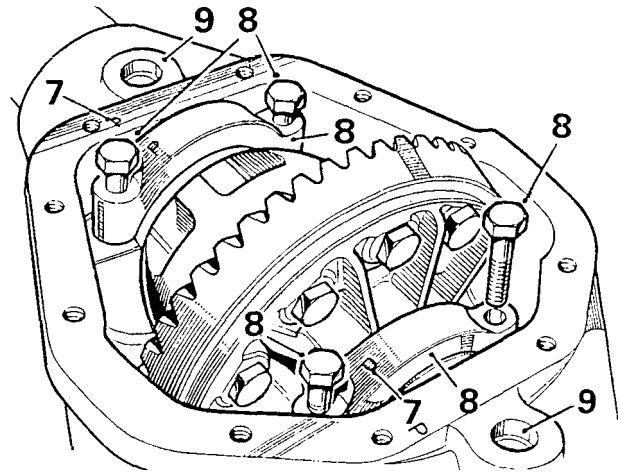
NOTE: All fixing bolts used on the differential assembly and differential cover have metric threads.

1. Drain off the differential lubricating oil, and refit plug.
2. Remove the rear axle assembly from the vehicle.
3. Remove the hub driving member fixings.
4. Withdraw the driving member and axle shaft sufficiently to disengage the differential.
5. Repeat instruction 4 for the other axle shaft.
6. Remove the fixings and support strip at the differential cover and withdraw the cover and joint washer.
7. Note the relationship marking on the bearing caps and axle casing to ensure correct refitting.



ST650M

8. Remove the fixings and withdraw the differential bearing caps.



ST639M

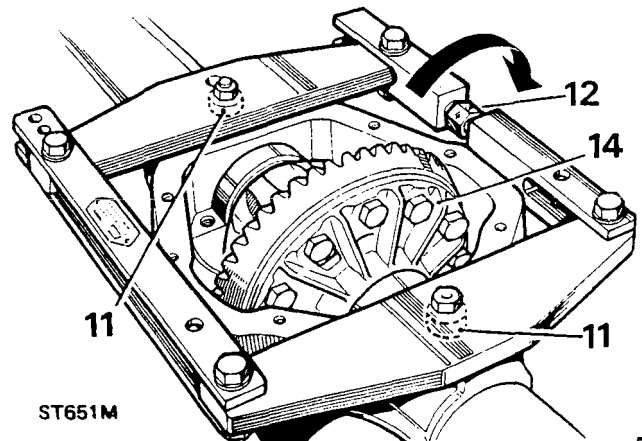
Using axle spreader 18G 131 C

9. Clean out and examine the spreader tool pegholes provided in the gear casing face; ensure that the holes are free from dirt and burrs and damage.
10. Ensure that the turnbuckle adjuster is free to turn.
11. Fit the axle spreader to engage the peg holes. Spreader 18G 131 C, Adaptor pegs 18G 131 F.
12. Using a spanner, turn the adjuster until all free play between the spreader and casing is taken up, denoted by the adjuster becoming stiff to turn.
13. Check that the side members of the spreader are clear of the casing.
14. Stretch the casing, rotating the adjuster by one flat at a time, until the differential assembly can be levered out. Do not lever against the spreader; use suitable packing under the levers to avoid damage to the casing.

CAUTION: To prevent permanent damage to the gear carrier case, it must not be over-stretched. Each flat on the turnbuckle is numbered to enable a check to be made on the amount turned. The maximum stretch permitted is 0,30 mm (0.012 in), equivalent to three flats.

15. Ease off the adjuster and remove the spreader

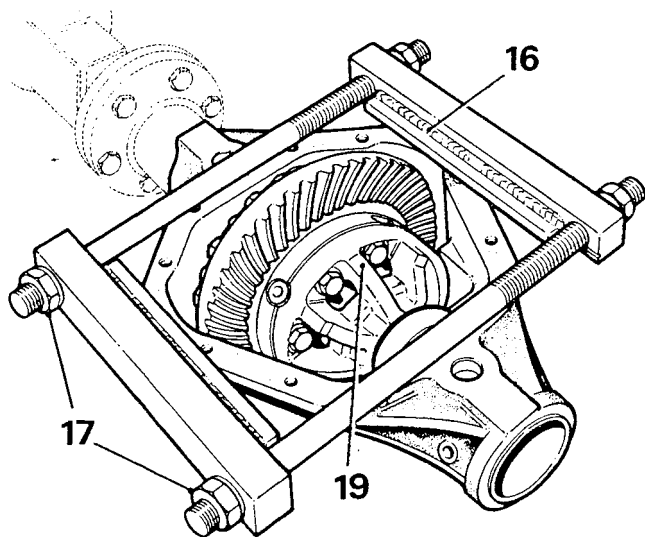
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ST651M

Using axle compressor GKN 131

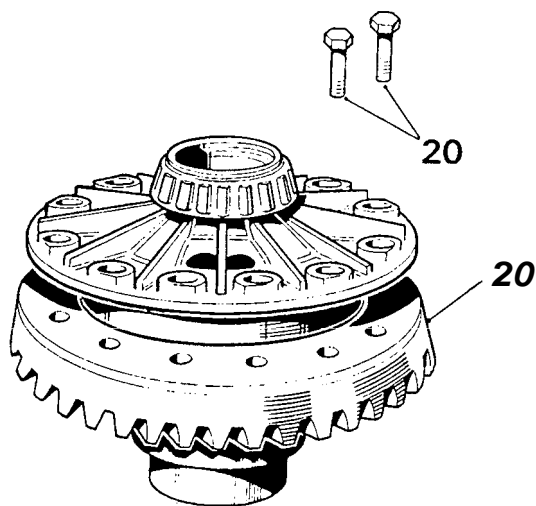
16. Place the tool on to the differential casing, as illustrated, with the weld seam uppermost. Ensure that the plates rest squarely on the differential machined surface and the end bars butt against the edges of the casing.
17. Tighten the adjusting nuts by hand only, until all slack is taken up.
18. Continue to tighten both nuts alternately with a spanner, one flat at a time, to a maximum of three flats.
19. Carefully lever-out the differential assembly.



ST597M

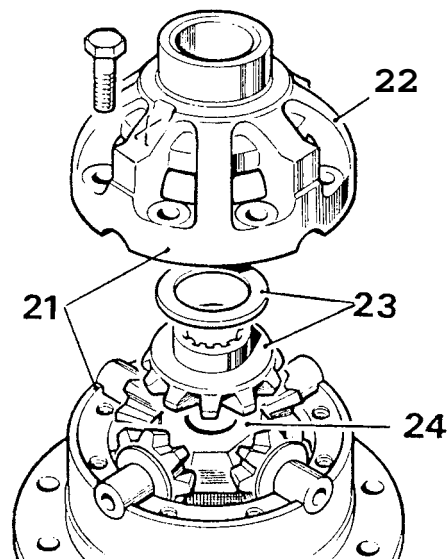
Dismantle differential

20. Add alignment marks between the crown wheel and the differential case for reassembly purposes, then remove the fixings and withdraw the crown wheel.



ST652M

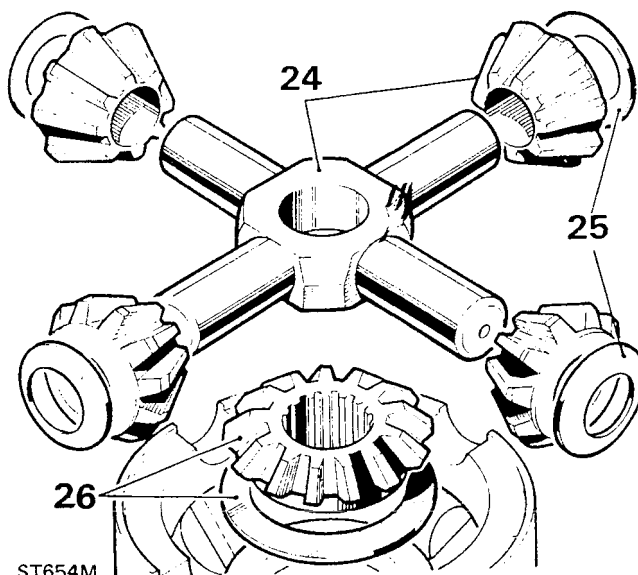
21. Note the alignment markings on the two differential casings to ensure correct refitting, then remove the fixings.
22. Lift off the upper case.
23. Withdraw the upper differential wheel and thrust washer.



ST653M

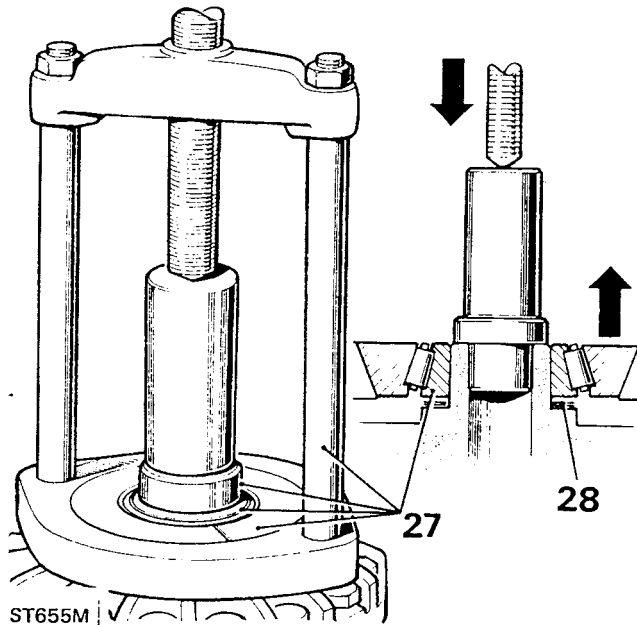
24. Lift out the cross-shaft and pinions.
25. Withdraw the four dished thrust washers.
26. Withdraw the lower differential wheel and thrust washer.

continued

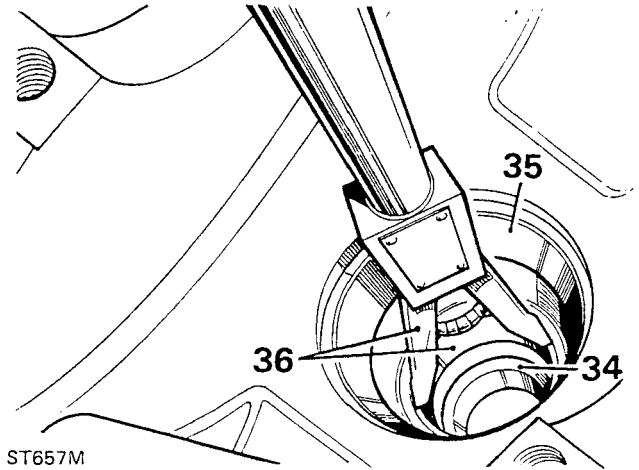


ST654M

- 27. Remove the differential bearing cones using remover 18G 47 BL and adaptors 1 and 2 and press 47.
- 28. Withdraw the shim washers fitted between the bearing cones and the differential casings.



- 34. Withdraw the outer bearing cone.
- 35. Extract the pinion inner bearing cup and shim washers from the casing. Note the shim washer thickness. Remover S 123 A.
- 36. Extract the pinion outer bearing cup from the casing. Remover S 123 A.



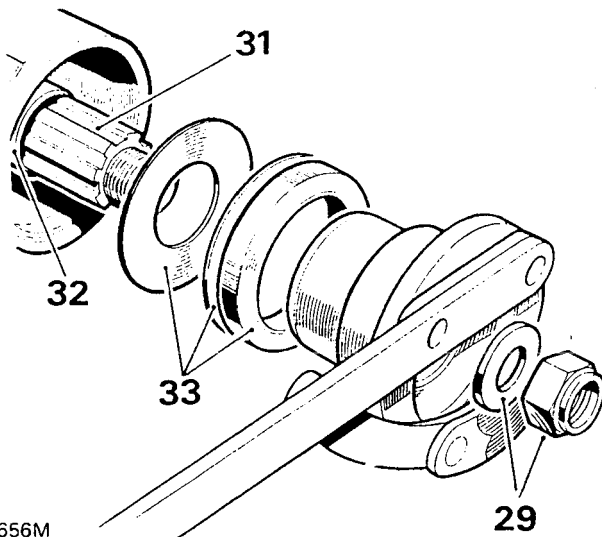
ST657M

- 37. Remove the inner bearing cone from the pinion. Remover 18G 47 RK and Press 47.

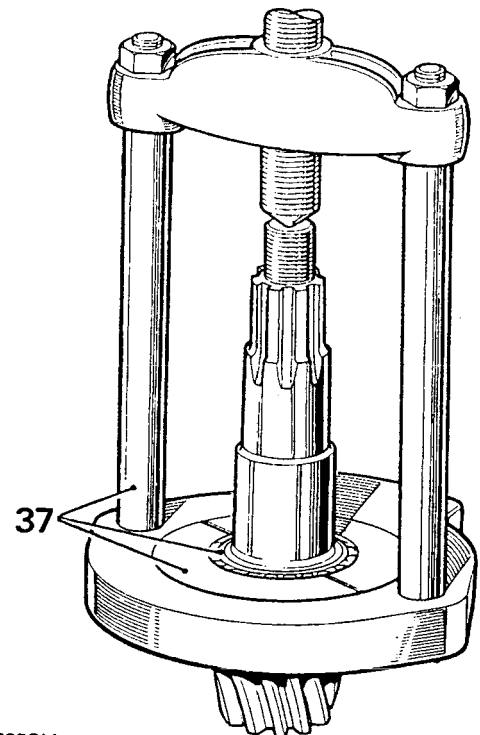
Remove final drive pinion

continued

- 29. Prevent the coupling flange from rotating and remove the flange locknut and plain washer. Spanner 18G 1205.
- 30. Support the drive pinion and remove the coupling flange by tapping with a hide hammer.
- 31. Withdraw the drive pinion together with the inner bearing cone.
- 32. Withdraw and discard the collapsible bearing spacer.
- 33. Withdraw the oil seal, gasket and oil thrower.



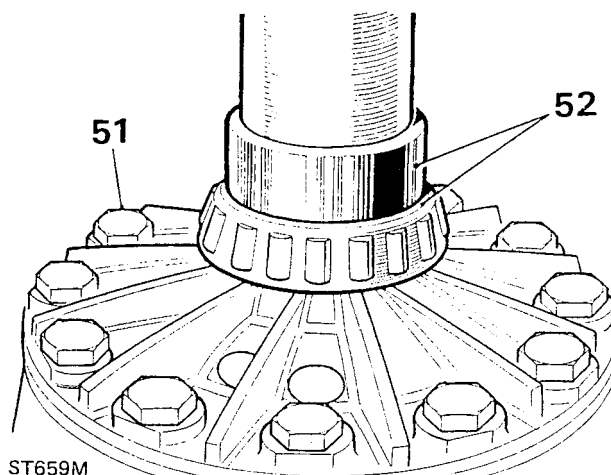
ST656M



ST658M

INSPECTION

38. Examine all components for obvious wear or damage.
39. The bearing cones must be a press fit on their locations, except the drive pinion flange and bearing which is a slide fit.
40. The crown wheel and pinion are supplied as a matched pair and must not be interchanged separately.
A new crown wheel and pinion matched pair may be fitted to an original gear carrier casing if sound. The original crown wheel and pinion, if sound, may be fitted into a replacement casing.
41. The two parts of the differential unit casing are matched and must not be replaced separately.
42. Discard and renew all thrust washers.
43. Differential housings with worn thrust washer seatings must be replaced as a pair.
44. Examine the differential case to crown wheel joint face for burrs and damage which could lead to crown wheel run-out when fitted.



ASSEMBLE

Assemble differential unit

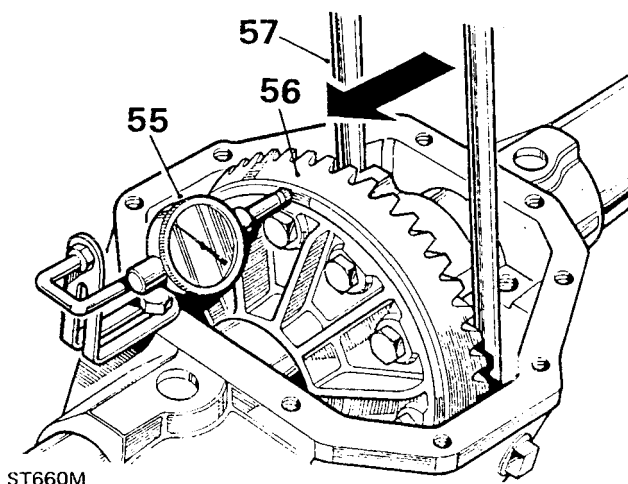
45. Fit the differential lower wheel and thrust washer to the differential case. See illustration following instruction 23.
46. Fit the dished thrust washers.
47. Fit the cross-shaft and pinions.
48. Fit the differential upper wheel and thrust washer.
49. Fit the differential upper case lining-up the marks.
50. Secure the assembly with bolts using Loctite 'Studlock' grade CVX on the threads and tighten evenly and diametrically to 9,1 to 10,4 kgf m (66 to 75 lbf ft).
51. Fit the crown wheel to the differential casing. Use Loctite 'Studlock' grade CVX on the fixing bolt threads and tighten to 13 to 14,5 kgf m (95 to 105 lbf ft).
52. Press on the differential roller bearing cones less shim washers, using 18G 134 DP, and leave to one side until required for instruction 96.
53. Fit the bearing cups to the differential.
54. Fit the differential unit and bearings to the gear carrier casing, and rotate unit to centralize the bearings. Do not fit the bearing caps.

55. Position a suitable dial gauge indicator on the casing with the stylus registering on the back face of the crown wheel.
56. Rotate the differential and check the total indicated run-out on the crown wheel back face. This must not exceed 0,05 mm (0.002in). If run-out is excessive, check the mating faces for dirt and damage; if necessary, select a new radial position for the crown wheel. When satisfactory, continue with the following check.

Differential bearing adjustment

57. Insert two levers between the casing and the differential unit at one side.
58. Move the differential unit fully to one side of the casing; do not tilt the unit.
59. Rotate the differential unit to settle the bearings, continue to lever the differential to the side, then zero the dial gauge indicator.
60. Lever the assembly fully to the other side of the casing, rotate the unit to settle the bearings, then note the total indicator reading.

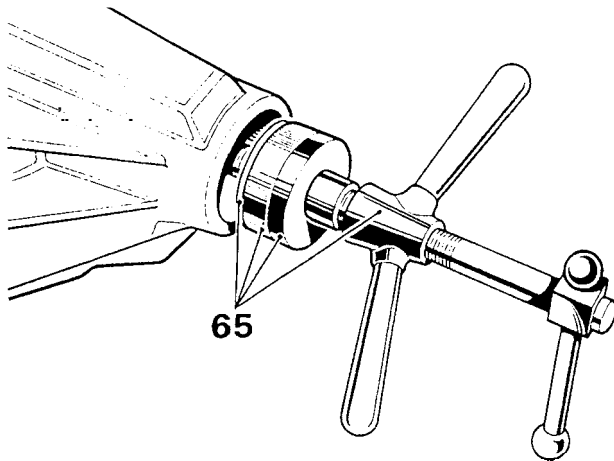
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61. Add 0,127 mm (0.005 in), for bearing pre-load, to the total noted in the preceding instruction. The sum is then equal to the nominal value of shims required for the differential bearings:
Shims are available in the range 0,07 mm (0.003 in), 0,12 mm (0.005 in), 0,25 mm (0.010 in) and 0,76 mm (0.030 in). Select the total value of shims required.
62. Remove the differential unit and bearings and place aside. Do not fit the shim washers until the subsequent 'Differential backlash' checks have been made, instructions 96 to 102.

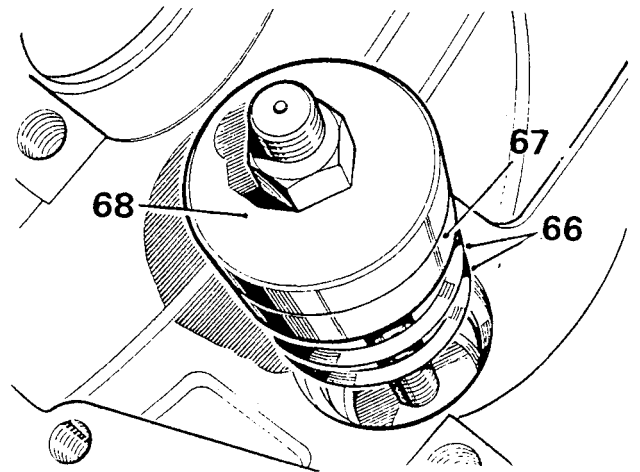
Fit drive pinion

63. Select shim washers of the same thickness value as those removed from under the pinion inner cup, instruction 35, and place ready for fitting.
64. Position the outer bearing replacer 18G 1122 G detail 2, and the outer bearing cup on the press tool 18G 1122.
65. Locate the assembly into the pinion housing nose.



ST661M

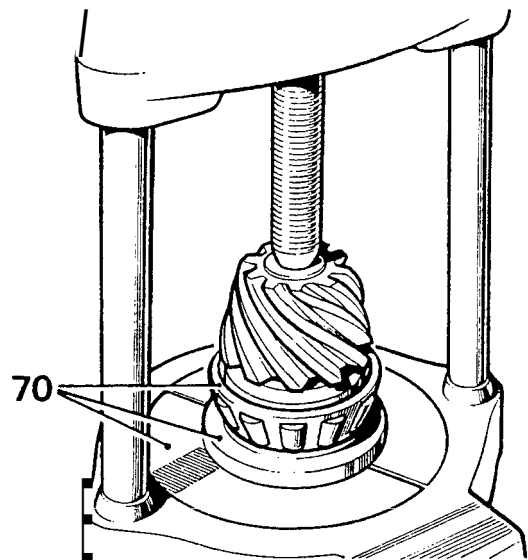
66. Place the selected shim washers on to the inner bearing cup seating.
67. Position the inner bearing cup in the casing.
68. Position the inner bearing replacer 18G 1122 G detail 1, onto 18G 1122 and secure with the fixing nut.
69. Hold still the centre screw and turn the butterfly lever to draw in the bearing cups.



ST662M

70. Press the inner bearing cone onto the drive pinion. 18G 47 BK, details 1 and 2 and press 47.
71. Position the pinion and bearing in the casing; omit the collapsible spacer at this stage.
72. Fit the outer bearing cone onto the pinion.
73. Fit the coupling flange and plain washer and loosely fit the flange nut.
74. Tighten the coupling flange locknut to remove end-float from the pinion.
75. Rotate the pinion to settle the bearings and slowly tighten the flange locknut. Use a spring balance to obtain a torque resistance of 9,25 to 13,8 kgf cm (8 to 12 lbf in) to rotate the pinion.

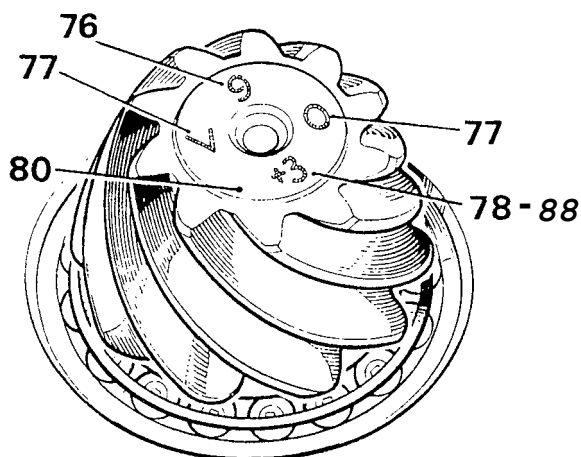
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ST638M

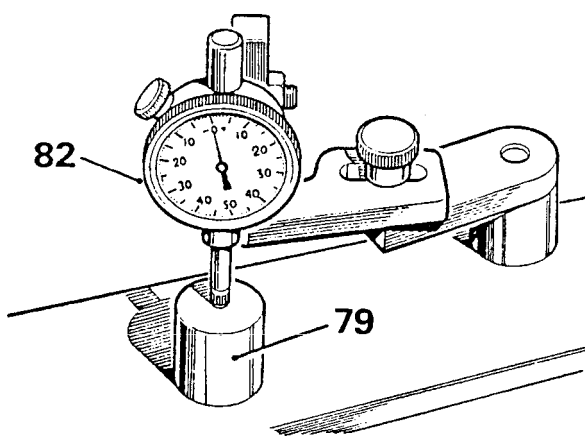
Drive pinion markings

- 76. Check that the serial number marked on the pinion end face matches that marked on the crown wheel,
- 77. The markings on the end face adjacent to the serial number are of no significance during servicing.
- 78. The figure marked on the end face opposite to the serial number indicates, in thousandths of an inch, the deviation from nominal required to correctly set the pinion. A pinion marked plus (+) must be set below nominal, a minus (-) pinion must be set above nominal. An unmarked pinion must be set at nominal.



ST649M

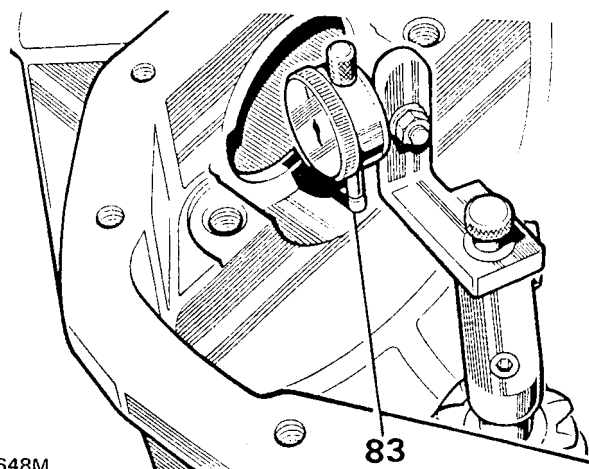
- 79. The nominal setting dimension is represented by the setting gauge block 18G 191 P or 18G 191-4, which is referenced from the pinion end face to the bottom radius of the differential bearing bore. The latter gauge is illustrated following instruction 85.



ST1380M

Drive pinion adjustment

- 80. Ensure that the pinion end face is free of raised burrs around the etched markings.
- 81. Remove the keep disc from the magnetized base of dial gauge tool 18G 191.
- 82. Place the dial gauge and setting gauge 18G 191 P or 18G 191-4 on a flat surface and zero the dial gauge stylus on to the setting gauge.
- 83. Position the dial gauge centrally on the pinion end face with the stylus registering on the lowest point on one differential bearing bore. Note the dial gauge deviation from the zeroed setting.
- 84. Repeat on the other bearing bore. Add together the readings, then halve the sum to obtain the mean reading. Note whether the stylus has moved up or down from the zeroed setting.



ST648M

Example 1

Reading obtained L.H. side + 0.006 in
 Reading obtained R.H. side - 0.003 in

$$\begin{aligned} &\text{Add } + 0.006 \text{ in} \\ &\quad - 0.003 \text{ in} \\ &= + 0.003 \text{ in} \\ &\text{Divide by 2} = \frac{+ 0.003}{2} = + 0.0015 \text{ in} \end{aligned}$$

Therefore **subtract** 0.0015 in from the shim thickness behind the pinion inner bearing track.

Example 2

Reading obtained L.H. side + 0.006 in
 Reading obtained R.H. side - 0.008 in

$$\begin{aligned} &\text{Add } + 0.006 \text{ in} \\ &\quad - 0.008 \text{ in} \\ &= - 0.002 \text{ in} \\ &\text{Divide by 2} = \frac{- 0.002}{2} = - 0.001 \text{ in} \end{aligned}$$

continued

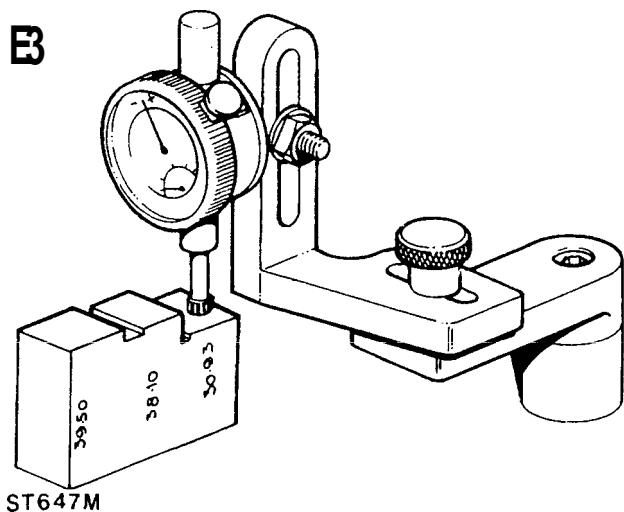
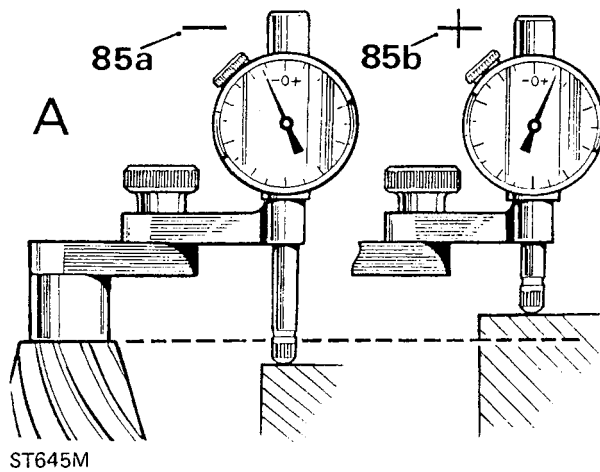
- 85a. Where the stylus has moved down, the amount is equivalent to the thickness of shims that must be removed from under the pinion inner cup to bring the pinion down to the nominal position.
- b. Where the stylus has moved up, the amount is equivalent to the additional thickness of shims required to bring the pinion up to the nominal position.

Illustration A. Using setting gauge 18G 191 P.

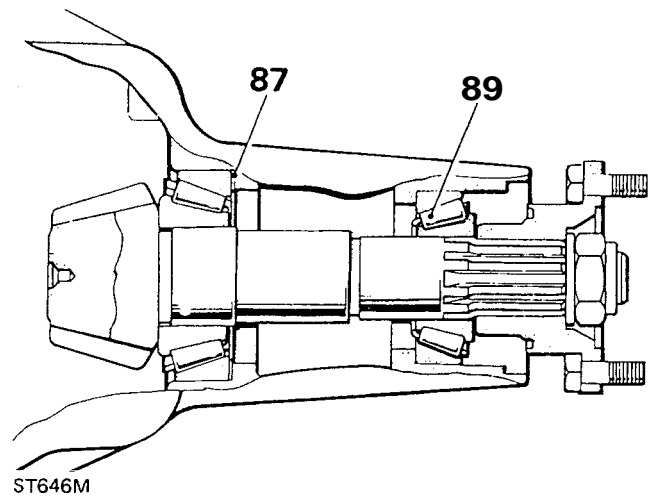
Illustration B. Using universal setting block 18G 191-4

NOTE: The setting block has three setting heights as follows:
 39.50mm Rationalised axle
 38.10mm Pre-Rationalised axle
 30.93mm Salisbury axle

Ensure that the height marked 30.93 mm is used for this differential.

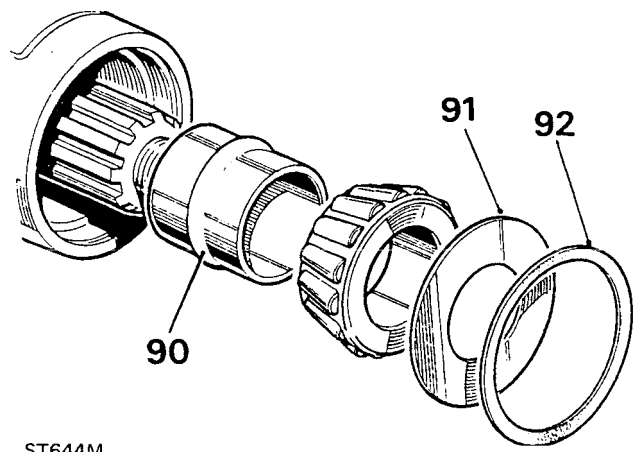


- 86. Before adjusting the shim thickness, check the pinion face marking and if it has a plus (+) figure, subtract that amount in thousands of inch from the shim thickness figure obtained in the previous instruction. Alternatively if the pinion has a minus (-) figure, add the amount to the shim thickness figure.
- 87. Adjust the shim thickness under the pinion inner cup as necessary, by the amount determined in instructions 85 and 86.
- 88. Recheck the pinion height setting instructions 82 to 84. If the setting is correct, the mean reading on the dial gauge will agree with the figure marked on the pinion end face. For example, with an end face marking of +3, the dial gauge reading should indicate that the pinion is 0.003 in below nominal.
- 89. When the pinion setting is satisfactory, temporarily remove the pinion outer bearing.



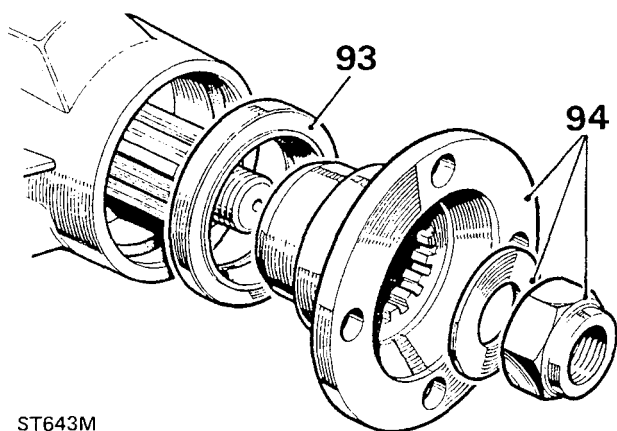
- 90. Fit a new collapsible bearing spacer, flared end outward, to the drive pinion and refit the outer bearing.
- 91. Fit the pinion oil slinger
- 92. Fit the oil seal gasket.

continued



93. Fit the pinion oil seal, lipped side first, using general purpose grease or, where available, a molybdenum disulphide based grease on the seal lip, using RO 1008 to drift in the seal.
94. Fit the coupling flange and plain washer and loosely fit a new flange nut. Secure 18G 1205 to the coupling flange, using slave fixings.
95. Alternately tighten the flange nut and check the drive pinion resistance to rotation until the following figures are achieved, as applicable:
 - a. Assemblies re-using original pinion bearings: 17,3 to 34,5 kgf cm (15 to 30 lbf in).
 - b. Assemblies with new pinion bearings: 34,5 to 46,0 kgf cm (30 to 40 lbf in).

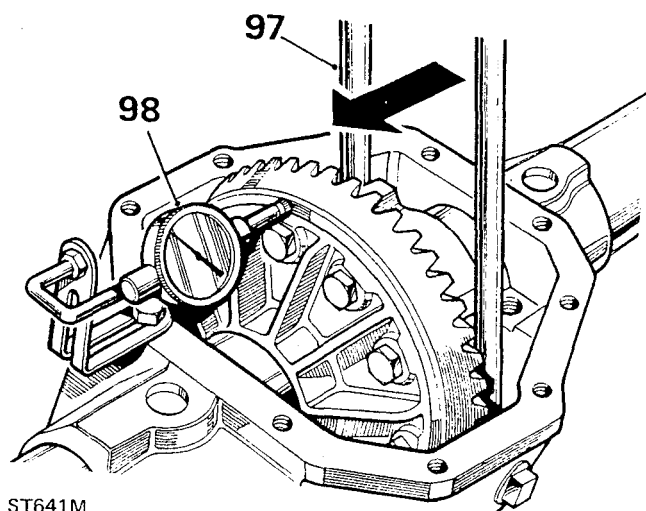
NOTE: Once the bearing spacer has started to collapse the torque resistance build-up is rapid, therefore check frequently, using a spring balance, to ensure the correct figures are not exceeded, otherwise a new collapsible bearing spacer will be required.



ST643M

Differential backlash checks

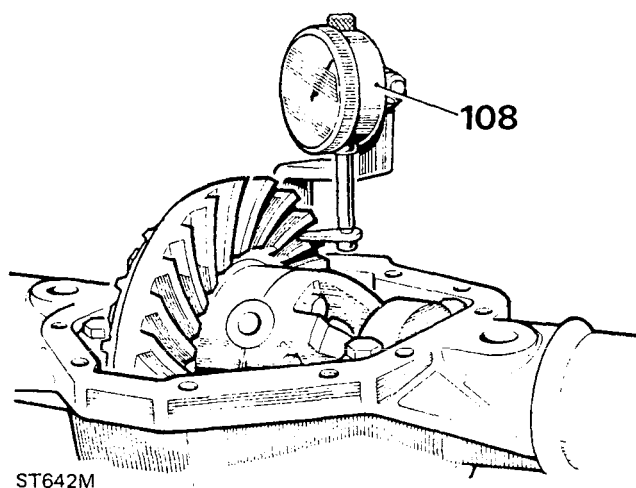
96. Pick up the differential unit as left after instruction 52.
97. Fit the differential unit and lever the unit away from the drive pinion until the opposite bearing cup is seated against the housing. Do not tilt the unit.
98. Install a dial gauge on the casing with its stylus resting on the back face of the crown wheel. Zero the gauge.
99. Lever the differential unit to engage the crown wheel teeth in full mesh with the drive pinion teeth. Do not tilt the unit.
100. Note the total reading obtained on the dial gauge.
101. From this figure subtract 0,25 mm (0.010 in) to obtain the correct crown wheel backlash when fitted. The result indicates the value of shimming to be fitted between the differential case and the bearing cone at the crown wheel side of the differential.



ST641M

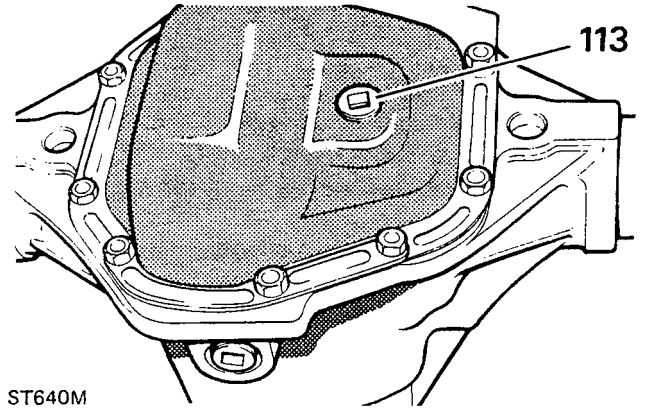
102. Fit the shim value determined in instruction 101, taking the shims from the pack previously determined during 'Differential bearing adjustment' checks, instructions 57 to 62 18G 47 BL details I and 2, press 47, 18G 134 DP.
103. Fit the remaining shims from instruction 101 to the opposite side of the differential. 18G 47 BL details I and 2, press 47, 18G 134 DP.
104. Fit the differential unit with shims and bearings to the axle casing, using the axle spreader 18G 131 C with pegs 18G 131 F.
105. Remove the axle spreader.
106. Fit the bearing caps in their correct position, referring to the relationship markings on the caps and on the axle casing.
107. Tighten the bearing caps fixings to 12,9 to 14,5 kgf m (93 to 105 lbf ft).
108. Mount a dial gauge on the axle casing with the stylus resting on a crown wheel tooth.

continued



ST642M

- 109. Prevent the drive pinion from rotating and check the crown wheel backlash which must be 0,15 to 0,27 mm (0.006 to 0.011 in). If the backlash is not within the specified limits, repeat the differential backlash checks, instructions 96 to 102 looking for possible errors.
- 110. Fit the differential cover and new gasket, coating both sides of the gasket with Hylomar PL 32M or an equivalent non-setting sealant.
Torque load for fixings is 2,8 to 3,5 kgf m (20 to 25 lbf ft).
- 111. Reverse instructions 3 to 5 and coat the threads of the hub driving member bolts with Loctite 'Studlock' grade CVX and fit and tighten the bolts evenly. Torque: 10,0 kgf m (73 lbf ft).
- 112. Fit the rear axle assembly to the vehicle.
- 113. Replenish the differential lubricating oil, (see Lubrication chart). After the initial axle run, check the oil level and replenish as necessary to the filler/level plug hole.



- 114. Where major running parts have been replaced during servicing, it is a recommended practice to allow the axle assembly to 'run in' by avoiding, where possible, heavy loads and high speeds during initial running.

DATA

Crown wheel backlash	0,15 to 0,27 mm (0.006 to 0.011 in)
Differential bearings pre-load	0,127 mm (0.005 in)
Pinion height setting	Set using gauge 18G 191 P or 18G 191-4

Torque resistance initial setting figures

Torque to turn drive pinion and new pinion bearings ...	34,5 to 46 kgf cm (30 to 40 lbf in)
Torque to turn drive pinion re-using the original bearings .	17,3 to 34,5 kgf cm (15 to 30 lbf in)

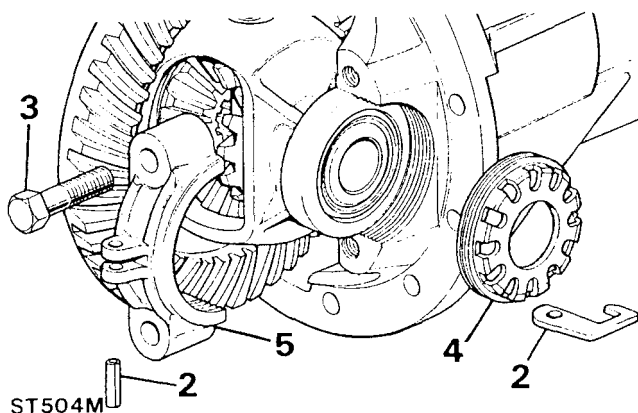
OVERHAUL AXLE DIFFERENTIAL ASSEMBLY
Service tools:

18G 1205 flange holder tool;
 18G 191 pinion height setting gauge;
 18G 191-4 universal setting block;
 18G 47-6 pinion head bearing remover/replacer;
 LST 106 oil seal replacer; or
 RO 262757A extractor for pinion bearing caps;
 RO 262757-1 replacer — use with RO 262757A;
 RO 262757-2 adaptor tail bearing cap replacer;
 RO 530105 spanner—differential flange and carrier bearing nuts;
 RO 530106 bracket for dial gauge and indicator;
 MS 47 press

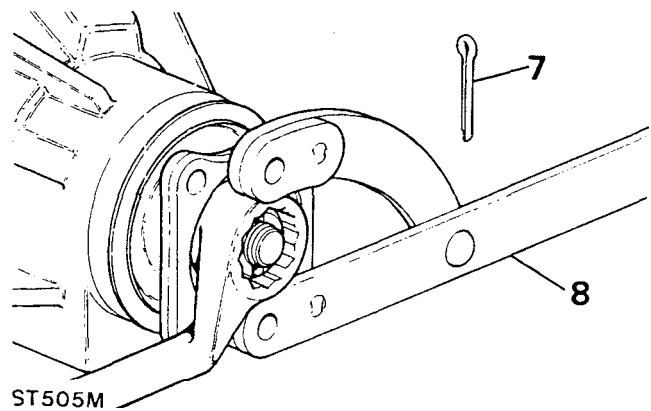
DISMANTLE

It is essential that differential components are marked in their original positions and relative to other components so that, if refitted, their initial setting is maintained. Note that the bearing caps must not be interchanged.

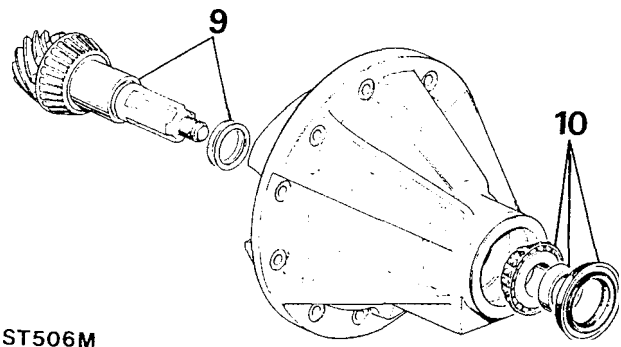
1. Remove the differential assembly from the axle.
2. Drift out the roll pin securing the bearing nut locking fingers to the bearing caps. Remove the locking fingers.
3. Slacken the bearing cap bolts and mark the caps for reassembly.
4. Using service tool RO 530105, remove the bearing adjusting nuts.
5. Remove the bearing cap bolts and bearing caps.
6. Lift out of the crown wheel, differential unit and bearings.



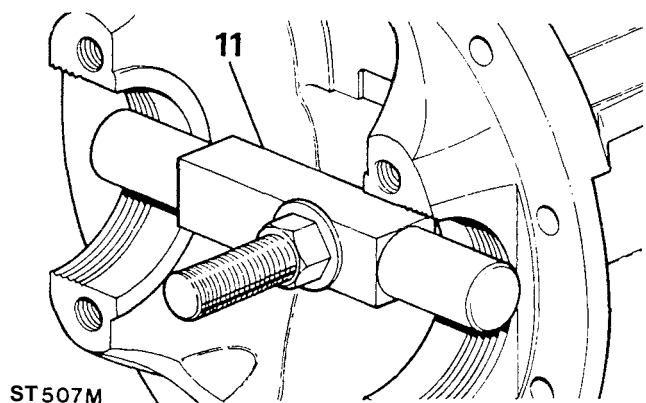
7. Remove the split pin securing the pinion flange nut.
8. Remove the pinion flange nut using service tool 18G 1205 to restrain the flange.



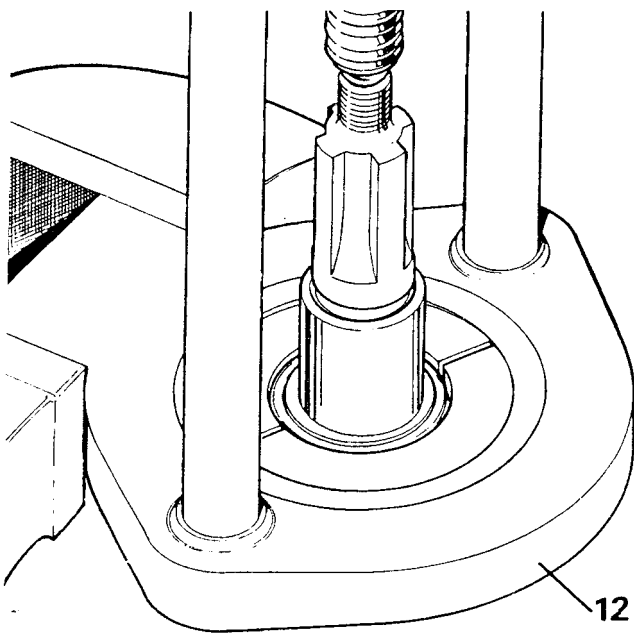
9. Withdraw the pinion complete with pinion head bearing and outer bearing shims. Withdraw the shims.
10. Remove the pinion flange oil seal, spacer and bearing. Discard the oil seal.



11. Using service tool RO 262757A, remove the pinion head bearing track and shim and drift out the outer bearing track from the differential housing.

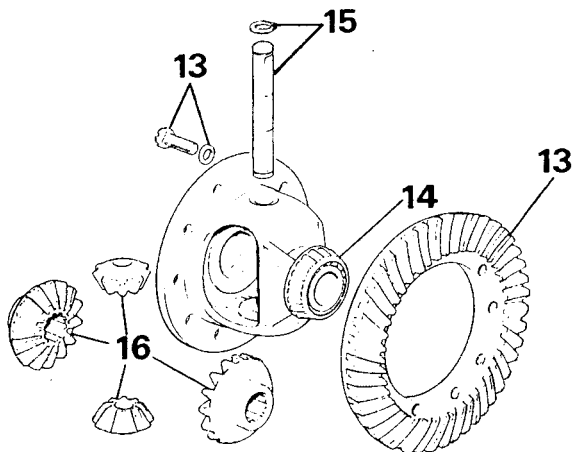


12. Remove the pinion head bearing with service tool MS 47 and adaptor 18G 47-6.



ST508M

13. Remove the bolts and washers securing the crown wheel to the differential flange. Withdraw the crown wheel.
14. Remove the differential carrier bearings.
15. Remove the circlips securing the differential cross shaft. Extract the cross shaft.
16. Withdraw the differential gears and pinions.
17. Thoroughly clean all components.



ST509M

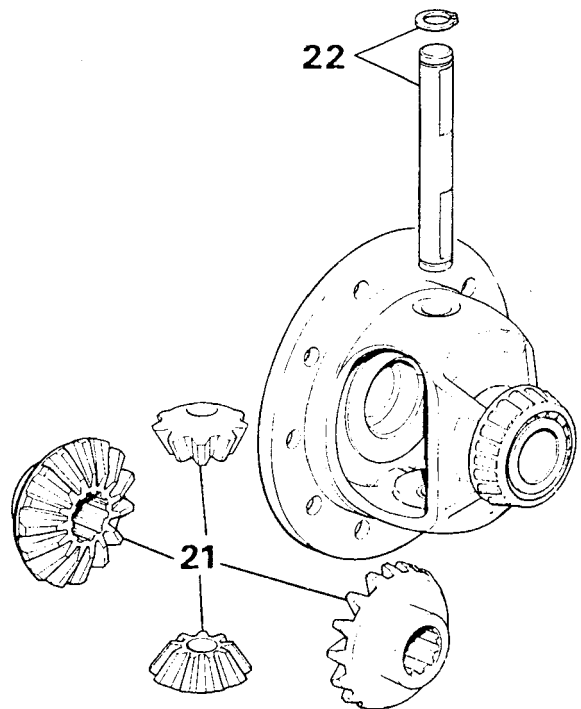
INSPECTION

18. Check all bearings for wear and/or pitting.
19. Check all gears for wear, scuffing, pitting and damaged teeth.
20. **NOTE.** The crown wheel and pinion are supplied as a matched set, also the pinion housing and bearing caps.

ASSEMBLE

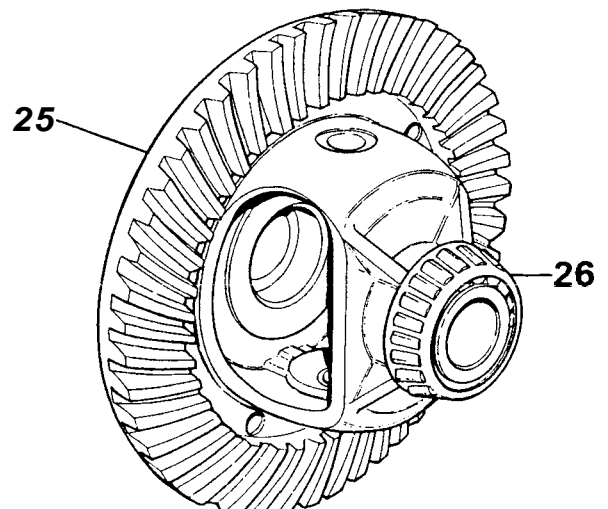
Differential gears

21. Fit the differential gears to the differential housing.
22. Fit the differential cross shaft and retaining circlips.



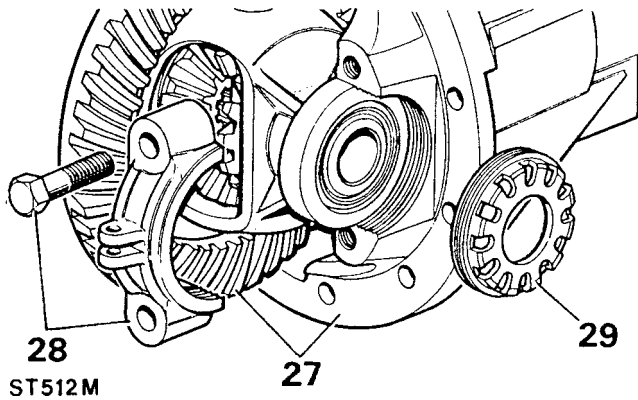
ST510M

23. Check the gear for freedom of rotation and backlash. Nominal backlash should be present. Excessive backlash will necessitate renewal of the gears and/or the differential housing. No provision is made for backlash adjustment.
24. Check that the serial number marked on the pinion end face matches that marked on the crown wheel.
25. Ensuring that the differential housing flange and crown wheel are thoroughly clean fit the crown wheel. Fit the crown wheel bolts and washers and evenly tighten.
26. Fit the carrier bearings using a suitable press or drift and assemble the tracks to the bearings.



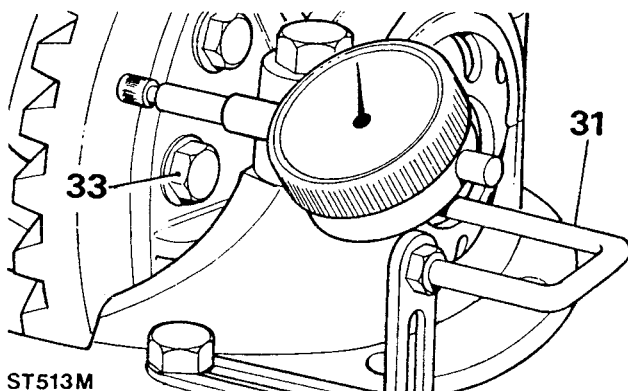
ST511M

27. Place the differential housing complete with crown wheel and bearings in the pinion housing.
28. Fit the bearing caps and bolts. Do not fully tighten the bolts.
29. Fit the bearing adjusting nuts and adjust to obtain zero end-float.
30. Tighten the bearing cap bolts.



ST512M

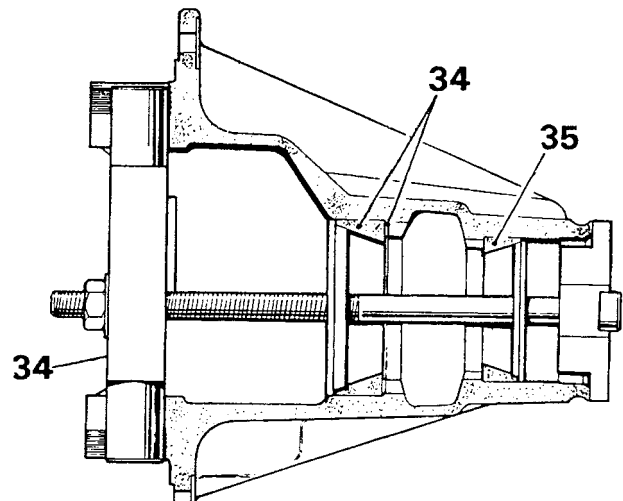
31. Using a dial gauge check the crown wheel for run-out. This should not exceed 0,10 mm (0.004 in). If excessive run-out is recorded remove the crown wheel and examine crown wheel and mounting flange for burrs, grit, etc. Refit the crown wheel and recheck. Run-out, attributable to a buckled or damaged differential housing flange can be corrected only by renewing the differential gear housing.
32. When satisfied that run-out is within the specified limits remove the differential housing from the pinion housing.
33. Remove the crown wheel bolts and refit them using Loctite 'Studlock'. Evenly tighten the bolts to the correct torque.



ST513M

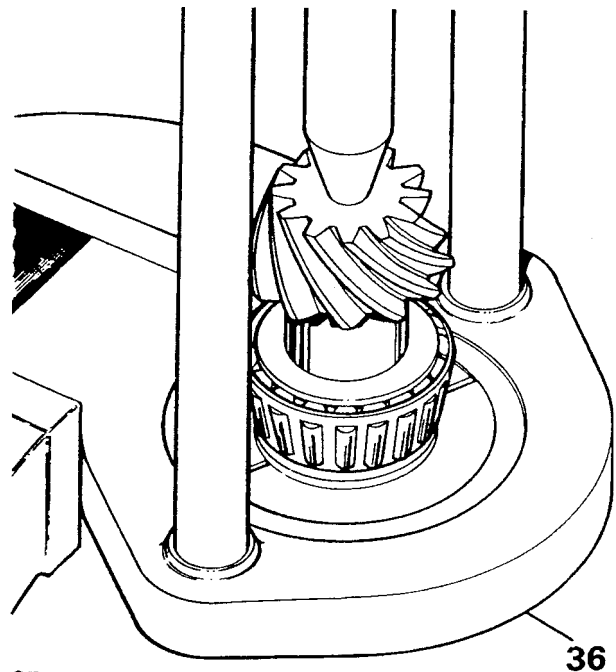
34. Fit the pinion head bearing track and the original shim to the pinion housing using service tools RO 262757A and RO 262757-1. If the original shim was damaged or mislaid use a new shim of at least 1,27 mm (0.050 in) thickness.
35. Fit the pinion outer bearing track to the pinion housing with service tool KO 262757A and RO 262757-2.

NOTE: Instructions 34 and 35 are carried out in one operation as illustrated.



ST514M

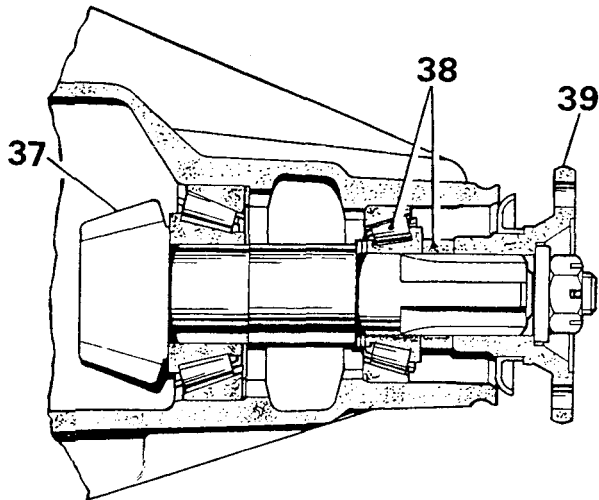
36. Fit the pinion head bearing to the pinion using service tool 18G 47-6.



ST515M

37. Enter the pinion into its location in the pinion housing. Do not fit the shims for bearing pre-load at this stage.
38. Fit the outer bearing and spacer.
39. Fit the driving flange, washer and nut.

continued

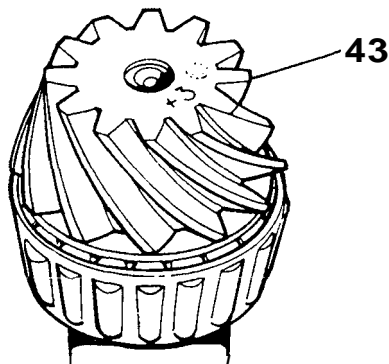


ST516M

- 40. Do not fit the oil seal at this stage.
- 41. Tighten the pinion flange nut slowly until the force required to rotate the pinion is 23 to 40,25 kgf cm (20 to 35 lbf in). This will pre-load the bearings in order to check the pinion height dimension.
NOTE: If using original bearings, which are bedded in, the pre-load figure is 11,5 to 17,25 kgf cm (10 to 15 in lb).

Drive pinion markings

- 42. The markings on the end face adjacent to the serial number are of no significance during servicing.
- 43. The figure marked on the end face opposite to the serial number indicates, in thousandths of an inch, the deviation from nominal required to correctly set the pinion. A pinion marked plus (+) must be set below nominal, a minus (-) pinion must be set above nominal. An unmarked pinion must be set at nominal.
- 44. The nominal setting dimension is represented by the setting gauge block 18G 191-4 which is referenced from the pinion end face to the bottom radius of the differential bearing bore.



ST517

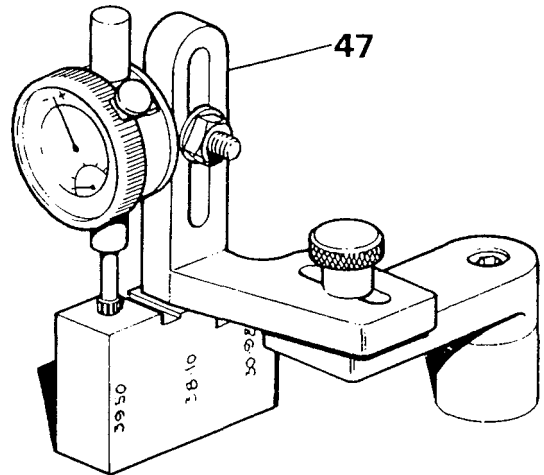
Drive pinion adjustment

- 45. Ensure that the pinion end face is free of raised burrs around the etched markings.
- 46. Remove the keep disc from the magnetised base of dial gauge tool 18G 191.
- 47. Place the dial gauge and setting block on a flat surface and zero the dial gauge stylus on the setting block.

NOTE: The setting block has three setting heights as follows:

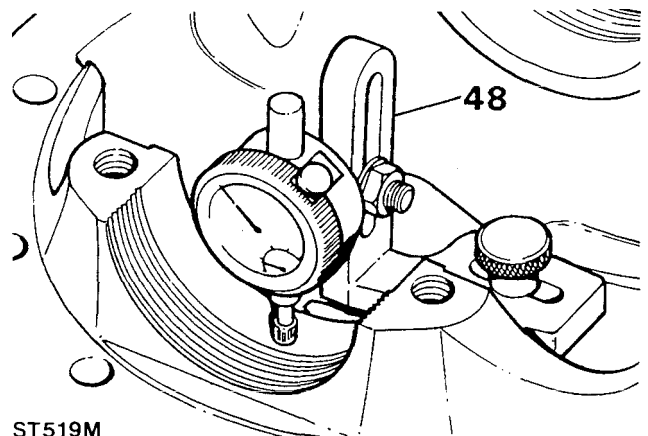
- 39,50 mm Rationalised axle
- 38,10 mm Pre-Rationalised axle
- 30,93 mm Salisbury axle

Ensure that the height marked 39,50 mm is used for this differential.



ST518M

- 48. Position the dial gauge centrally on the pinion end face with the stylus registering on the lowest point on one differential bearing bore. Note the dial gauge deviation from the zeroed setting.



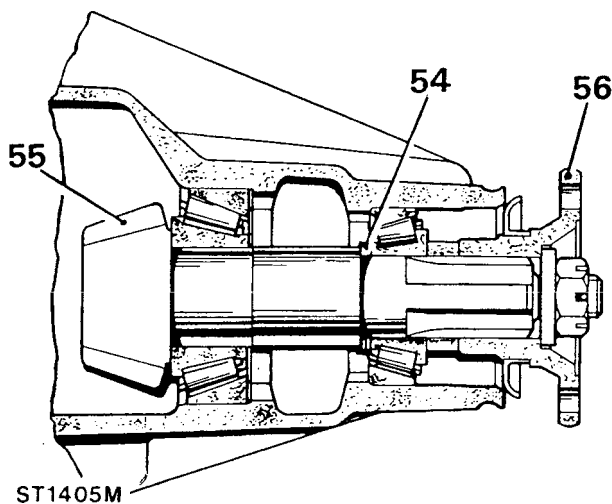
ST519M

continued

49. Repeat on the other bearing bore. Add together the readings then halve the sum to obtain the mean reading. Note whether the stylus has moved up or down from the zeroed setting.
 - a. Where the stylus has moved down, the amount is equivalent to the thickness of shims that must be removed from under the pinion inner track to bring the pinion down to the nominal position.
 - b. Where the stylus has moved up, the amount is equivalent to the addition thickness of shims required to bring the pinion up to the nominal position.
50. Before adjusting the shim thickness, check the pinion face marking and if it has a plus (+) figure, subtract that amount in thousandths of an inch from the shim thickness figure obtained in the previous item.
51. Alternatively, if the pinion has a minus (-) figure, add the amount to the shim thickness figure. Adjust the shim thickness under the pinion head bearing track as necessary.
52. Recheck the pinion height setting. If the setting is correct, the mean reading on the dial gauge will agree with the figure marked on the pinion end face. For example, with an end face marking of +3, the dial gauge reading should indicate that the pinion is +0.003 in.

Bearing pre-load adjustment

53. Remove the pinion flange, pinion, outer bearing and spacer.
54. Slide new shims, of the same thickness as the originals (bearing pre-load) into position on the pinion shaft. If the original shim was damaged or mislaid use a new shim of at least 4,06 mm (0.160 in) thickness.
55. Enter the pinion in its location in the pinion housing and fit the outer bearing and spacer.
56. Fit the driving flange, washer and nut.
57. Do not fit the oil seal at this stage.



58. Tighten the pinion flange nut to the specified torque. The force required to rotate the pinion shaft should be within 23 to 40,25 kgf cm (20 to 35 lbf in) when initial inertia has been overcome. Change the bearing pre-load shim as necessary to obtain this requirement. A thicker shim will reduce pre-load; a thinner shim will increase pre-load.

NOTE: If using original bearings, which are bedded in, the pre-load figure is 11,5 to 17,25 kgf cm (10 to 15 in lb).

59. Remove the pinion flange.

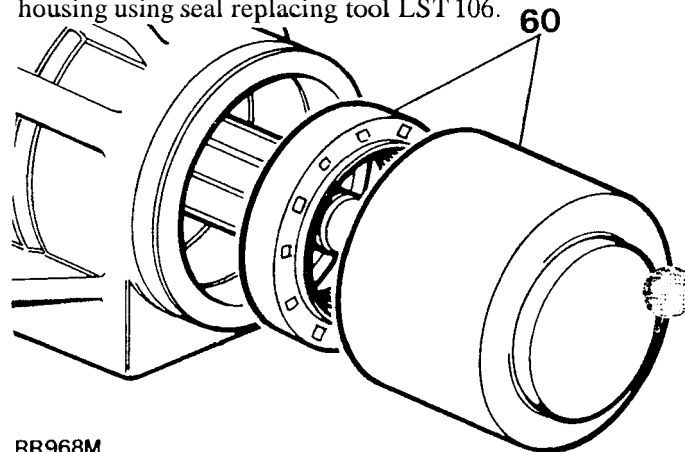
Fitting Pinion Oil Seal — latest type FRC 8220

CAUTION A — When fitting the latest type oil seal FRC 8220 in place of the early type FRC 4586 the latest mudshield FRC 8154 must be fitted in place of the early type 236072.

Also seal replacer 18G 1382 must be used to fit the early type oil seal FRC 4586. This tool must not be used to fit latest seal FRC 8220.

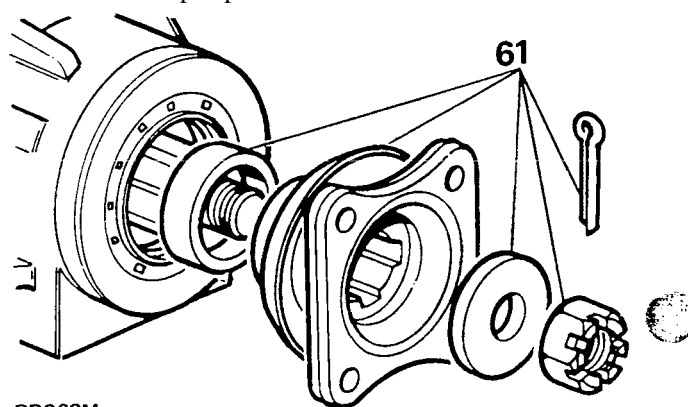
CAUTION B — Before fitting the new seal to the differential, examine the seal to ensure that it is clean, undamaged and that the garter spring is properly located. A small scratch on the seal lips could impair its efficiency.

60. Coat the outer diameter of the new seal with an all-purpose grease and fit the seal, lip side leading squarely on the pinion nose housing and drive the seal into position flush with the end face of the housing using seal replacing tool LST 106.



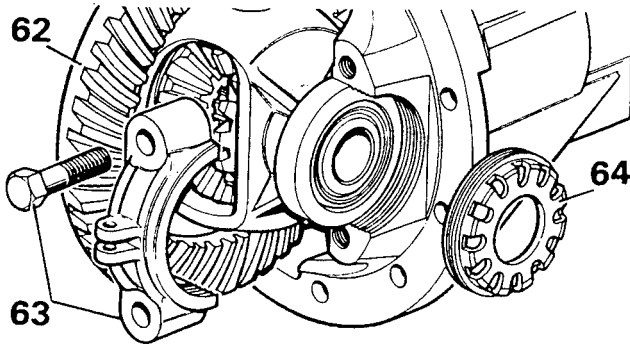
RR968M

61. Lightly lubricate the seal lips with EP90 oil. Fit the distance piece and flange and secure with washer and nut. Tighten the nut to the specified torque and fit a new split pin.



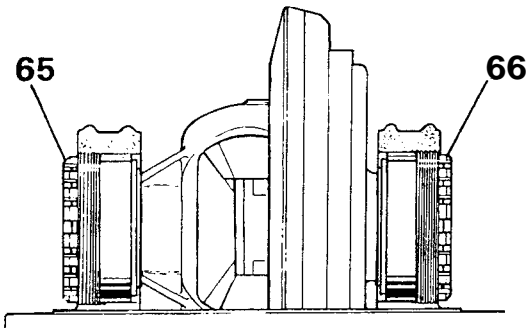
RR969M

62. Place the differential housing in the pinion housing.
63. Fit the bearing caps and bolts. Do not fully tighten the bolts.
64. Fit the bearing adjusting nuts.



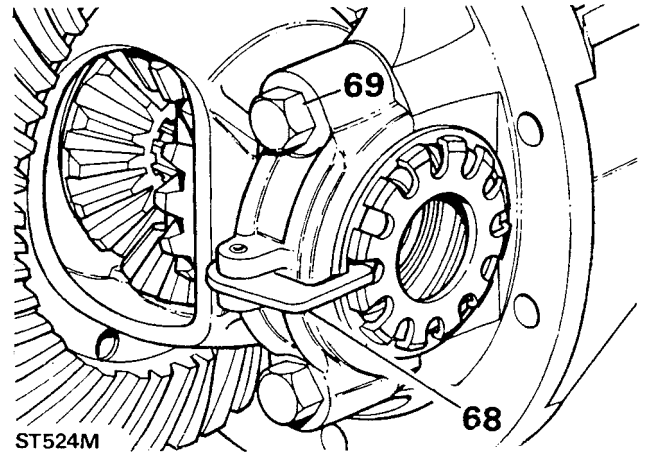
ST522M

65. Using service tool 530105, slacken the left hand bearing adjustment nut (as illustrated) to produce end float.
66. Tighten the right hand nut until crown wheel/pinion backlash is just removed.



ST523M

67. Tighten the left hand nut slowly until it contacts the bearing. Continue turning the left-hand nut until a backlash of 0,10 to 0,17 mm (0.004 to 0.007 ins) is achieved. Do not slacken the right-hand nut at any time, otherwise the bearing preload will be affected.
68. Fit the locking fingers and roll pins. If necessary, tighten the adjustment nuts slightly to align the locking finger with a slot.



ST524M

69. Evenly tighten the bearing cap bolts to the specified torque.
70. Recheck crown wheel/pinion backlash.
71. Lubricate the bearings and gears.

DATA

Pinion bearing pre-load	23 to 40,25 kgf cm (20 to 35 lbf in)
Crown wheel run-out	0,10 mm (0.004 in)
Crown wheel/pinion backlash	0,10 to 0,17 mm (0.004 to 0.007 in)

