



TRANSMISSION

SECTION FI - ELISE 2001 M.Y. Onwards

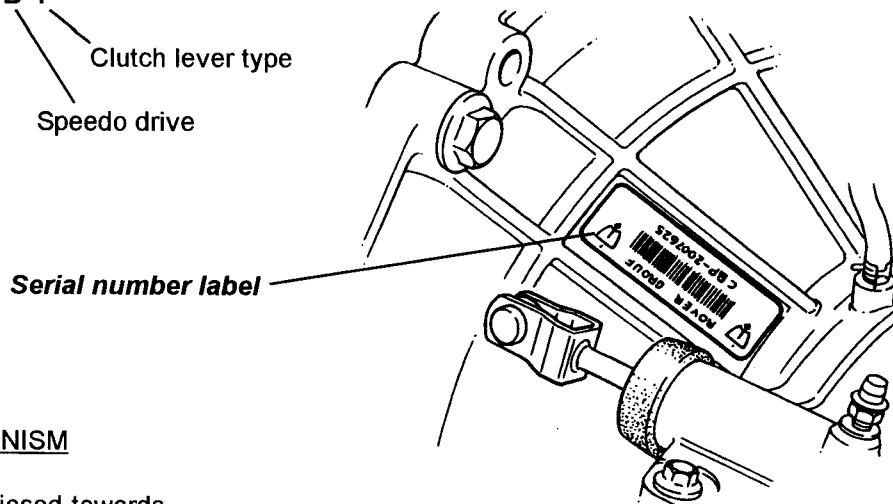
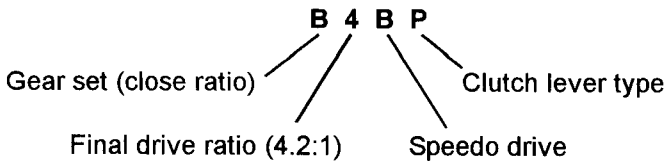
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FI.1 - INTRODUCTION

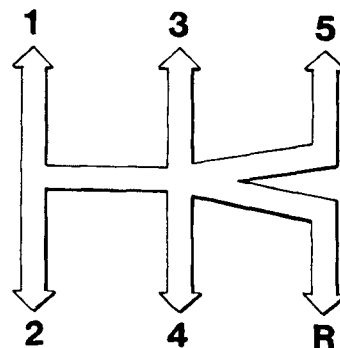
The transmission assembly is an 'end on' type, mounted on the left hand end of the engine unit, and comprises of the clutch housing, five speed gearbox, final drive gears, and differential. The unit is supplied by Rover, and is designated 'PG1', with Rover publication RCL 0124ENG covering the description and overhaul of this transmission. A conventional bevel gear differential is fitted for the Elise application. The gearchange mechanism is different to that used by Rover, with the two cables running beneath the power unit (see subsection FI.2).

The transmission serial number is printed on a bar code label fixed to the top of the clutch housing, and is prefixed by a specification code. In the case of the Elise 2001 M.Y. the code is:



FI.2 - GEARCHANGE MECHANISM

The gearlever is spring biased towards the 3rd/4th gear plane such that it must be moved against light spring pressure to the left before selecting first or second gear, and against similar pressure to the right before selecting 5th or reverse gear. An inhibitor device within the transmission selector mechanism prevents the selection of reverse gear directly from 5th, by requiring that the lever first be moved across the gate to release an interlock. A reverse selector 'brake' mechanism utilises the 4th gear synchroniser to halt the input gear train, and assist the engagement of reverse gear.



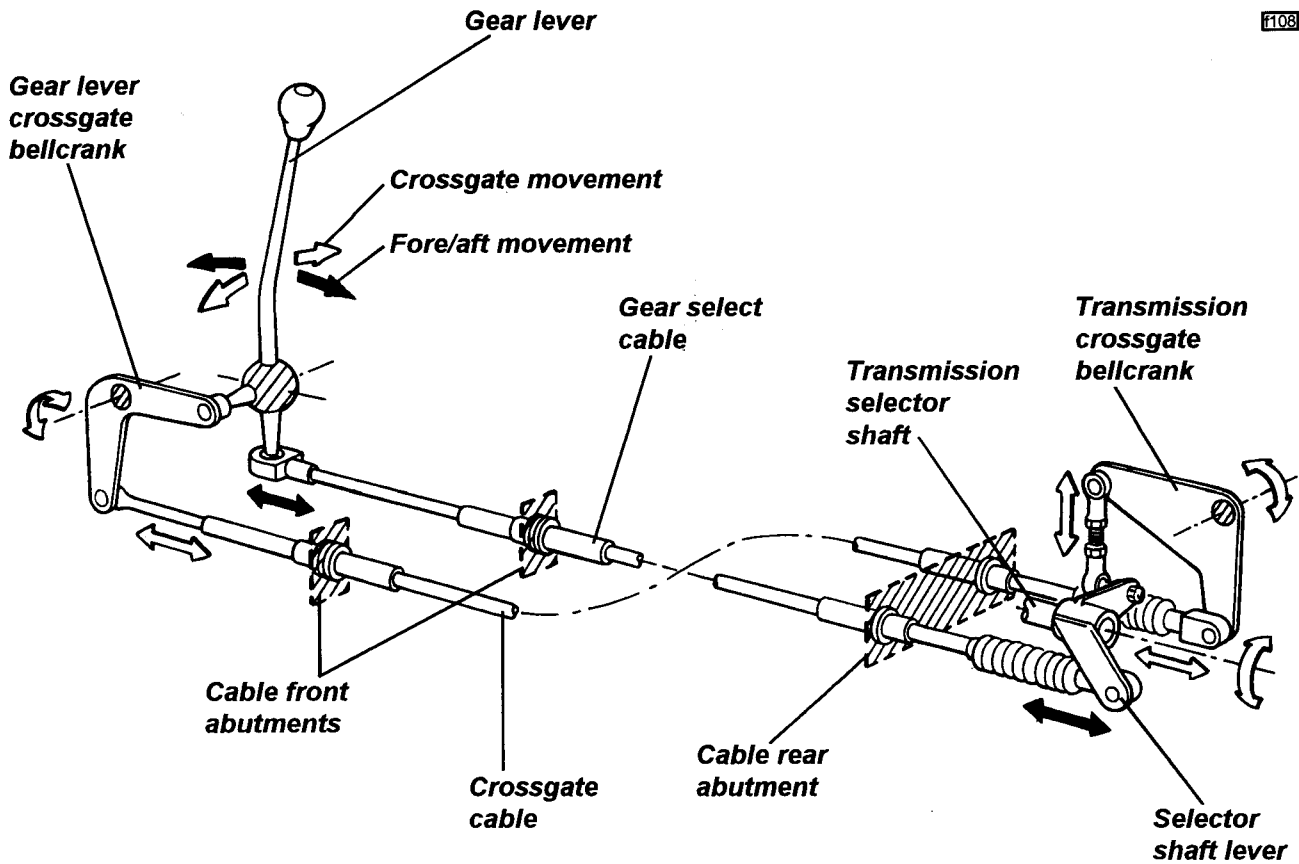
A two cable mechanism is used to connect the gearchange lever with the transmission, one cable ('shift') to transmit the fore/aft movement of the lever, and a second ('crossgate') for the sideways movement. The steel gearchange lever incorporates an integral pivot ball which pivots in a two piece nylon socket in an alloy housing. The housing is mounted on a fabricated steel bracket which incorporates abutments for the two cables, and is fixed to the cabin floor crossmembers. Both gearchange cables run down the centre of the cabin floor, beneath the fuel tank bay, and under the engine to connect with the transmission selector shaft at the bottom rear of the power unit.

A vertical extension to the gearchange lever, below the pivot ball, connects via a ball joint to the shift cable. Fore/aft movement of the lever is thus transmitted directly to the cable, the rear end of which is connected directly to the transmission selector shaft via a short leg.

Crossgate movement of the gear lever is transmitted to a second cable via a short horizontal leg protruding from the left side of the gear lever pivot ball. Vertical movement of this leg is translated into a fore/aft motion by a forward mounted bellcrank lever, the other end of which connects with the crossgate cable. The rear end of this cable links via another bellcrank lever, and a ball jointed link, to a lever on the transmission selector shaft, to which is imparted a rotational movement.



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Gearchange Cable Adjustment

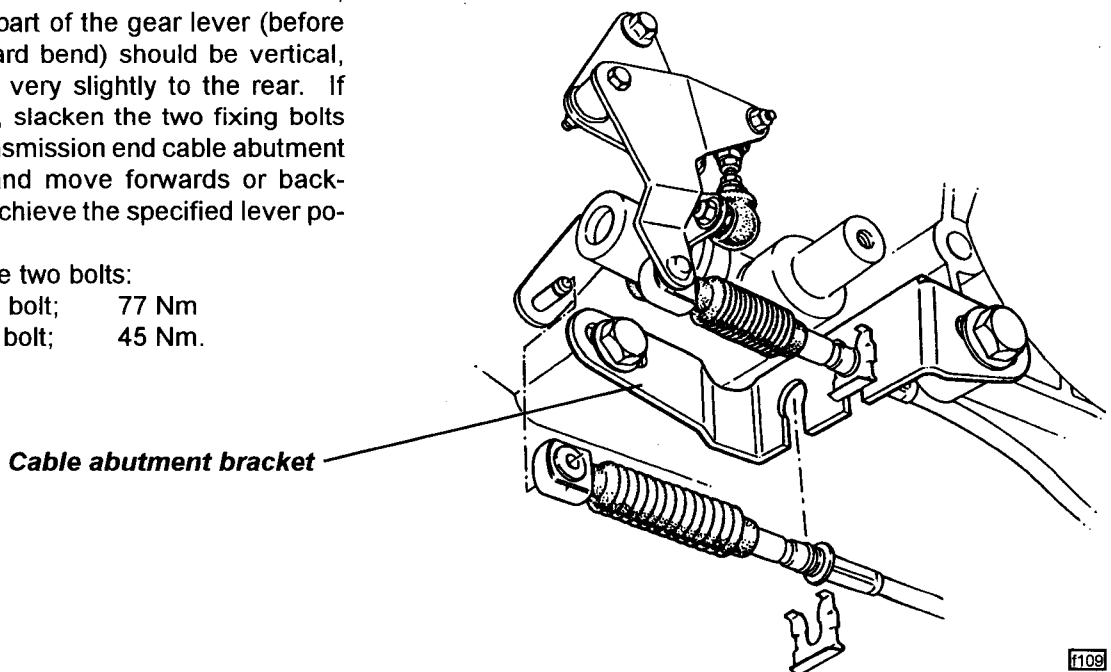
Both gearchange cables, crossgate and select, are of fixed length. Fore/aft adjustment is provided via slotted fixing holes in the transmission end abutment bracket, with crossgate adjustment catered for by an adjustable length tie rod between transmission end bellcrank lever and selector shaft.

With the gearchange mechanism assembled, and the transmission in neutral:

1. Fore/aft position: Viewed from the side, the lower part of the gear lever (before the rearward bend) should be vertical, or leaning very slightly to the rear. If necessary, slacken the two fixing bolts on the transmission end cable abutment bracket, and move forwards or backwards to achieve the specified lever position.

Tighten the two bolts:

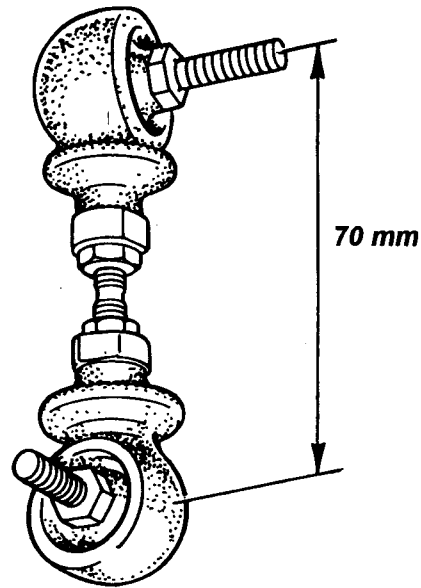
- Front M12 bolt; 77 Nm
- Rear M10 bolt; 45 Nm.



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2. Crossgate position: Viewed from behind, the gear lever should be vertical. If necessary, adjust the length of the transmission end bellcrank tie rod. The nominal length between ball joint centres is 70 mm. The tie rod is RH threaded at both ends, so that before an adjustment can be made, the lower ball joint must be released from the selector shaft lever. Adjustments to the tie rod length can be made only in increments of one thread pitch:



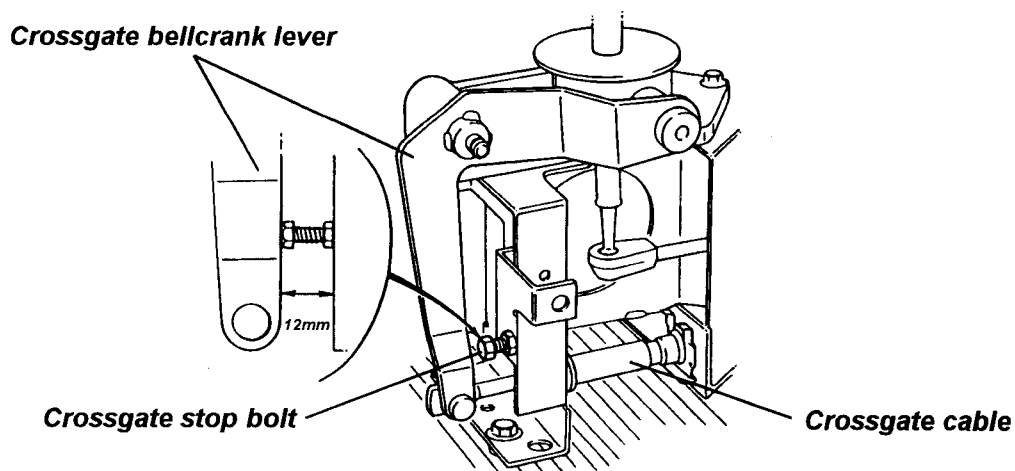
f110

- Lengthen the rod to move the lever position to the left;
- Shorten to move the lever to the right.

Ensure that there is similar thread engagement into each of the two ball joints. Refit the ball joint to the lever and tighten to 4.7 Nm.

3. 5th & reverse crossgate stop: An adjustable stop bolt is provided to limit the gear lever crossgate movement to the right (5th and reverse plane). If any adjustment to the crossgate cable is made, the stop bolt adjustment should be checked. For access to the lever mechanism, the gear lever knob and shroud must first be removed - unscrew the knob, remove the screw each side of the shroud, and lift the shroud over the lever.

The nominal stop bolt setting of 12 mm should be adjusted as necessary to provide minimal clearance when the lever is operated in the 5th/reverse gear plane, as is consistent with satisfactory gear selection.



Gearlever Replacement

For access to the gear lever assembly, unscrew the gear knob, remove the single screw each side of the gear lever shroud, and lift the shroud over the lever. To remove the gear lever:

- Remove the 'E' clip from the bellcrank lever pivot.
- Unsnap the select cable socket from the gear lever ball.
- Remove the three screws securing the gear lever housing to the mounting bracket, disengage the bellcrank

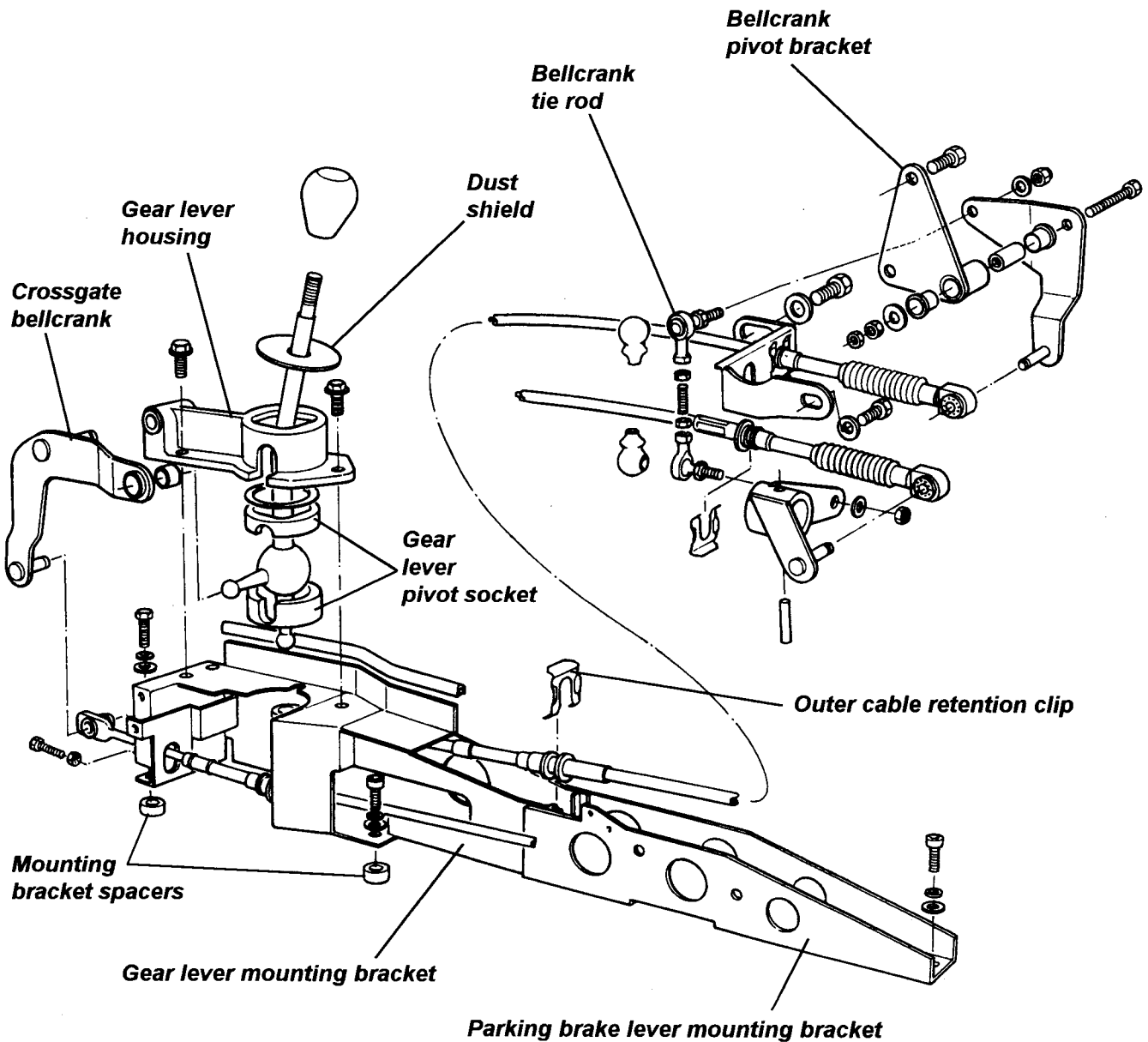


lever pivot and crossgate spigot bush, and withdraw the housing and gear lever assembly.

To re-assemble:

- Fit the pivot socket gasket into the gear lever housing, followed by the top (smaller) section of the pivot socket.
- Apply Dow Corning Molykote 33 Medium silicone grease (A111F6016) to the gear lever pivot ball and to the crossgate spigot ball before fitting the lever into the housing followed by the lower section of the socket. Snap the plastic bush onto the lever crossgate spigot ball.
- Locate the bellcrank lever pivot into the gear lever housing, and retain with the 'E' clip. Fit the crossgate spigot into the bellcrank lever and locate the gear lever housing onto the mounting bracket.
- Fit and tighten the three gear lever housing screws, and snap the select cable socket onto the bottom of the gear lever.
- Check gear linkage operation and adjustments before fitting the pivot ball dust shield over the lever, and refitting the shroud.

NOTE: To avoid the requirement to replace the retaining clip/bush, do not disconnect the crossgate cable from the bellcrank lever unless necessary.



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Gearchange Cable Replacement

For access to the gear cables, the gear lever shroud and parking brake lever trim must be removed: Unscrew the gear lever knob, remove the single screw each side of the shroud, and withdraw the shroud. Remove the single screw securing the parking brake trim to the rear bulkhead and ease the panel over the lever.

Unclip the crossgate cable from the bellcrank lever, or unsnap the select cable from the lever ball. Pull off the spring clip retaining the cable outer to the abutment bracket, and release the cable from the bracket. At the rear end, prise the cable off the lever, pull off the outer cable spring clip, and release from the abutment bracket. Release cable ties and clips as necessary to allow the cable to be withdrawn, noting the routing past the park brake lever.

Refit in reverse order to removal, paying particular attention to the routing through or alongside the park lever and gear lever mounting brackets. Check the cable adjustments as detailed above.

Gearlever Mounting Bracket

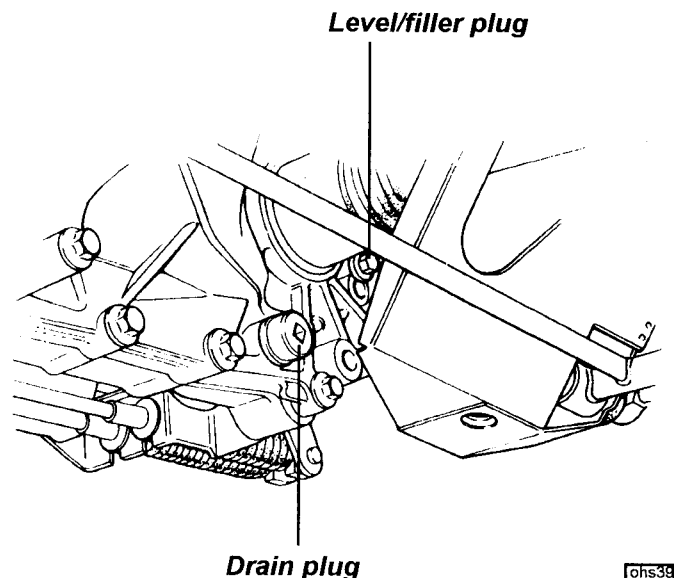
The gear lever mounting bracket is secured to the cabin floor by four M8 bolts, the rearmost of which also fixes the front of the parking brake lever bracket. Note that alloy spacers are used on the front three fixing points between bracket and floor. The whole assembly is offset towards the passenger side of the car, with alternative fixing holes provided either in the mounting bracket, or in the cabin floor.

FI.3 - LUBRICATION

The PG1 transmission is 'filled for life' with Texaco MTF94 fully synthetic lubricant, and requires no periodic renewal. No other transmission oil is approved. If there are any signs of leakage, the source should be identified and appropriate action taken to rectify the fault.

A filler/level plug is provided on the left hand side of the the final drive housing, and with the car parked on a level surface, the oil level should be up to the level of this hole. A drain plug in the underside of the casing (square socket plug) permits the oil to be drained prior to transmission removal or repair.

Dry fill capacity = 2.4 litres. Refill = 2.1 litres.



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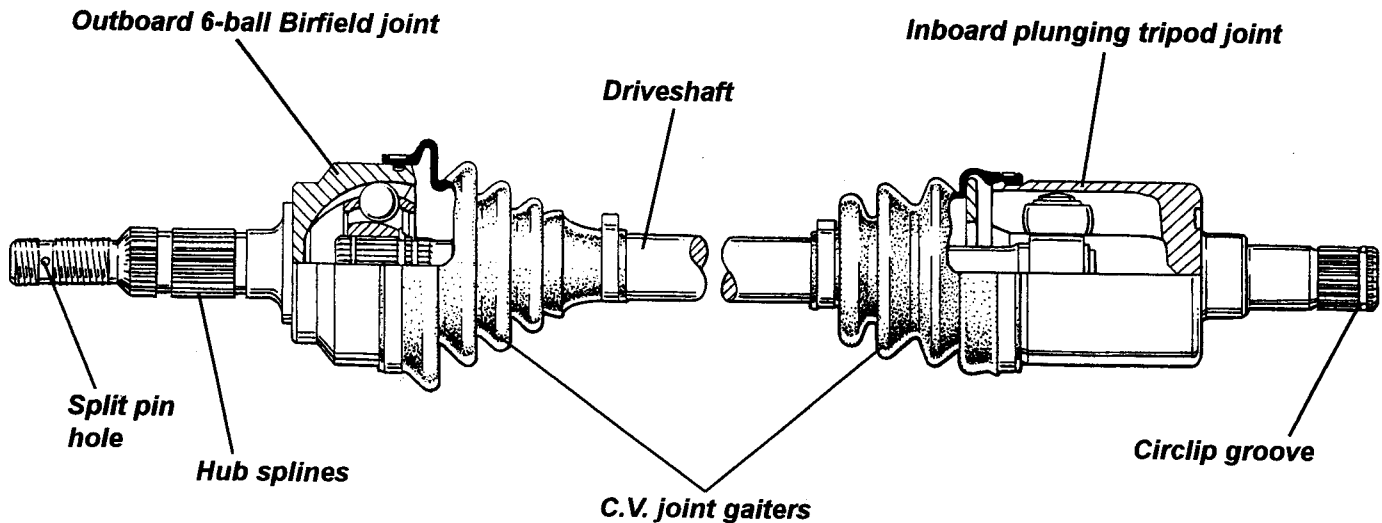
FI.4 - DRIVE SHAFTS

A driveshaft assembly comprising a steel shaft with a constant velocity joint at each end, is used to transmit the drive from each differential output gear to the rear wheel hub. The two shafts are of unequal length due to the offset transmission housing, with the longer shaft on the right hand side. Both driveshaft assemblies use plunging tripod type inboard C.V. joints, and six ball Birfield type outboard C.V. joints. The outboard joint is available as a service part, as is the inboard joint complete with shaft. Replacement gaiter kits are available for both joints. The joints themselves are packed with grease on initial assembly, and are maintenance free. It is however vitally important that the protective gaiters are carefully inspected at service intervals, to check for splits, tears or punctures, since the joint will deteriorate very quickly once contaminated with dirt or water. Damaged gaiters should be renewed immediately, once the servicibility of the joint has been established.

Clicking noises, torque reversal 'clonks', or shudder and vibration when accelerating are all possible symptoms of worn C.V. joints. It should not be possible to discern any free play in a joint, but care must be taken not to confuse this with transmission backlash, which may be considerable. Any symptoms that could be due to worn driveshaft joint assemblies, should be investigated and rectified without delay, since safety considerations are always of paramount importance.



The inboard C.V. joint is equipped with a male splined spigot shaft which engages with the female splines of the differential output sun gear, and is retained by a round section spring circlip on its end. Each of the two transmission output oil seals runs on a stepped shoulder on the C.V. joint spigot shaft. The outboard end of each driveshaft carries a second C.V. joint whose spigot shaft is used to clamp the hub and wheel bearing into the hub carrier via a thread on the end of the shaft.



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Driveshaft Replacement

Removing a driveshaft from the transmission will result in some loss of transmission lubricant. It may be preferred to drain off some oil via the transmission drain plug beforehand.

1. Remove the transmission drain plug and drain off approximately 1 litre of oil into a clean container for re-use.
2. Remove the rear road wheel.
3. Before attempting to release the driveshaft hub nut, first use a punch to knock the distorted end of the nut clear of the driveshaft slot. Apply the parking brake and release the driveshaft hub nut.
4. Remove the wheel speed sensor from its plinth to prevent damage during driveshaft removal.
5. To allow the hub carrier to be leant outwards and provide room for the driveshaft to be withdrawn from the transmission and hub, remove the bolt securing the toe link to the hub carrier and remove the two bolts securing the top ball joint plinth to the hub carrier, taking note of the shim pack fitted between plinth and carrier.
6. The inboard C.V. joint is retained in the transmission by a rounded section circlip, and may be removed by applying a shock pull to the C.V. joint body using a slide hammer with a forked end, or on the RH side, by using a special wedge tool T000T1276.

CAUTION: Do NOT attempt to remove the inboard C.V. joint from the transmission by pulling on the driveshaft. This action will cause the joint to become disassembled and may entail replacement of the joint. The components of the inboard plunging joint are held in position, for transit purposes only, by a collar within the boot which will be overridden if excessive axial force is used. Apply pressure only to the 'tulip' or outer body of the joint.

Withdraw the inboard C.V. joint from the transmission, taking great care not to damage the output seal, and fit blanking plug T000T1385 into the transmission to limit the amount of transmission oil loss.

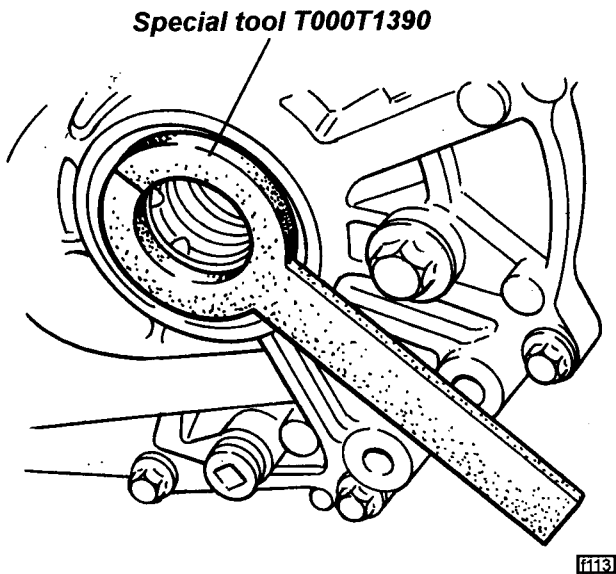
7. Withdraw the driveshaft from the hub using a puller if necessary, and remove the driveshaft assembly from the car.

8. Before re-fitting a driveshaft, first renew the round section circlip (A100R6001F) on the end of the inboard joint spigot shaft, and lubricate the circlip with grease. Also, check the condition of the transmission output seal, and renew if necessary. Lubricate the lip of the seal with transmission oil, and grease the corresponding shoulder on the driveshaft (C.V. joint) spigot, to reduce the danger of damaging the seal on assembly.

9. A special tool T000T1390 is available to protect the seal during driveshaft fitment, and should always be used with the more vulnerable early type seal (see above).

To use the tool:

- Check first that the tool is clean and undamaged before fully inserting into the oil seal. Check that the split joint in the tool is butted correctly.
- Carefully insert the driveshaft through the seal protector until it engages in the splines of the differential output gear.
- Remove the protector tool by pulling over the shaft.
- Press the C.V. joint into the differential gear splines until a 'click' indicates that the circlip has engaged in its location. Pull on the body of the joint to check security.



10. Fit the outer end of the shaft into the hub, and retain with the nut.
11. Refit the top ball joint plinth to the hub carrier with the camber adjustment shim pack in position, and tighten the two socket head bolts to 45 Nm. Apply the parking brake and tighten the driveshaft nut to 220 Nm. Tighten the toe link to hub carrier pivot bolt to 45 Nm. Refit the wheel speed sensor to its plinth.
12. With the car on a level surface, top up the transmission oil to the filler/level plug hole.

Driveshaft C.V. Joint and/or Gaiter Replacement

The outboard joint is available as a separate part, whilst the inboard joint is supplied complete with the driveshaft. Gaiter kits are separately available for both joints.

1. Remove the driveshaft assembly from the car (see above).
2. Cut off the gaiter retaining clips from both joints, and slide the gaiters along the shaft.
3. The outboard joint is retained by a round section circlip on the end of the shaft. To remove the joint, hold the drive shaft in a vice, and use a soft mallet to tap the joint over the circlip and off the shaft. If the joint is reluctant to move, use a brass drift on the front face of the inner race.

CAUTION: Do not attempt to remove an outboard joint without first removing the shaft assembly from the car. Unless the shaft is securely retained (e.g. in a vise) attempts to remove the outboard joint may result in the inboard joint becoming disassembled.

4. Slide both C.V. joint gaiters off the driveshaft.
5. Cleaning & Inspection: Complete disassembly of either joint is NOT recommended. The separate components are a precision fit and develop their own individual wear patterns, such that any interchanging or re-orientation of parts is likely to result in premature failure.



If the grease in the joint is contaminated with dirt or water, it is likely that the joint is damaged, and should be replaced. If the grease is not contaminated, the joint should be degreased by soaking in a suitable solvent (NOT petrol), and then carefully inspected.

On the outboard ball type joint, tilt the inner race to one side to expose each ball. Severe pitting, galling, play between ball and its cage window, any cracking or damage to the cage, or pitting, galling or chips in raceways, call for joint replacement.

On the inboard, tripod type joint, examine the fit between the rollers and the housing. Excessive free play, roughness on either roller or track surfaces, damage to the bearings or trunnion, call for joint replacement. If the joint is found to be serviceable, it must be repacked with special grease as follows:

Outboard joint; 1 sachet A100R6009 (52 ml) - boot kit contains 2 sachets

Inboard joint; 2 sachet A100R6010 (62 ml) - boot kit contains 3 sachets

6. Replace the circlips securing the inboard joint to the transmission and the outboard joint to the shaft. New circlips should always be used to ensure security of joint retention. Note that the circlip for the outboard joint is supplied in the boot kit for either joint, but that the inboard joint circlip should be ordered separately.
7. Tape over the shaft outboard splines to prevent damage to the new gaiters, and slide the inboard gaiter and small retaining clip onto the shaft, followed by the outboard gaiter small clip and gaiter. Remove the tape.
8. Outboard Joint: New joints are pre-packed with grease, but if re-fitting a cleaned out joint, lubricate the joint with one sachet of the special grease provided in the boot kit. Fill the ball tracks with grease both behind and in front of the balls, pack around the balls, and the inside of the splines, so that grease is pushed behind the joint when the shaft is inserted. Use the second grease sachet from the boot kit to fill the inside of the new boot.
NOTE: The grease provided in the kits is specially formulated for wear resistance and durability. DO NOT use substitutes or mix with other lubricants.
9. Inboard Joint: If re-fitting a cleaned out joint, pack the joint with two of the grease sachets from the gaiter kit. Use the third grease sachet from the gaiter kit to fill the inside of the new gaiter.
10. Slide the outer joint onto the shaft splines, and tap the joint into position until the circlip 'clicks' into its groove. Pull on the joint to ensure it is fully located.
11. Pull each gaiter over its C.V. joint and locate the lips of the gaiter in the grooves on the joint and shaft. Before fitting the gaiter clamps, ensure that the gaiter is ventilated so that it is not dimpled or collapsed. Position the plunging joint with 80 mm between the boot clip grooves before ventilating by inserting a smooth rod (take care not to damage the boot) between the large end of the boot and the joint, and fitting the retaining clips. Tighten the clips using suitable pliers.
12. Refit the driveshaft assemblies to the car (see above).

F1.5 - TRANSMISSION REPLACEMENT

With the car supported on a 'wheel free' lift, the transmission can be removed from below, leaving the engine 'in situ':

1. Remove the LH rear lower wishbone:
 - Release the bolt securing the spring/damper unit to the lower wishbone;
 - Release the wishbone to chassis pivot bolts;
 - Release the parking brake cable clip and swing the wishbone out of the way.
2. Release the RH rear suspension toe control link from the hub carrier, and release the top ball joint plinth from the hub carrier taking note of the camber adjustment shimplates. in order to allow withdrawal of the driveshaft from the transmission.



- 3. Remove both inboard C.V. joints by applying a shock pull to the joint body using a slide hammer with a forked end, or on the RH side, by using a special wedge tool T000T1276. Fit blanking plug T000T1385 into the transmission to limit the amount of transmission oil loss.

CAUTION: Do NOT attempt to remove an inboard C.V. joint from the transmission by pulling on the driveshaft. This action will cause the joint to become disassembled and may entail replacement of the joint. The components of the inboard plunging joint are held in position, for transit purposes only, by a collar within the boot which will be overridden if excessive axial force is used. Apply pressure only to the 'tulip' or outer body of the joint.

- 4. Remove the 'R' clip and clevis pin connecting the clutch slave cylinder to the release arm. Remove the four bolts fixing the slave cylinder bracket to the transmission, and support aside.
- 5. Release the two bolts securing the starter motor and dirt shield to the clutch housing. Remove the shield, and withdraw and support the starter motor, taking care to protect the live starter motor lead from grounding.
- 6. Remove the dirt shield from the top front of the clutch housing.
- 7. Disconnect the reverse light switch.
- 8. Disconnect the two gearchange cables from their transmission levers, and release the cables from the abutment bracket.
- 9. Remove the air cleaner housing and mounting plate from the roll over bar brace.
- 10. Support the weight of the transmission assembly before removing the LH engine (transmission) mounting and bracket.
- 11. Remove the six bolts securing the clutch housing to the engine:
 - 2 bolts to the sump;
 - 1 bolt each side through the block lower 'wings';
 - 2 bolts securing the top of the clutch housing to the engine.
- 12. Pushing the engine to the right and downwards at the flywheel end, withdraw the transmission from the engine.
- 13. Refit the transmission in the reverse order to removal with the following notes:
 - Check that the type of output shaft seals fitted are compatible with the driveshaft inboard C.V. joints - see Sub-Section FI.4.
 - Use new circlips on the spigots of the inboard C.V. joints, and follow the procedure in Sub-Section FI.4 to refit.

FI.6 - TRANSMISSION OVERHAUL

The overhauling of the Rover supplied type PG1 transmission, is detailed in Rover publication RCL 0124ENG. Note that a conventional bevel gear differential is used for the Elise application. Special tools are available through Lotus under the following part numbers:

Transmission Special Tools

Description	Lotus Part No.	Churchill Part No. (ref.)
Driveshaft Removal Wedge (RH)	T000T1276	18G1578
Adaptor Plate, bearing puller	T000T1291	18G 2-3
Replacer Dolly, input shaft oil seal	T000T1293	18G 134-4

Continued

Transmission Special Tools (continued)

Description	Lotus Part No.	Churchill Part No.(ref.)
Slide Hammer, output shaft bearing remover	T000T1294	18G 284
Adaptor, output shaft bearing remover	T000T1295	18G 284-14
Driver Handle, bearing dolly	T000T1296	18G 1354
Replacer Dolly, output shaft bearing	T000T1297	18G 1354-5
Circlip Pliers, bearing access plug	T000T1298	18G 1392
Thrust Pad, bearing puller	T000T1299	18G 1397
Hex. Socket, M14, access plug	T000T1300	18G 1472
Anti-Spread Plate, input/output shafts	T000T1301	18G 1473
Replacer Dolly, differential bearings	T000T1302	18G 1675
Replacer, clutch release shaft inner bush	T000T1303	18G 1723-1
Replacer, clutch release shaft outer bush	T000T1304	18G 1723-2
Clutch Alignment Mandrel	T000T1277	18G1483
Blanking Plug, driveshaft output	T000T1385	-
Replacer Dolly, output seal, RH	T000T1388	18G1354-16
Replacer Dolly, output seal, LH	T000T1389	18G1354-21
Seal Protector, output shaft seals	T000T1390	-



PG1 MANUAL GEARBOX

OVERHAUL MANUAL

This gearbox is fitted to the following models:-

Rover 218/418 Diesel
New Rover 200 Diesel
New Rover 218
New Rover 400 Diesel
Rover 220
Rover 420
Rover 600 Diesel
Rover 600 Ti
Rover 820
Rover 800 KV6
MG-F

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INTRODUCTION

How to use this manual

To assist in the use of this manual the section title is given at the top and the relevant sub-section is given at the bottom of each page.

This manual contains procedures for the overhaul of the gearbox on the bench with the engine removed. For all other information regarding General Information, Adjustments, Removal of oil seals, gearbox unit, consult the Repair Manual for the model concerned.

This manual is divided into 3 sections, Description and Operation, Overhaul and Data, Torque & Tools. To assist filing of revised information each sub-section is numbered from page 1.

The individual overhaul items are to be followed in the sequence in which they appear. Items numbered in the illustrations are referred to in the text.

Overhaul operations include reference to Service Tool numbers and the associated illustration depicts the tool. Where usage is not obvious the tool is shown in use. Operations also include reference to wear limits, relevant data, torque figures, and specialist information and useful assembly details.

WARNINGS, CAUTIONS and Notes have the following meanings:



WARNING: Procedures which must be followed precisely to avoid the possibility of injury.



CAUTION: Calls attention to procedures which must be followed to avoid damage to components.



NOTE: Gives helpful information.

References

With the engine and gearbox assembly removed, the crankshaft pulley end of the engine is referred to as the front.

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 with Service limits where applicable.

REPAIRS AND REPLACEMENTS

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

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

Safety features and corrosion prevention treatments embodied in the car may be impaired if other than Rover recommended parts are fitted. In certain territories, legislation prohibits the fitting of parts not to the manufacturer's specification.

Torque wrench setting figures given in this Manual must be used. Locking devices, where specified, must be fitted. If the efficiency of a locking device is impaired during removal it must be renewed.

The Terms of the vehicle Warranty may be invalidated by the fitting of other than Rover recommended parts. All Rover recommended parts have the full backing of the vehicle Warranty.

Rover Dealers are obliged to supply only Rover recommended parts.

INTRODUCTION

SPECIFICATION

Rover are constantly seeking to improve the specification, design and production of their vehicles and alterations take place accordingly. While every effort has been made to ensure the accuracy of this Manual, it should not be regarded as an infallible guide to current specifications of any particular component or vehicle.

This Manual does not constitute an offer for sale of any particular component or vehicle. Rover Dealers are not agents of Rover and have no authority to bind the manufacturer by any expressed or implied undertaking or representation.

Gearbox identification

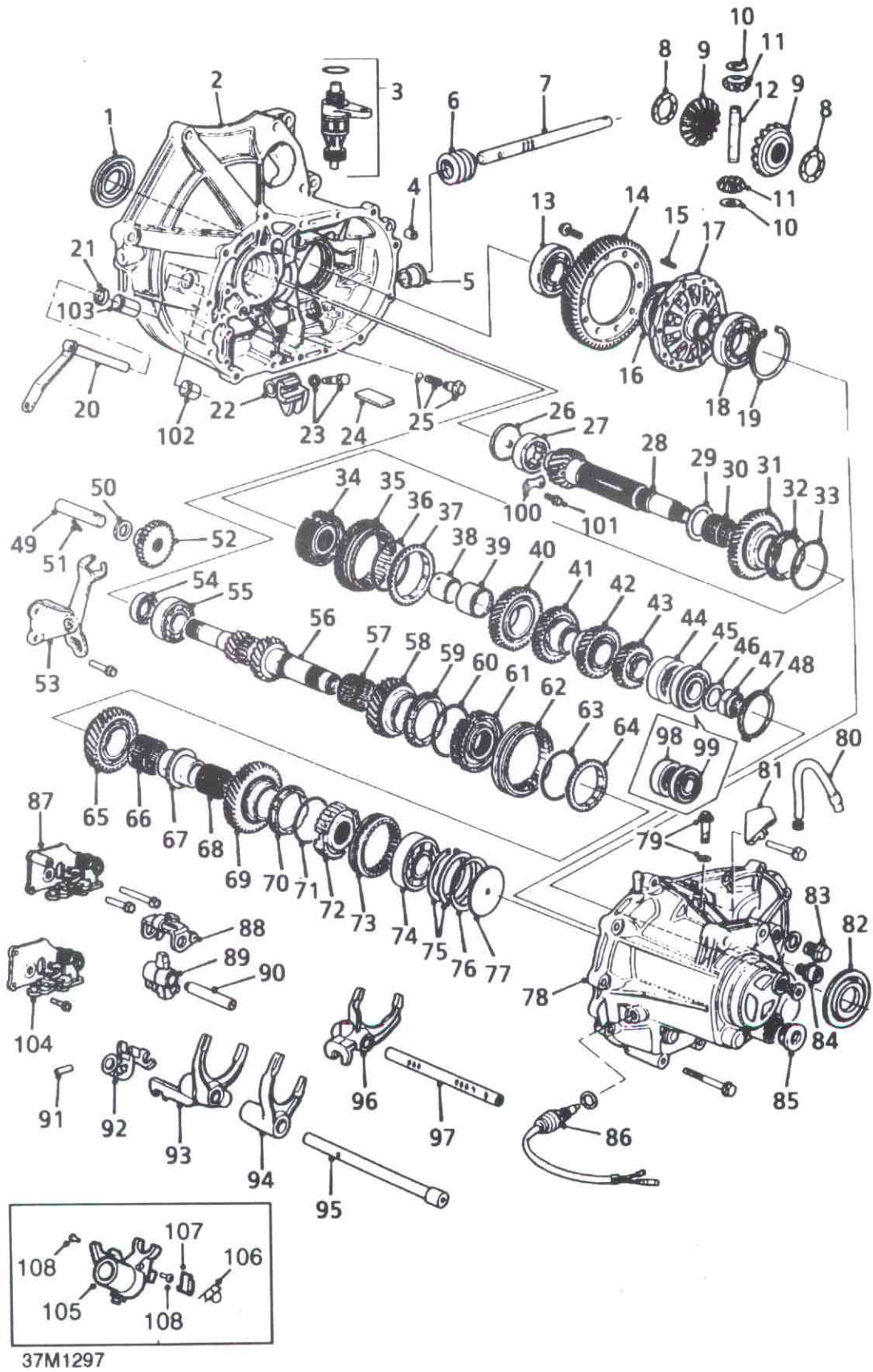
This overhaul manual is applicable to PG1 gearboxes having the following Serial No. prefixes:

C4BP	R4A0
C4BS	R4DT
C6BN	S4DTU
C6BP	S4EM
C6BS	S4FTU
S6BSU	S6A0
C6DTUT	S6BN
C6DTUTH	S6BNU
C6DUTH	S6BS
C6FTUT	S7EMU
K4BS	V4DT
K4BX	V6BS
K6A0	W4DT
K6BN	W4DTUT
K6BS	Y4A0
K7BSUT	
K7BX	
M5BS	



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MANUAL GEARBOX





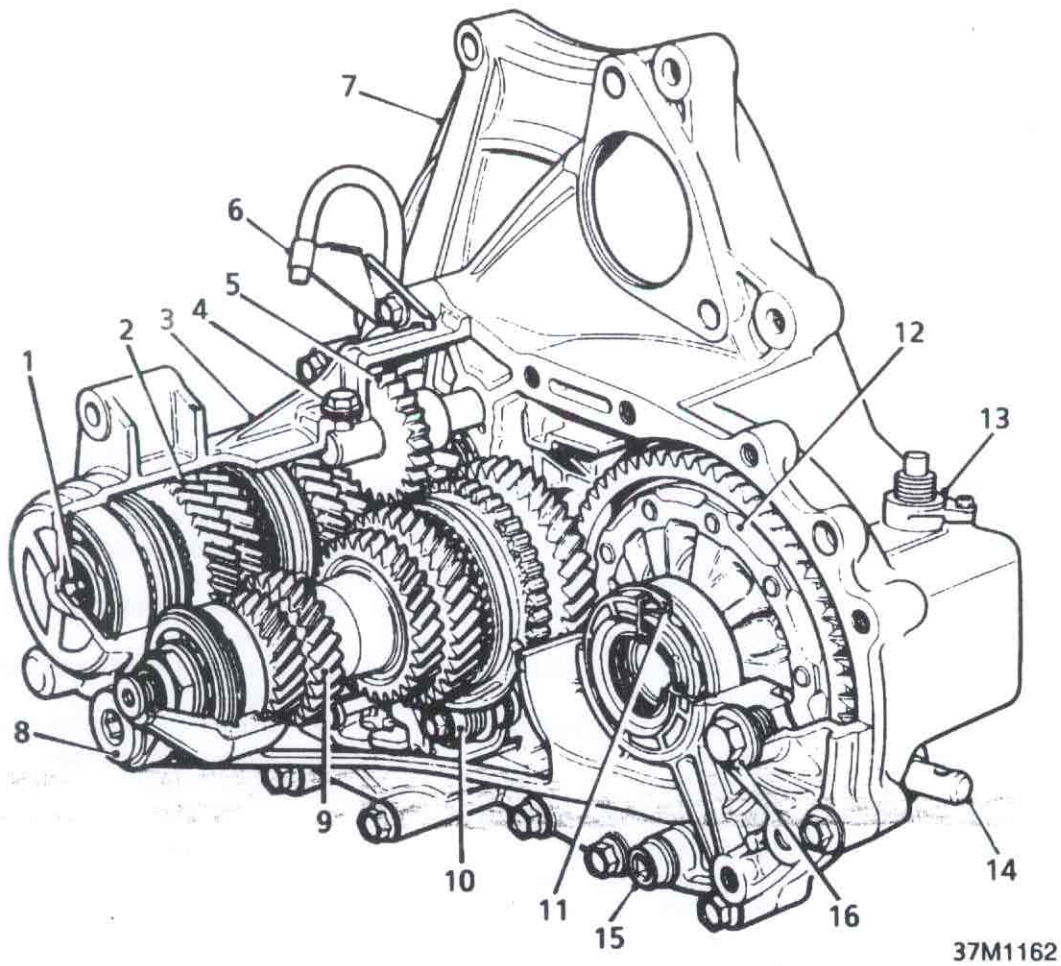
GEARBOX COMPONENTS

- | | | |
|---|---|--|
| 1. Oil seal - differential | 39. Needle roller bearing - 2nd gear | 77. Oil guide plate |
| 2. Differential housing | 40. 2nd gear | 78. Gearbox casing |
| 3. Speedometer drive pinion and housing | 41. 3rd gear | 79. Reverse idler shaft bolt and washer |
| 4. Dowel | 42. 4th gear | 80. Breather pipe |
| 5. Oil seal - selector shaft | 43. 5th gear | 81. Breather pipe bracket |
| 6. Boot | 44. Ball bearing - output shaft | 82. Oil seal - differential |
| 7. Selector shaft | 45. Ball bearing - output shaft | 83. Filler/level plug |
| 8. Thrust washer - sun gear | 46. Tongued washer | 84. Drain plug |
| 9. Sun gear | 47. Output shaft nut - L.H. thread | 85. Access plug - output shaft bearing circlip |
| 10. Thrust washer - planet gear | 48. Circlip | 86. Reverse light switch |
| 11. Planet gear | 49. Reverse idler shaft | 87. Interlock assembly - early gearboxes |
| 12. Pinion shaft | 50. Thrust washer - reverse idler gear | 88. Gearshift holder |
| 13. Ball bearing - differential | 51. Roll pin - reverse idler shaft | 89. Gearshift arm guide |
| 14. Final drive gear | 52. Reverse idler gear | 90. Shift shaft |
| 15. Roll pin - differential pinion shaft | 53. Reverse selector fork | 91. Roll pin - 5th/reverse gear selector |
| 16. Speedometer drive gear | 54. Oil seal - input shaft | 92. Gear selector - 5th/reverse gears |
| 17. Differential casing | 55. Ball bearing - input shaft | 93. Selector fork - 3rd/4th gears |
| 18. Ball bearing - differential | 56. Input shaft | 94. Selector fork - 5th gear |
| 19. Selective shim | 57. Needle roller bearing - 3rd gear | 95. Selector shaft - 5th/reverse gears |
| 20. Clutch release shaft | 58. 3rd gear | 96. Selector fork - 1st/2nd gears |
| 21. Oil seal - clutch release shaft | 59. Synchro ring - 3rd gear | 97. Selector shaft - 1st/2nd gears |
| 22. Selector shaft guide | 60. Synchro spring | 98. Bearing - roller ** |
| 23. Dowel bolt and washer | 61. Synchro hub - 3rd/4th gears | 99. Bearing - ball ** |
| 24. Magnet | 62. Synchro sleeve - 3rd/4th gears | 100. Retainer plate - output shaft bearing ** |
| 25. Detent cap bolt, ball and spring - selector shaft | 63. Synchro spring | 101. Retainer plate bolts - Patchlok ** |
| 26. Oil guide plate | 64. Synchro ring - 4th gear | 102. Clutch release shaft bush - inner |
| 27. Parallel roller bearing - output shaft | 65. 4th gear | 103. Clutch release shaft bush - outer |
| 28. Output shaft | 66. Needle roller bearing - 4th gear | 104. Interlock assembly - later gearboxes |
| 29. Selective thrust washer - 1st gear end float | 67. Distance collar - 4th/5th gears | 105. Gear selector - 5th/reverse gears/with reverse brake* |
| 30. Needle roller bearing - 1st gear | 68. Needle bearing - 5th gear | 106. Spring - reverse brake* |
| 31. 1st gear | 69. 5th gear | 107. Lock plate - reverse brake* |
| 32. Synchro ring - 1st gear | 70. Synchro ring - 5th gear | 108. Taptite screws - reverse brake* |
| 33. Synchro spring | 71. Synchro spring - 5th gear | |
| 34. Synchro hub - 1st/2nd gear | 72. Synchro hub - 5th gear | |
| 35. Synchro sleeve - 1st/2nd gear | 73. Synchro sleeve - 5th gear | |
| 36. Synchro spring | 74. Ball bearing - input shaft | |
| 37. Synchro ring - 2nd gear | 75. Selective snap rings - input shaft end thrust | |
| 38. Selective collar - 2nd gear end float | 76. Belleville washer - input shaft end thrust | |

* Gearboxes with reverse brake fitted

** Fitted to gearboxes having the letter U in the gearbox serial number prefix

MANUAL GEARBOX



SECTIONED VIEW OF GEARBOX

- | | |
|---|--------------------------------------|
| 1. Oil guide plate | 9. Output shaft assembly |
| 2. Input shaft assembly | 10. Shift arm assembly and interlock |
| 3. Gear case | 11. Selective shim |
| 4. Reverse idler shaft bolt | 12. Final drive assembly |
| 5. Reverse idler gear | 13. Speedometer drive pinion housing |
| 6. Breather pipe and bracket | 14. Selector shaft |
| 7. Differential housing | 15. Oil drain plug |
| 8. Access plug - output shaft bearing circlip | 16. Oil filler/level plug |



DESCRIPTION

The 5 speed constant mesh gearbox employs single helical gears for speed transmission and final drive. The input shaft carries the primary input gear, reverse pinion, 2nd gear and 3rd, 4th and 5th gear synchromesh hubs and idler gears. It is supported by two ballraces. End float is controlled by selective circlips and a Belleville washer. Its short input end eliminates the need for support in the engine crankshaft. The output shaft carries the final drive pinion, 1st idler gear, 1st and 2nd synchromesh hubs, 2nd speed idler gears and 3rd, 4th and 5th gears. The shaft is supported in the differential housing by a parallel roller bearing and depending on application, is supported in the gearcase by either a double ballrace or a single ballrace and roller bearing. Pinion location is controlled by a selective washer. The rear end of the shaft is secured by a circlip which retains the bearings in the gear case. Synchromesh is by spring rings and spline extensions in the inner faces of the synchromesh sleeves. Gear selection is via an interlock and gearshift holder assembly which transmits movement of the main selector shaft to the selector forks. Later specification gearboxes employ a reverse brake mechanism. Lubrication is by splash. An oil gutter located on the upper side of the gear case collects splashed oil and directs it to oil guide plates which distribute it to the hollow input and output shafts.

DESCRIPTION - TORSEN DIFFERENTIAL

Gearboxes fitted to certain models incorporate a 'Torsen' limited slip differential. The word 'Torsen' is derived from torque sensing which describes the principle of operation.

Two types of differential are fitted, type A is fitted to gearboxes having serial number prefixes K4BX and K7BSUT. Type B is fitted to gearboxes having serial number prefixes C6FTUT; W4DTUT; C6DTUT and C6DTUTH.

Type A

The assembly comprises a final drive gear bolted to the differential casing; two helical gears splined to the drive shafts and three pairs of element gear assemblies arranged at 120° intervals within the differential casing and running at right angles to the helical gears. Each of the element gear assemblies comprises a worm gear and two spur gears running on a journal pin. The worm gears are in constant

mesh with the helical gears and the spur gears mesh with those of the adjoining element gear assembly. Axial thrust of the helical gears is controlled by a combination of thrust washers and needle roller bearings located at each end of and between the two gears.

Type B

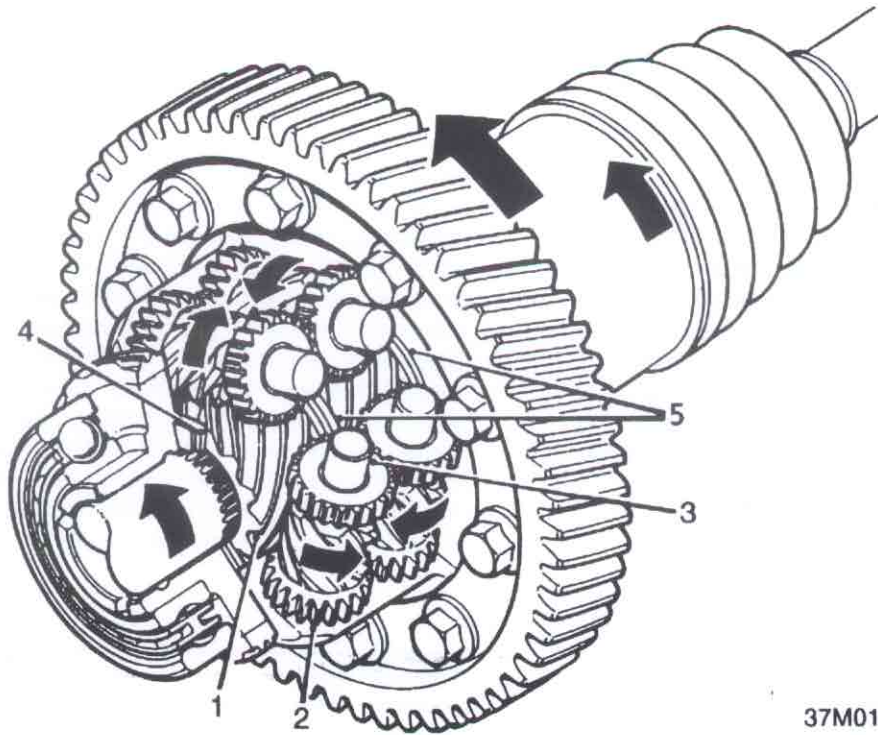
The assembly comprises a final drive gear bolted to the differential casing two helical side gears splined to the drive shafts and four pairs of element gear assemblies arranged at ninety degree intervals within the differential casing and running parallel to the side gears. Each of the element gear assemblies comprises two helical gears of unequal length, the long gears are in constant mesh with the helical side gears splined to the drive shafts and also with the short gears of the adjoining element. Axial thrust of the helical side gears is controlled by thrust washers located between the end of each gear and the differential casing and by a thrust washer and friction washer located between the two gears.

OPERATION

With the exception of reverse all gears are in constant mesh. Forward ratios are obtained by locking a gear to its shaft using its individual synchronizer hub and sleeve. Reverse gear is obtained by engaging reverse idler gear with the reverse gears changing the direction of rotation of the output shaft. When a forward gear is selected the synchronizer sleeve presses the synchromesh female cone into contact with a corresponding male cone in the gear chosen. This synchronizes the speeds of the synchronizer hub and gear. The synchronizer sleeve then engages the gear and by means of a spring ring, teeth extensions on the synchronizer sleeve and detents in the selector shaft holds the selected gear in engagement. Torque is transmitted from the input shaft through the selected gear to the output shaft pinion and final drive gear to the drive shafts.

MANUAL GEARBOX

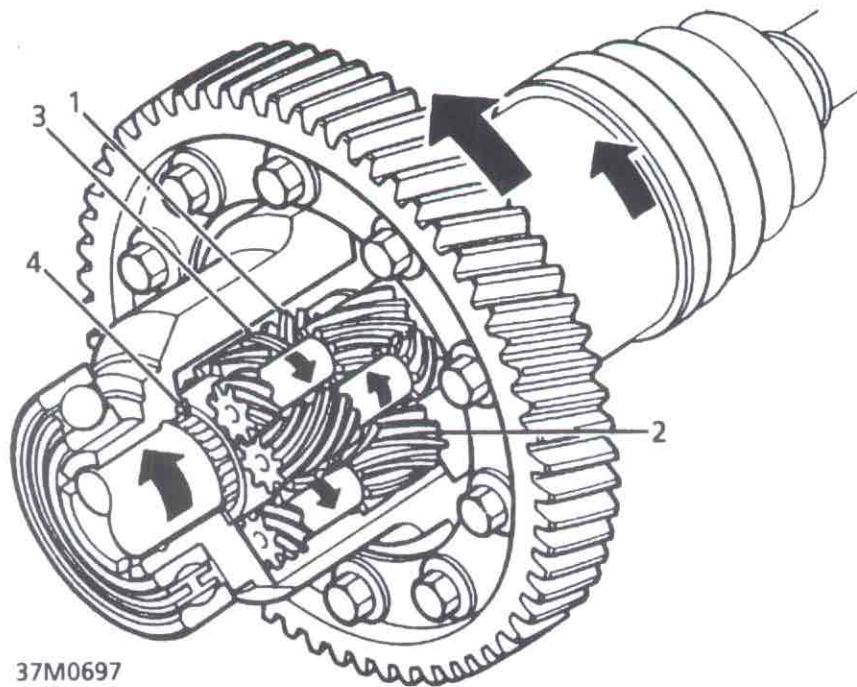
OPERATION - TORSEN DIFFERENTIAL



37M0181

**Torsen differential - Type A - Serial number
prefixes K4BX and K7BSUT**

1. Helical side gear
2. Element gear assembly - worm and spur gears
3. Journal pin
4. Thrust washer and spacing washer
5. Two thrust washers and needle roller bearing



37M0697

Torsen differential - Type B - Serial number prefixes C6FTUT; W4DTUT; C6DTUT and C6DTUTH

1. Helical side gear
2. Element gear assembly - helical gears
3. Friction washers
4. Thrust washers

Unlike a conventional limited slip differential, the torque sensing differential does not rely on the locking value of friction discs but by the friction produced by the teeth of the two helical side gears splined to the drive shafts meshing with the gears of the element gear assemblies. On Type A differentials, additional locking values are generated by the thrust washers and needle roller bearings located at each end of and between the side gears; whilst on Type B differentials, a combination of thrust washers and friction washers is used.

When both front wheel speeds are equal, then the frictional loads imposed by the element gears on the side gears are also equal. However, when the drive resistance on a road wheel is reduced through loss of traction then a torque imbalance is created; less torque being required to turn the wheel with the highest speed. This torque imbalance is sensed by the differential and results in a lowering of the friction imposed by the element gears on the side gear

driving that particular wheel. This causes a reduction in wheel speed until a point is reached where traction is restored, the torque required to turn both wheels is equal and both wheels are rotating at the same speed.

MANUAL GEARBOX

DESCRIPTION - REVERSE BRAKE

A reverse brake mechanism has been introduced to the PG-1 gearbox, and is operated by the selector fork mechanism, which stops the input shaft from rotating prior to the engagement of reverse gear and provides a quiet and smooth engagement of reverse gear, providing the vehicle is stationary.

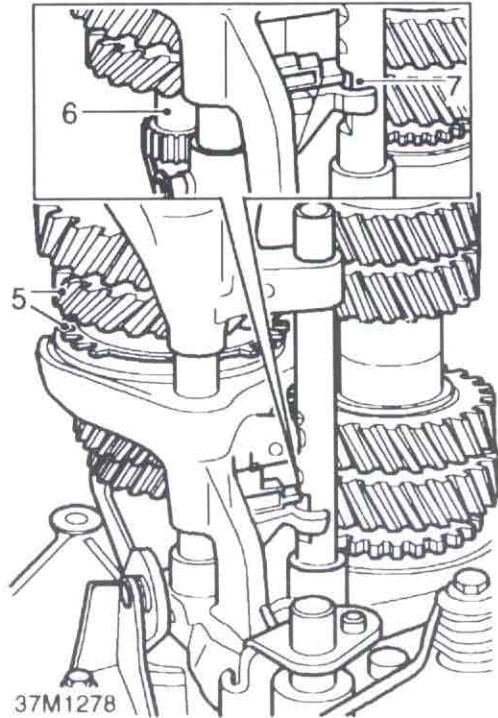
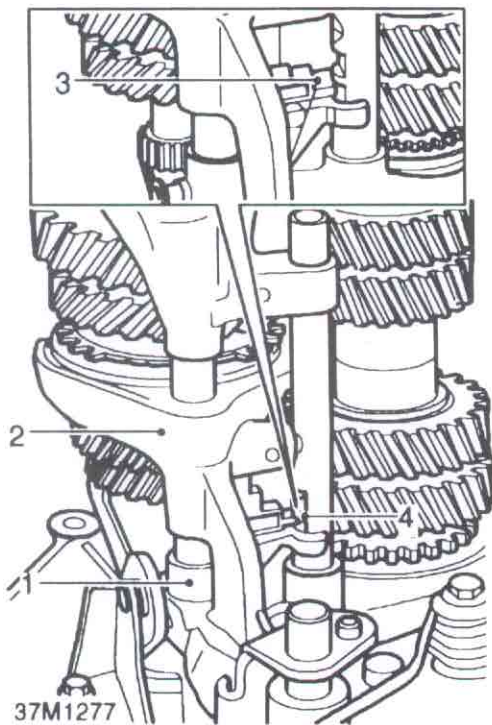
The reverse brake utilizes the 3rd/4th synchro hub for its operation. The 5th/reverse shift piece, which is secured to the selector shaft by a roll pin, and incorporates two guide lugs with two machined grooves that form a platform for a lock plate. The inner face of the lock plate is angled approximately at 45°, with two machined flanges either side of the lock plate which are positioned in machined grooves in the guide lugs. A return spring, which biases the lock plate against the stop surface, extends along the step at the front of the lock plate, with the two free ends of the spring held in position by two 'Taptite' screws either side of the shift piece. A lug on the 3rd/4th selector fork has a machined face at an angle of 45° which acts as a ramp when in contact with the angled face of the lock plate. 1st/2nd selector shaft has a machined abutment surface located below the detent grooves, the abutment surface being the area of contact for the lock plate.



OPERATION - REVERSE BRAKE

When selecting reverse gear, the 5th/reverse shift piece (1) moves upwards, and the angled face of the lock plate (3) contacts the ramp of 3rd/4th selector fork (2). The upward movement carries the lock plate (3) outwards until it contacts the abutment (4) on 1st/2nd selector shaft. From this point, continued upward movement of the 5th /reverse shift piece (1) causes the lock plate (3) to move the 3rd/4th selector and synchro sleeve (5) towards 4th gear. The movement of the 3rd/4th synchro sleeve (5) is sufficient to restrain the input shaft (6), thus permitting smooth engagement of reverse gear.

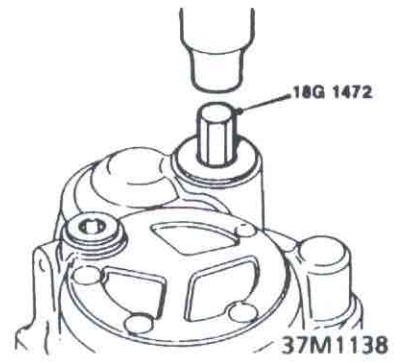
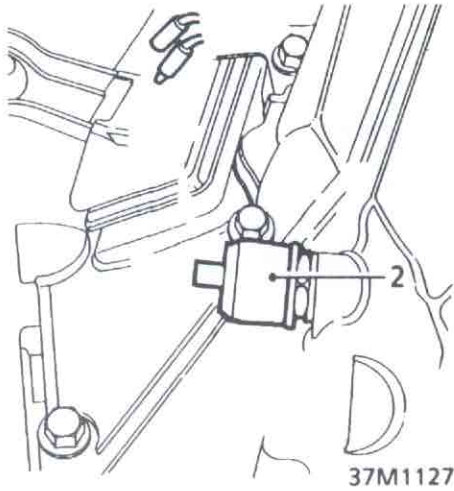
To prevent any further movement of the 3rd/4th synchro sleeve (5) and engagement of 4th gear, the spring on the lock plate (3) moves the lock plate into the machined groove (7) above the abutment (4).



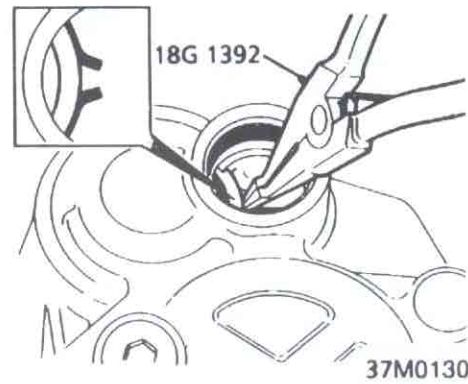


GEARBOX DISMANTLING

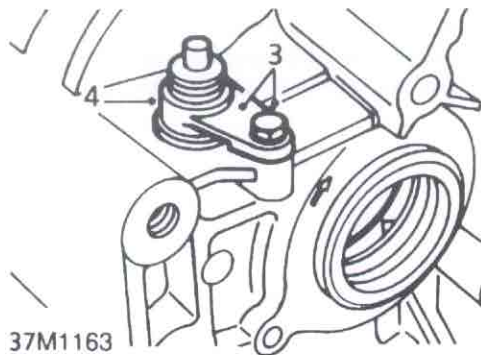
1. Thoroughly clean exterior of gearbox.



5. Remove access plug using tool 18G 1472.



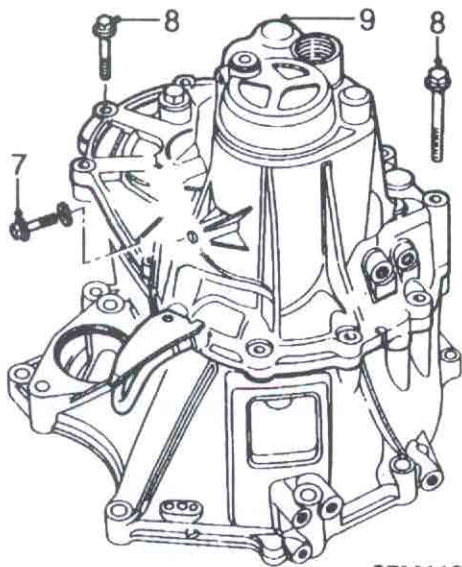
2. Remove reverse light switch; discard sealing washer.



6. Using tool 18G 1392, release circlip retaining output shaft bearing.

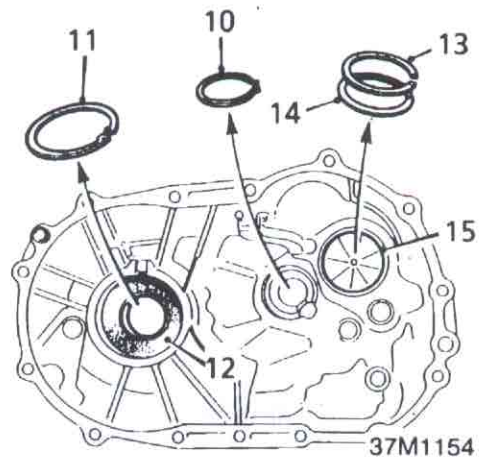
3. Remove bolt and locating plate securing speedometer drive pinion and housing.
4. Remove speedometer drive pinion and housing, discard 'O' ring.

MANUAL GEARBOX



37M1128

7. Remove bolt retaining reverse idler shaft, discard washer.
8. Noting their fitted position, remove 14 bolts securing gear case to differential housing; release breather pipe bracket.
9. Using a soft-faced mallet, release gear case from differential housing; remove gear case.

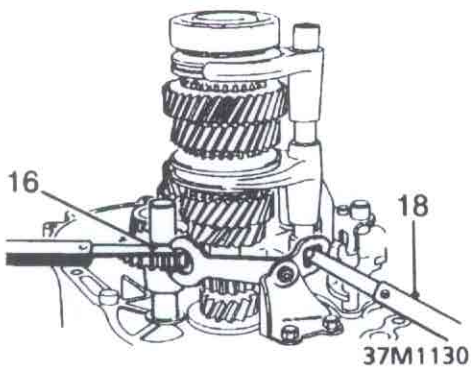


10. Remove and discard output shaft bearing circlip from gear case.
11. Remove selective circlip from differential bearing recess in gear case; retain circlip.
12. Remove differential oil seal.



CAUTION: Two types of oil seal have been fitted, retain oil seal for reference to ensure that replacement is of correct type.

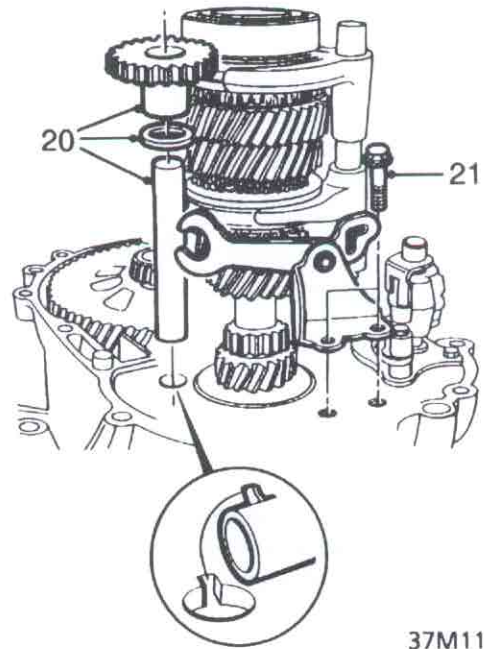
13. Remove selective circlip(s).
14. Remove and discard Belleville washer.
15. Remove input shaft oil guide plate.



16. Using feeler gauges, measure clearance between reverse idler gear and selector fork. Clearance = 0.5 to 1.1 mm
17. If clearance obtained exceeds above figure, measure width across prongs of selector fork. Prong width = 13.0 to 13.3 mm.
18. Using feeler gauges, measure clearance between pin and selector fork groove. Standard = 0.05 to 0.35 mm
Service limit = 0.5 mm
19. If clearance obtained exceeds service limit, measure width of selector fork groove. Groove width = 7.05 to 7.25 mm

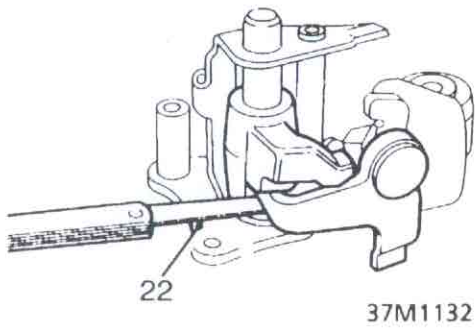


CAUTION: If dimensions obtained exceed figures given, selector fork must be replaced.



20. Remove reverse idler gear, thrust washer and idler shaft.
21. Remove 2 bolts securing reverse selector fork bracket; remove bracket and fork.

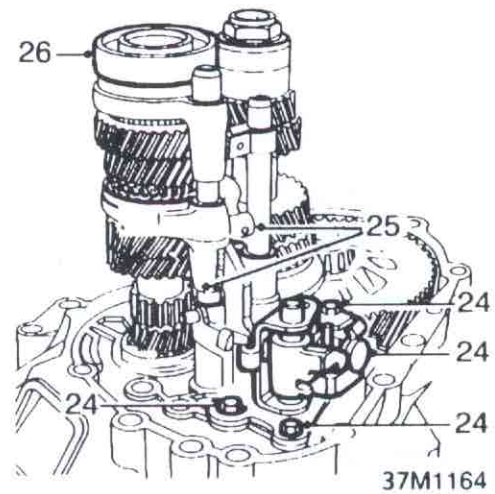
MANUAL GEARBOX



22. Using feeler gauges, measure clearance between gearshift arm and guide.
Standard = 0.2 to 0.3 mm
Service limit = 0.55 mm
23. If clearance obtained exceeds service limit, measure width of groove in guide.
Groove width = 8.1 to 8.2 mm

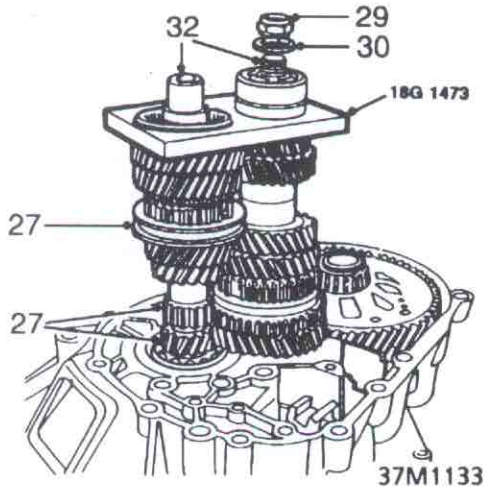


CAUTION: If dimensions obtained exceed figures given, interlock assembly must be replaced.



NOTE: Latest type interlock assembly illustrated

24. Noting their fitted position, remove 3 bolts and retaining interlock assembly; remove assembly.
25. Raise both input and output shafts slightly, remove selector forks and rails.
26. Using 2 suitable levers, remove input shaft bearing.



27. Move synchro sleeve to engage 1st and 4th gears.



CAUTION: Damage to components will result if gears other than 1st and 4th are engaged.

28. Position tool **18G 1473** on input shaft and around output shaft bearing.

29. Release staking, remove and discard nut from output shaft.

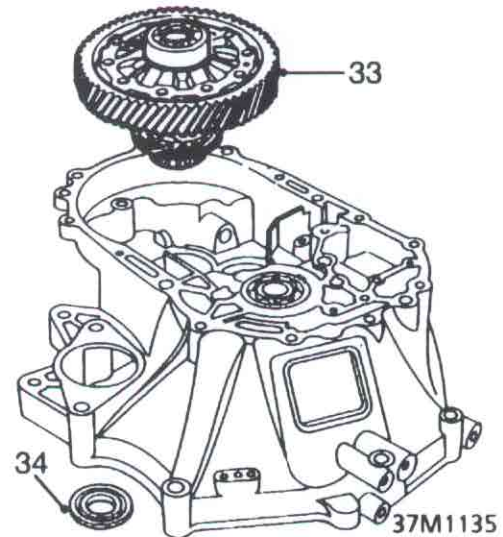


NOTE: Nut has a LH thread.

30. Remove and discard tongued washer.

31. Remove tool **18G 1473**.

32. Remove input and output shafts from differential housing.



33. Lift differential assembly out of housing.

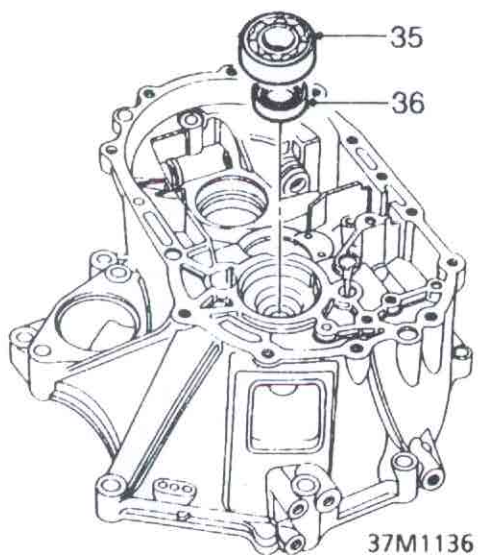


NOTE: Standard differential illustrated.

34. Remove differential oil seal.



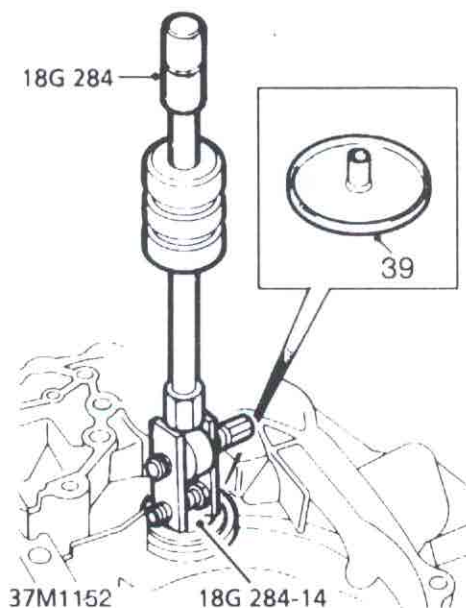
CAUTION: Two types of oil seal have been fitted, retain oil seal for reference to ensure that replacement is of the correct type.



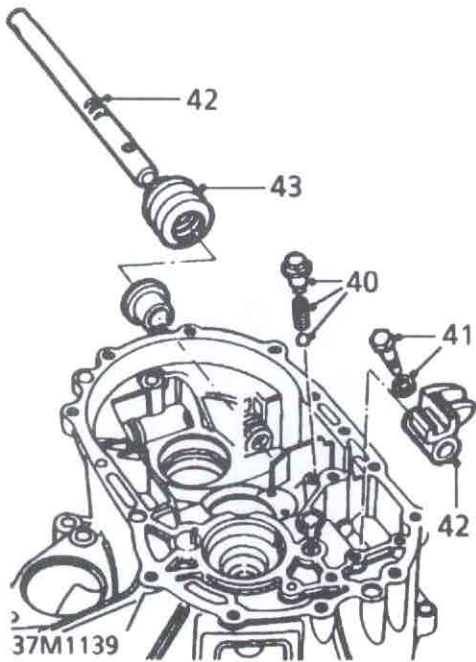
- 35. Using a soft metal drift, remove input shaft bearing from differential housing; discard bearing
- 36. Remove and discard input shaft oil seal.



- 37. Remove and discard 2 Patchlok bolts securing output shaft bearing retaining plate - if fitted; remove plate.



- 38. Remove output shaft bearing using tools 18G 284 and 18G 284-14, discard bearing.
- 39. Remove output shaft oil guide plate.

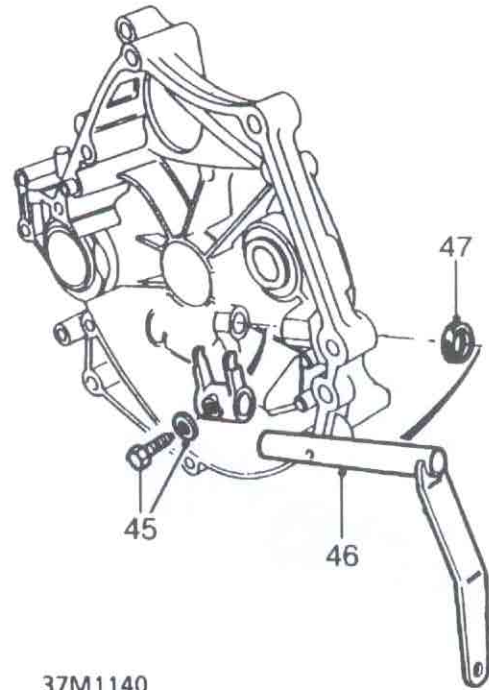


- 40. Remove detent cap bolt and washer, recover detent spring and ball.

NOTE: Use a stick magnet to recover ball.



- 41. Remove bolt and washer securing selector shaft guide to shaft.
- 42. Withdraw selector shaft; remove selector shaft guide.
- 43. Remove gaiter from shaft.
- 44. Remove and discard oil seal.



- 45. Remove bolt and washer securing clutch release fork to release shaft.
- 46. Withdraw release shaft.
- 47. Remove and discard release shaft oil seal.

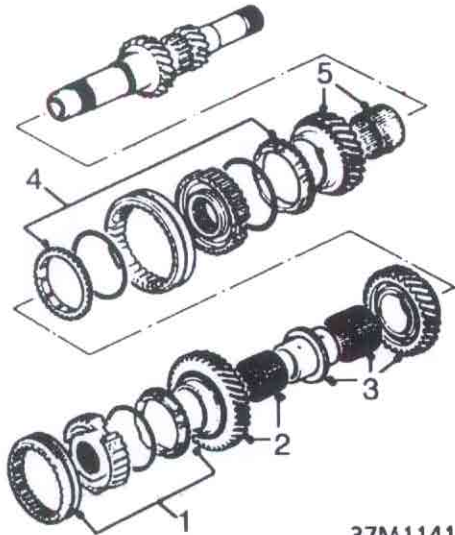
MANUAL GEARBOX

COMPONENT DISMANTLING

Input Shaft

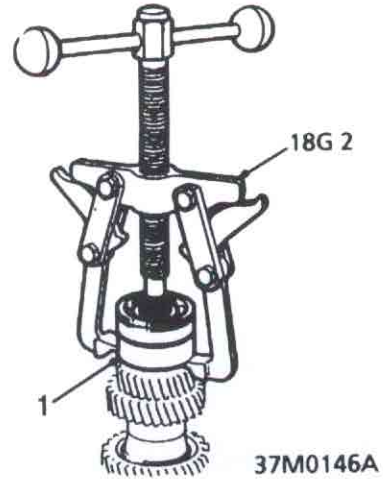


CAUTION: Keep component parts of each synchro assembly together.



1. Remove 5th gear synchro assembly.
2. Remove 5th gear and needle bearing.
3. Remove 4th gear together with collar and needle bearing.
4. Remove 3rd/4th synchro assembly.
5. Remove 3rd gear and needle bearing.

Output Shaft

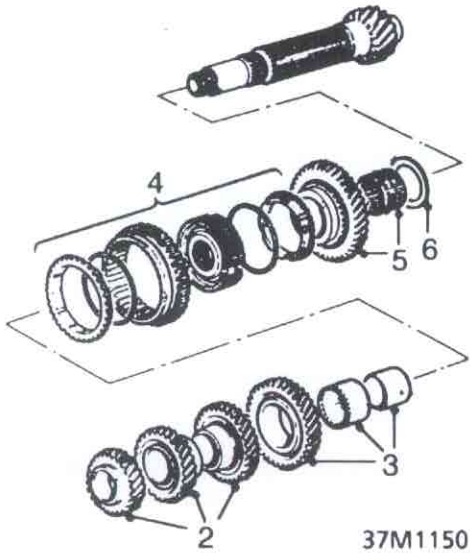


1. Remove bearings using tool 18G 2, note type of bearing fitted; discard bearings.



NOTE: Depending on the application, either a double ballrace or single ballrace and roller bearing is fitted.

Gearboxes having the letter U in the serial number prefix are all fitted with a single ballrace and roller bearing.



37M1150

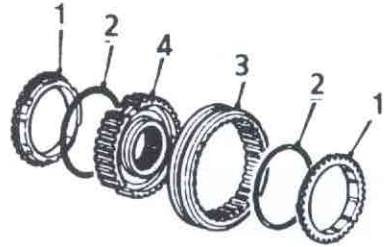
2. Remove 5th, 4th and 3rd gears.
3. Remove 2nd gear, needle bearing and collar.
4. Remove 1st/2nd synchro assembly.



CAUTION: Keep component parts of synchro assembly together.

5. Remove 1st gear and needle bearing.
6. Remove and retain selective thrust washer.

Synchro assemblies



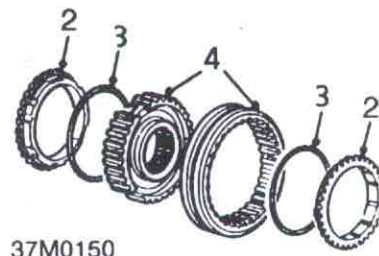
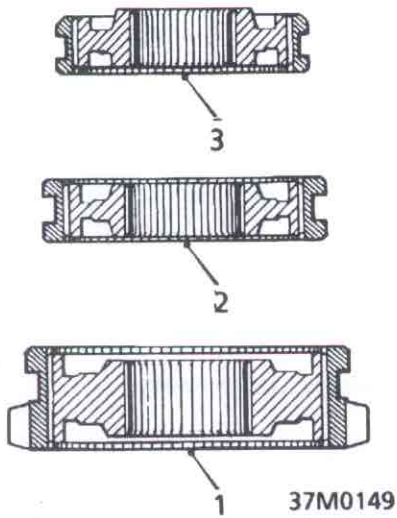
37M0148

Synchro Assembly Components

1. Synchro ring
2. Spring spring ring
3. Synchro sleeve
4. Synchro hub



NOTE: Only one synchro ring and spring ring are fitted to 5th speed synchro.



37M0150

2. Remove 2 synchro rings.
3. Remove 2 spring rings.

△ NOTE: Only one synchro ring and spring ring are fitted to 5th synchro.

4. Remove synchro hub from sleeve.

Synchro Assembly Identification

1. 1st/2nd synchro
2. 3rd/4th synchro
3. 5th synchro

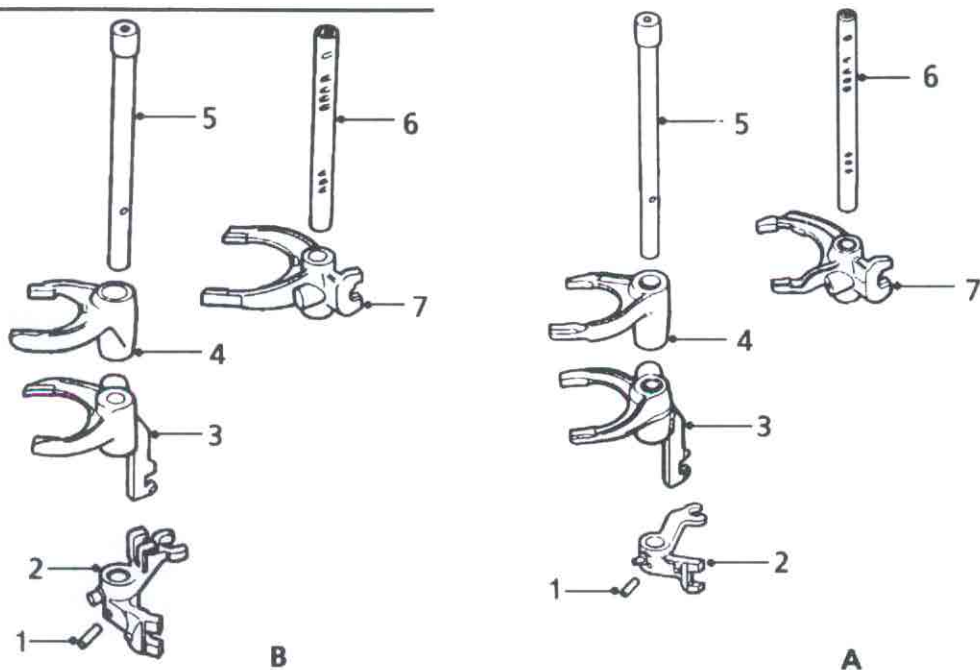


CAUTION: Keep component parts of each synchro assembly together.

1. Suitably mark relative position of each synchro hub to its respective sleeve.



Selector shafts



37M1147

Selector Shaft Components

1. Roll pin
2. 5th/reverse gear selector
3. 3rd/4th gear selector fork
4. 5th gear selector fork
5. 5th/reverse selector shaft
6. 1st/2nd gear selector fork
7. 1st/2nd selector shaft

4. Slide 5th/reverse gear selector off 5th/reverse selector shaft.
5. Slide 3rd/4th and 5th selector forks off 5th/reverse selector shaft.



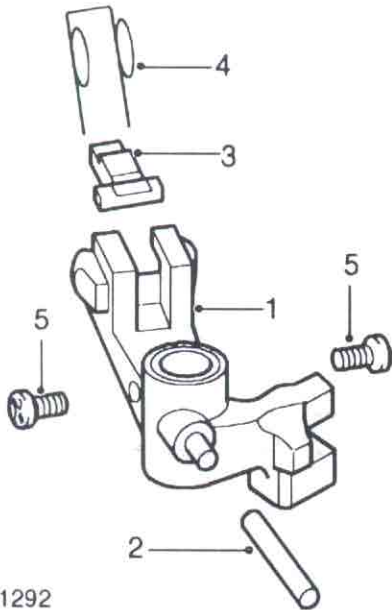
CAUTION: Two types of selector shaft assemblies have been fitted. Type A selectors are manufactured from cast steel whilst type B are manufactured from aluminium bronze and are gold in colour. Do not interchange selector forks or shafts between type A and B assemblies.

1. Identify each selector fork and its fitted position to the relevant selector shaft. Slide 1st/2nd gear selector fork off 1st/2nd selector shaft.
2. Slide 1st/2nd selector shaft out of 5th gear selector fork and 5th/reverse gear selector.
3. Using a suitable punch, remove roll pin securing 5th/reverse gear selector; discard roll pin.

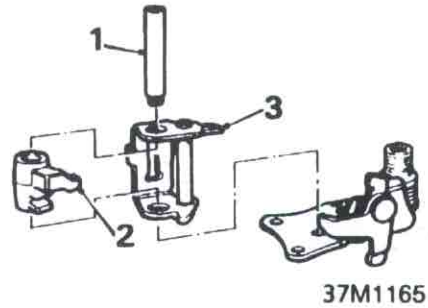
MANUAL GEARBOX

5th/Reverse Selector - with reverse brake

The 5th/reverse selector (1) is secured to the selector shaft by a roll pin (2). The selector incorporates the components for the reverse brake operation. This comprises of a lock plate (3) a retaining spring (4). The spring retains the lock plate in position, with The two ends of the spring located under two 'Taptite' screws (5) which are positioned either side of the 5th/reverse selector.



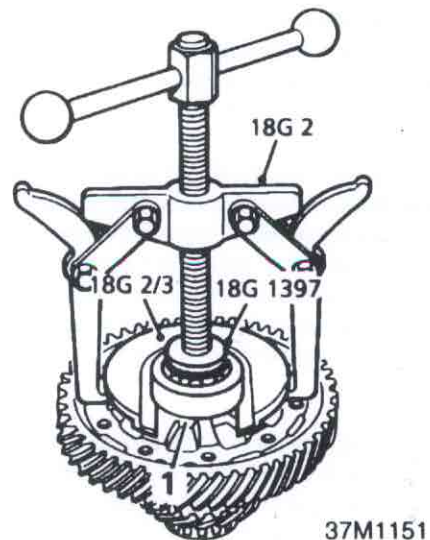
Interlock Assembly



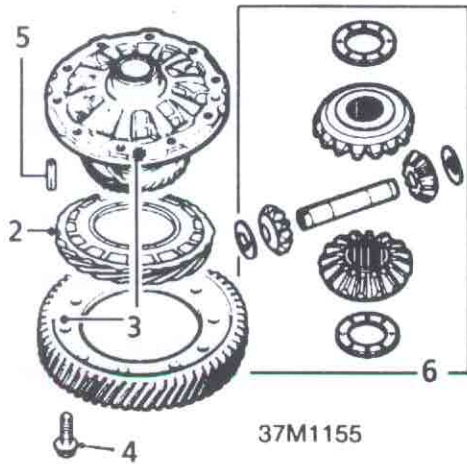
NOTE: A modified interlock assembly having 2 springs has been introduced; this assembly may be fitted as a replacement to early gearboxes.

1. Withdraw shift shaft from gearshift holder and arm guide.
2. Release lug on arm guide from slot in interlock.
3. Slide gearshift holder off arm guide.

Differential Assembly



1. Remove bearings using tools 18G 2, 18G 2/3 and 18G 1397; discard bearings.



2. Remove speedometer drive gear from carrier.
3. Suitably mark fitted position of final drive gear to carrier.
4. Progressively slacken, then remove 10 bolts securing final drive gear to carrier; remove gear.

CAUTION: With the exception of the speedometer drive gear, Torsen differentials are supplied as a complete assembly; do not dismantle.

5. Using a suitable punch, remove roll pin securing pinion shaft; discard pin.
6. Remove pinion shaft, sun gears, planet gears and thrust washers; retain thrust washers - if fitted.

NOTE: Selective thrust washers are fitted to planet gears. non-selective washers are fitted to sun gears.

INSPECTING COMPONENTS

1. Clean all components ensuring all traces of RTV sealant are removed from gear case, differential housing and access plug. Ensure oil drillings in input and output shafts and oil guide plates are clear. Ensure gearbox breather is unobstructed.



CAUTION: Do not clean plastic components with chlorinated solvent e.g. trichloroethane.

2. Check speedometer pinion for wear and pinion housing threads for damage.

Input and Output Shaft Assemblies

1. Check gears for worn or chipped teeth, cracks or uneven wear.
2. Check coning surfaces of gears for wear.



CAUTION: Gearboxes having the letter K in the Serial Number prefix: Commencing at gearbox Serial Numbers K4BS 2027303, K6BS 2018506 and K7BSUT 2002029, the helix angle of 2nd gear on both input and output shafts was changed to 33 and it is essential that if a replacement input shaft or output shaft 2nd gear is to be fitted, the correct replacement is obtained. The 33 helix gears may be fitted to gearboxes built prior to the above Serial Numbers provided that the input shaft and output shaft 2nd gear are replaced together.

3. Check needle bearings for wear and overheating (blueing).



CAUTION: Where any of the above are evident, all bearings on the shaft must be replaced.

MANUAL GEARBOX

4. Check shaft splines for wear and threads of output shaft for damage.
5. Check bearing collars for wear and damage.



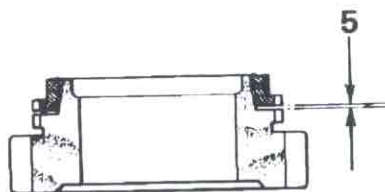
NOTE: Gearboxes having the letter U in the gearbox serial number prefix are fitted with a modified output shaft assembly having an increased diameter and shot peened gears. Due to the increased diameter of the output shaft, differential housing bearing and the method of retaining the bearing, this assembly must not be fitted to any other type of gearbox.

Reverse Idler Shaft and Gear

1. Check idler shaft for wear.
2. Check gear for wear, chipping or cracking of teeth.
3. Check needle bearings for wear, replace gear and bearings as an assembly if wear is evident.

Synchro Assemblies

1. Check component parts of each synchro assembly for wear or damage, ensure teeth on hubs and sleeves are not chipped or rounded off.
2. Ensure teeth on synchro rings are not chipped or damaged, check inner surfaces of rings for wear.
3. Ensure each hub moves freely in its respective sleeve.
4. Place a synchro ring on its respective gear cone and rotate it until it stops (approximately 10 to 20°).



37M0155

5. Measure clearance between synchro ring and gear.
Ring to gear clearance:
Standard = 0.85 to 1.1 mm
Service limit = 0.4 mm (minimum clearance)
6. Repeat for remaining rings and gears.



CAUTION: If any ring to gear clearance is less than above service limit, synchro assembly must be replaced.

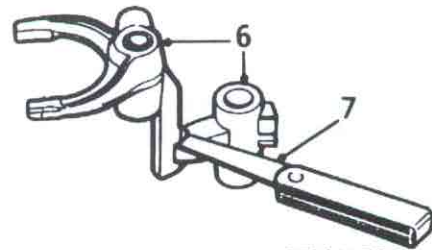


Selector Shafts and Forks



CAUTION: Type B selector shaft assembly: The selector forks fitted to the 5th/reverse selector shaft are matched to the shaft and in the event of any wear or damage, shaft and forks must be replaced as an assembly.

Do not interchange selector forks or shafts between type A and B assemblies.



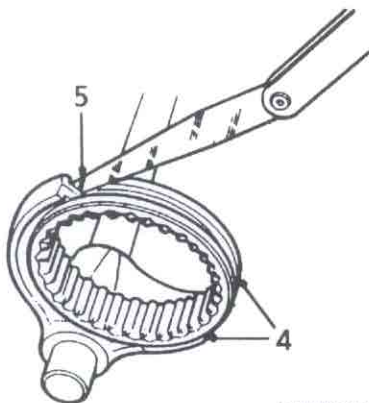
37M1156

1. Check shafts for wear and alignment.
2. Check selector forks for wear, cracks or damage.
3. Check the retained detent balls and springs, there must be no visible 'flats' on the balls and springs must keep balls in contact with the staked portion of the selector fork.



CAUTION: It is not possible to replace balls or springs, selector fork must be replaced.

6. Assemble gearshift arm guide to 3rd/4th selector fork.
7. Using feeler gauges, measure clearance between gearshift arm guide and fork.
Standard = 0.2 to 0.5 mm
Service limit = 0.8 mm
8. If clearance obtained exceeds service limit, measure width of tongue on gearshift arm guide.
Standard = 11.9 to 12.0 mm



37M0156

CAUTION: If width of tongue is within limits, 3rd/4th selector fork must be replaced, if width of tongue is less than quoted, gearshift arm guide must be replaced.

9. Repeat above procedures for 1st/2nd selector fork.

4. Assemble each selector fork to its respective synchro sleeve.
5. Check clearance of selector fork in synchro sleeve groove.
Selector fork to groove clearance:
Standard = 0.45 to 0.65 mm
Service limit = 1.0 mm

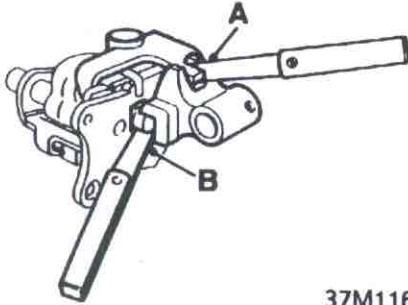


CAUTION: If clearance is found to exceed service limit, selector fork must be replaced.


MANUAL GEARBOX

Interlock Assembly


1. Check components for wear or damage, replace assembly if necessary.



37M1166


 **NOTE:** Modified interlock assembly illustrated. This assembly may be fitted as a replacement to early gearboxes but modified interlock assemblies fitted to gearboxes having Serial Number prefixes C4BP and C6BP have updated springs and must not be interchanged with modified interlock assemblies fitted to other gearboxes.

2. Assemble gearshift arm guide to interlock assembly.
3. Using feeler gauges, measure clearance **A**.
Clearance **A**:
Standard = 0.02 to 0.3 mm
Service limit = 0.55 mm
4. If clearance exceeds service limit, check width of groove in gearshift arm guide.
Groove width = 13.05 to 13.25 mm

 **CAUTION:** If width of groove exceeds above dimension, gearshift arm guide must be replaced. If width of groove is within service limit, replace interlock assembly.

5. Using feeler gauges, measure clearance **B** between interlock ball and gearshift arm guide.
Clearance **B**:
Standard = 0.05 to 0.25 mm
Service limit = 0.5 mm

6. If clearance exceeds service limit, measure outside diameter of interlock ball.
Interlock ball outside diameter = 12.05 to 12.15 mm

 **CAUTION:** If diameter of ball is within limits, replace gearshift arm guide, if diameter of ball is less than 12.05 mm, replace interlock assembly.



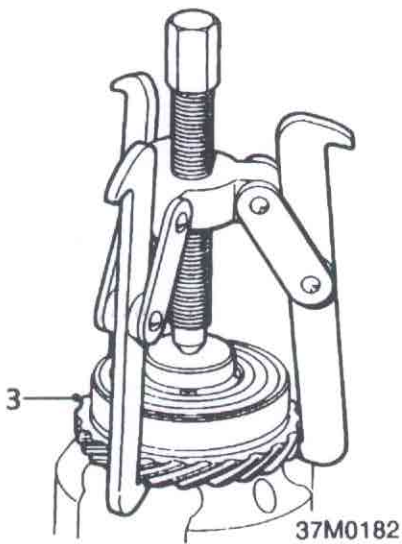
Differential Assembly

1. Check gear teeth for wear, chipping and signs of overheating.

CAUTION: It is not possible to overhaul Torsen differentials. Replace complete assembly if any of the above are apparent.

Torsen differential

2. Check speedometer drive gear for damage, replace if necessary.



3. Remove speedometer drive gear using a suitable three legged puller and thrust button.

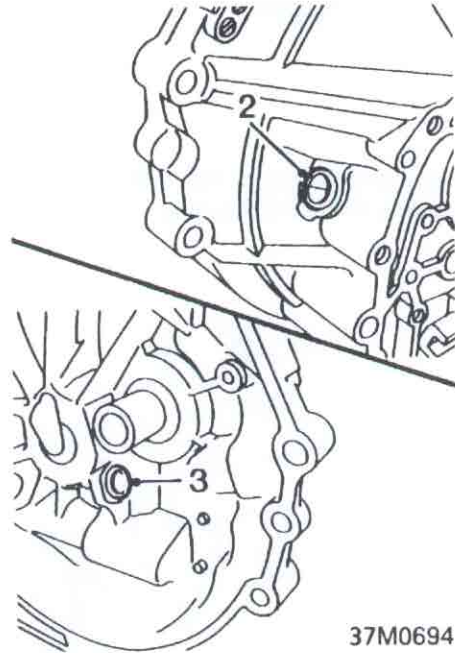
Standard differential

4. Check pinion shaft for wear.
5. Check speedometer drive gear teeth for wear or damage, replace as necessary.

Differential Housing

1. Check housing for damage, check that locating dowels are fitted; check clutch release shaft bushes for damage or wear and that shaft is free to turn, replace if necessary using the following procedure.

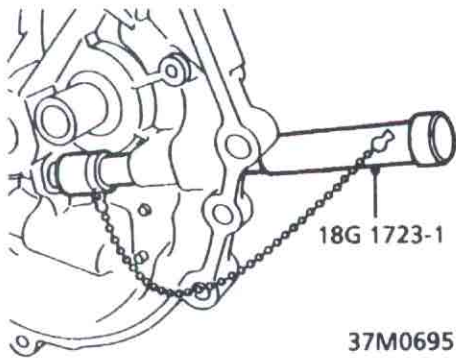
Remove



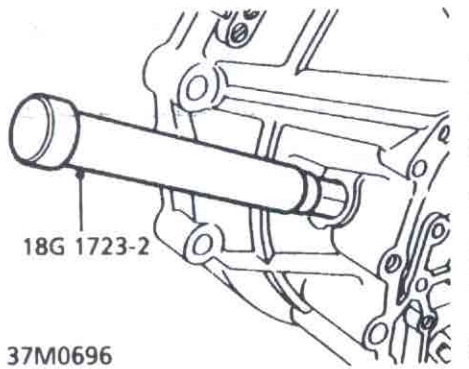
2. *Outer bush:* Using a hacksaw blade, carefully cut a longitudinal slot opposite the split in the bush; prise bush out of differential housing.
3. *Inner bush:* Carefully prise inner bush out of differential housing.

MANUAL GEARBOX


Refit




4. *Inner bush:* Using tool **18G 1723-1**, drift inner bush into differential housing.



5. *Outer bush:* Using tool **18G 1723-2**, drift outer bush into differential housing.

 **CAUTION:** Ensure end of tool **18G 1723-2** is located in inner bush.

6. *Gearboxes fitted with output shaft bearing retainer plate:* Remove all traces of Patchlok compound from output shaft bearing retainer plate bolt holes using an M6 tap.

 **CAUTION:** Ensure bolt holes are thoroughly cleaned.



COMPONENT ASSEMBLING

Differential

1. Assemble planet gears and original thrust washers.
2. Fit sun gears and original thrust washers - if fitted.
3. Rotate gears and thrust washers to align drillings in carrier.

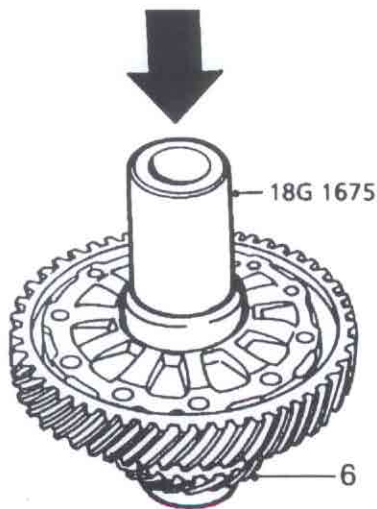


CAUTION: Do not fit roll pin or final drive gear at this stage.

Torsen differential

4. Position speedometer drive gear on carrier.
5. Using a suitable length of tubing, drift gear fully on to carrier.

Standard differential



6. Position speedometer drive gear on carrier.
7. Fit new ball bearings to carrier using tool **18G 1675**.



NOTE: Larger of the two bearings is fitted on speedometer drive gear side.

Synchro Assemblies

1. Assemble each synchro sleeve to its respective hub ensuring that raised teeth on the sleeve are aligned with the deeper grooves in hub.
2. Fit spring rings to retain hub.



NOTE: Only one spring ring is fitted on 5th speed synchro.

3. Assemble synchro rings to their respective sleeves.



CAUTION: When assembling the 5th gear synchro sleeve to hub, it is possible to position the raised teeth on the synchro sleeve in the machined cut-aways for the synchro ring. Although the gearbox can be assembled, it will not be possible to select 5th gear.

MANUAL GEARBOX

Selector Shafts

1. Slide 5th and 3rd/4th selector forks on to 5th/reverse selector shaft.



CAUTION: Ensure that longest portion of selector fork lugs face away from shoulder of shaft.

2. Slide 5th/reverse selector on to 5th/reverse selector shaft; secure selector with a new roll pin.



NOTE: Make sure the lock plate and retaining spring are correctly located on 5th/reverse selector fitted with reverse brake.

3. Slide 1st/2nd gear selector fork on to 1st/2nd selector shaft.
4. Locate 1st/2nd selector shaft in 5th/reverse gear selector and 5th gear selector fork.
5. Locate lug on shift arm guide in gearshift holder.
6. Position gearshift holder to interlock; fit shaft.

Reverse Idler Gear and Shaft

1. Fit a new thrust washer.
2. Smear needle bearing rollers with petroleum jelly and fit in idler gear.
3. Fit reverse idler gear to shaft.



NOTE: Boss on gear must face towards thrust washer.

Input Shaft



NOTE: Smear needle bearing rollers with petroleum jelly prior to assembly.

1. Fit needle bearing rollers in third gear.
2. Fit 3rd gear on shaft.
3. Fit 3rd/4th synchro assembly.
4. Fit needle bearing rollers in 4th gear, position gear on collar and fit assembly on shaft.
5. Fit needle bearing rollers in 5th gear, position gear on collar.



NOTE: Boss on 5th gear must face away from 4th gear.

6. Fit 5th synchro assembly.



NOTE: Machined groove in synchro hub must face towards 5th gear and large chamfer on synchro sleeve must face away from 5th gear.

7. Fit a new input shaft bearing.

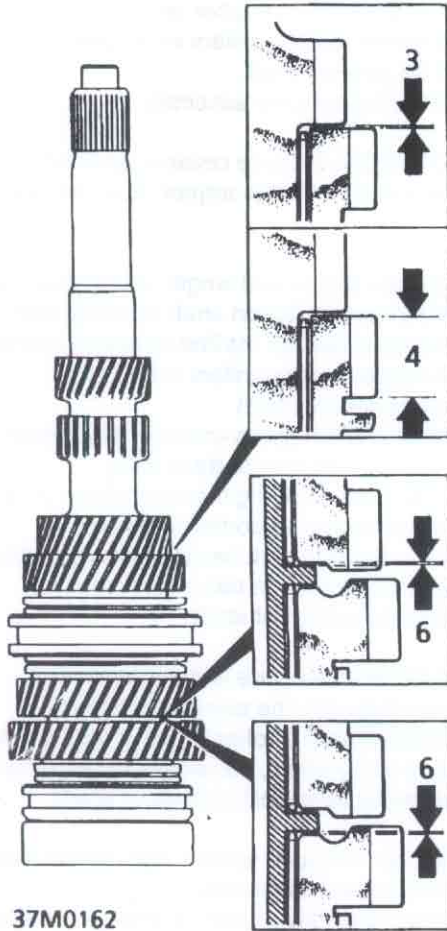


Input Shaft Gear End-float - Check

1. Position input shaft on bed of a hand press with bearing located on a suitable socket.
2. Apply downward pressure to input shaft.



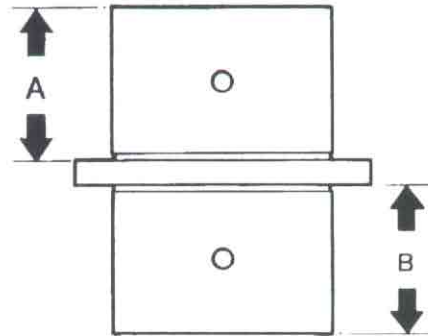
NOTE: Maintain pressure whilst checks are carried out.



37M0162

3. Using feeler gauges, measure clearance between 2nd and 3rd gears.
3rd gear clearance:
Standard = 0.06 to 0.21 mm
Service limit = 0.3 mm

4. If clearance exceeds service limit, measure thickness of 3rd gear.
3rd gear thickness:
Standard = 35.42 to 35.47 mm
Service limit = 35.30 mm
5. If 3rd gear thickness is greater than service limit, replace 3rd gear synchro assembly; if thickness is less than service limit, replace 3rd gear.
6. Using feeler gauges, measure clearance between the spacer collar and 4th gear and spacer collar and 5th gear.
4th and 5th gear clearance:
Standard = 0.06 to 0.21 mm
Service limit = 0.3 mm



37M0163

7. If clearance of either gear exceeds service limit measure length of appropriate side of spacer collar **A** or **B**.
Length A = 4th gear side
Length B = 5th gear side
Spacer collar length **A** or **B**:
Standard = 26.03 to 26.08 mm
Service limit = 26.01 mm
8. If length **A** exceeds service limit, measure thickness of 4th gear.
4th gear thickness:
Standard = 30.92 to 30.97 mm
Service limit = 30.80 mm

9. If thickness of 4th gear exceeds service limit, replace 3rd/4th synchro assembly; if thickness of gear is less than service limit, replace gear.
10. If length **B** exceeds service limit, measure thickness of 5th gear.
5th gear thickness:
Standard = 30.42 to 30.47 mm
Service limit = 30.30 mm
11. If thickness of 5th gear exceeds service limit, replace 5th synchro assembly; if thickness of gear is less than service limit, replace gear.

Output Shaft



NOTE: Smear needle bearing rollers with petroleum jelly prior to assembly.

1. Measure and record thickness of original thrust washer.
2. Fit original thrust washer on shaft.
3. Fit needle bearing rollers in 1st gear.
4. Fit 1st gear on shaft.
5. Fit 1st/2nd synchro assembly.



CAUTION: Ensure reverse gear on synchro sleeve is adjacent to 1st gear.

6. Measure and record length of 2nd gear collar.
7. Fit 2nd gear collar on shaft ensuring lubrication groove is towards 1st/2nd synchro assembly.
8. Fit needle bearing rollers in 2nd gear.
9. Fit 2nd gear on shaft.
10. Fit 3rd and 4th gears ensuring that bosses on gears are adjacent to each other.
11. Fit 5th gear ensuring that large boss on gear is towards threaded portion of shaft.
12. Fit new output shaft bearings ensuring that snap ring groove in ball race is towards threaded portion of shaft.



CAUTION: Ensure that replacement bearings are the same as originally fitted. Where a roller bearing and single ballrace is to be fitted, the single ballrace must be adjacent to threaded portion of shaft.

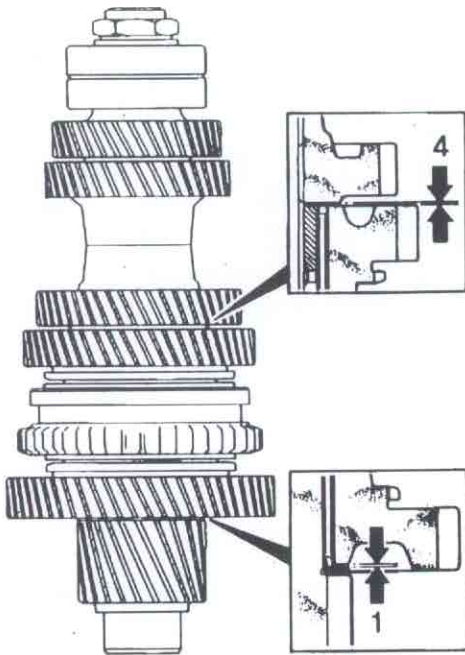
13. Fit a new tongued washer with dished side of washer towards bearing.
14. Secure final drive pinion of shaft in a soft-jawed vice.
15. Fit a new nut and tighten to 110 Nm.



NOTE: Nut has a LH thread; do not stake nut at this stage.



Output Shaft Gear End-float - Check



37M0164

6. Compare length of original collar and select a collar which will provide specified clearance. Collars are available in the following lengths: 28.99 mm and 29.04 mm
7. Having determined thickness of selective thrust washer and length of 2nd gear collar required, fit thrust washer and collar.
8. Secure output shaft nut by staking.

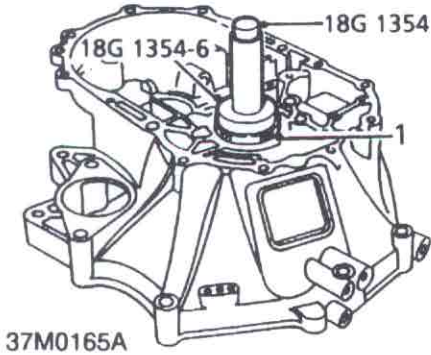
1. Using feeler gauges measure clearance between 1st gear and thrust washer.
Standard = 0.03 to 0.08 mm
Service limit = 0.18 mm
2. From clearance obtained, calculate thickness of thrust washer required to give correct clearance. If clearance obtained exceeds service limit, fit a thicker thrust washer; if it is less than 0.03 mm, fit a thinner thrust washer.

NOTE: Thrust washers are available as follows:
1.96 to 2.08 mm thick in increments of 0.03 mm.

3. Select a thrust washer of the required thickness to bring end-float within limits.
4. Using feeler gauges measure clearance between 2nd and 3rd gears.
2nd/3rd gear clearance = 0.03 to 0.10 mm
5. If clearance exceeds figure given, it will be necessary to fit a shorter 2nd gear collar; if clearance is less than figure given, it will be necessary to fit a longer collar.

MANUAL GEARBOX

Input Shaft End thrust - Check and Adjust



1. Fit a new input shaft bearing in differential housing using tools 18G 1354 and 18G 1354-6.

CAUTION: Do not fit oil seal at this stage.

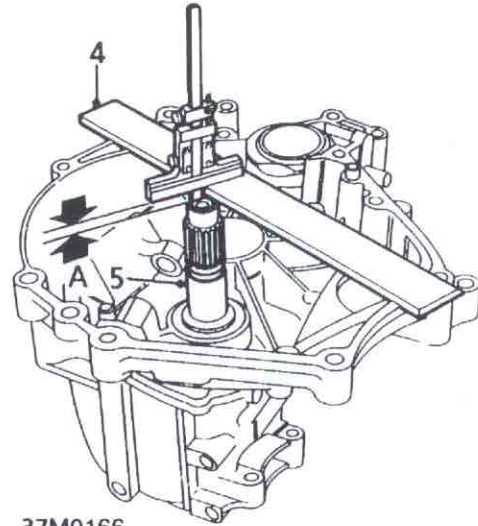


2. Position input shaft assembly in differential housing ensuring it is fully inserted in bearing.



NOTE: Position housing so that end of shaft is clear of bench.

3. Fit gear case, fit and tighten bolts to 45 Nm.



4. Position a straight edge and depth gauge across face of differential housing.
5. Pull input shaft into differential housing and position end of depth gauge on end of shaft; record measurement shown on gauge.
6. Push input shaft towards gearcase, record measurement shown on gauge.
7. Subtract thickness of straight edge from above readings.
8. Subtract first measurement from second measurement; record figure obtained. Call resultant measurement **A**.
9. Calculate thickness of circlip(s) required by subtracting 0.97 mm from dimension **A**.
Input shaft end thrust = 0.14 to 0.21 mm



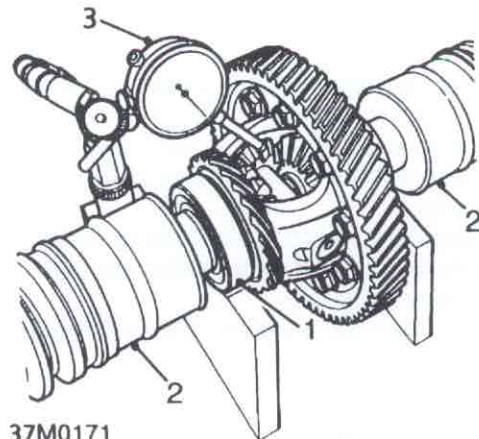
10. Select circlip(s) from sizes available which equal thickness required. Fourteen circlips are available ranging from 0.5 mm to 1.15 mm thick in increments of 0.05 mm.



CAUTION: No more than two circlips may be fitted. It is not always possible to select the exact thickness of circlips required; where this occurs, always fit a slightly thinner pack to avoid pre-loading bearings.

11. Remove bolts securing gear case; remove gear case.
12. Remove input shaft assembly.
13. Remove input shaft bearing from differential housing using a soft metal drift.

Differential Pinion Gear Backlash - Check and Adjust



1. Position differential assembly with bearings located in V blocks.
2. Fit both inboard drive shaft joints to align gears.
3. Assemble a DTI gauge with stylus of gauge contacting one of the planet gears; zero the gauge.
4. Measure and record planet gear backlash.
5. Repeat procedure for other planet gear.
6. Compare backlash figures obtained with the following:
Planet gear backlash = 0.05 to 0.15 mm
7. If backlash is not as specified, remove planet gears, measure thickness of original thrust washers and from figures obtained, calculate thickness of thrust washers required to give correct backlash.



CAUTION: Thrust washers selected must be of equal thickness, and are available from 0.70 to 0.90 mm thick in increments of 0.20 mm.

8. Fit selected thrust washers, secure pinion shaft with a new pin.

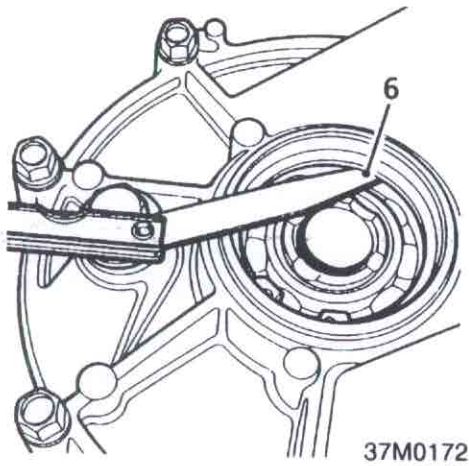
MANUAL GEARBOX

Standard and Torsen differentials:

9. Fit final drive gear to carrier ensuring reference marks are aligned.
10. Fit 10 bolts and tighten progressively to 110 Nm.

Differential Bearing Pre-load - Check and Adjust

1. Position original selective circlip in gear case.
2. Position differential assembly in differential housing.
3. Fit gear case, fit and tighten bolts to 45 Nm.
4. Lightly drive differential assembly into gear case to seat circlip.
5. Lightly drive differential into differential housing to settle bearing.



6. Using feeler gauges measure and record clearance between circlip and bearing outer face.
Correct clearance = 0.15 mm maximum

7. If clearance is not as specified, select the appropriate circlip from the range available.



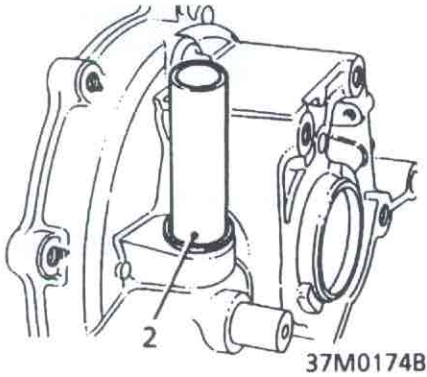
NOTE: Circlips are available from 2.50 to 3.00 mm thick in increments of 0.10 mm.

8. Remove original circlip through oil seal aperture using tool 18G 1392.
9. Fit selected circlip using tool 18G 1392.
10. Re-check bearing pre-load using above procedure.
11. Remove differential assembly, retain selected circlip.

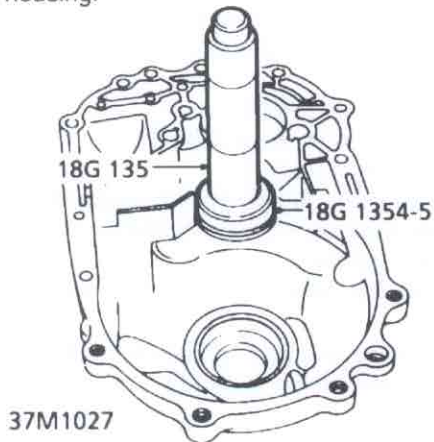


GEARBOX ASSEMBLING

1. Lightly lubricate all components with gearbox oil.

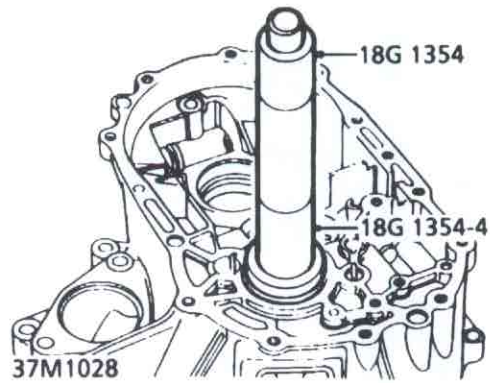


2. Using a suitable piece of tubing, fit a new selector shaft oil seal.
3. Fit output shaft oil guide plate in differential housing.

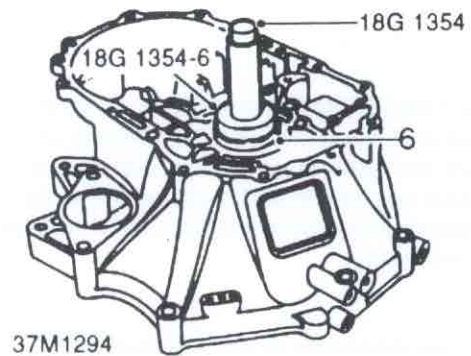


4. Fit a new output shaft bearing in differential housing using tools **18G 1354** and **18G 1354-5**.

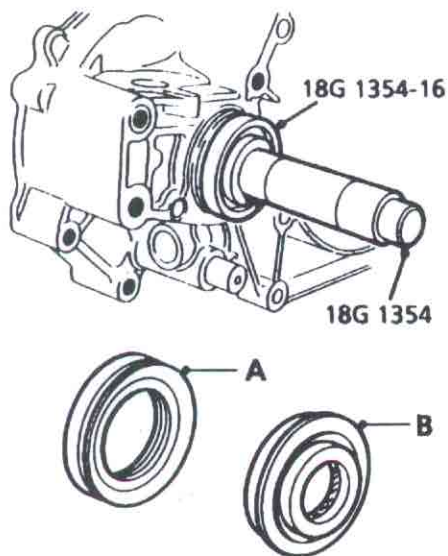
△ NOTE: Depending on application, output shaft bearing may have oil holes drilled in bearing cage; these holes must face towards output shaft when fitting bearing. Bearings without the oil hole may be fitted either way round.



5. Fit a new input shaft oil seal in differential housing using tools **18G 1354** and **18G 1354-4**.



6. Fit input shaft bearing into differential housing using tools **18G 1354** and **18G 1354-6**.



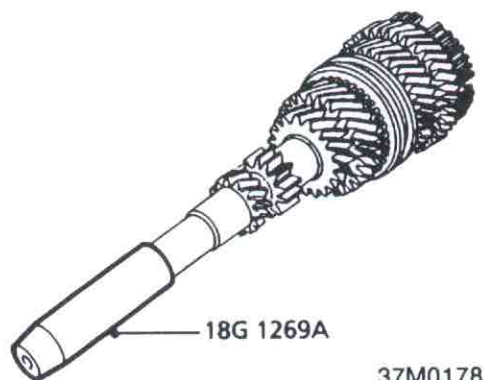
37M1145

CAUTION: Differential oil seals: Type A are fitted with early drive shafts. Type B oil seals are fitted to later drive shafts. The later oil seals are waxed and must be fitted dry. Ensure that replacement seals are the same type as those removed.

7. Fit a new differential oil seal in differential housing using tools **18G 1354** and **18G 1354-16**.
8. Fit output shaft bearing retaining plate - if fitted.

CAUTION: Ensure side marked **TOP** is facing towards output shaft.

9. Fit 2 new Patchlok bolts to secure bearing retaining plate; tighten bolts to 8 Nm.
10. Fit selector shaft and selector shaft guide.
11. Fit and tighten dowel bolt to 28 Nm.
12. Fit detent ball, spring and cap bolt, tighten bolt to 22 Nm.
13. Position differential assembly into housing.



37M0178

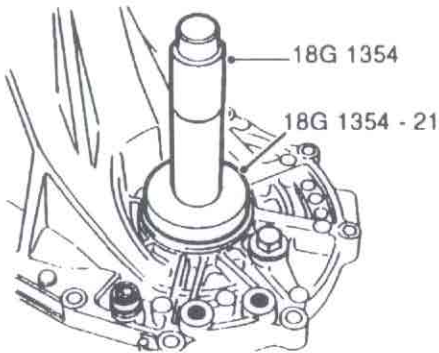
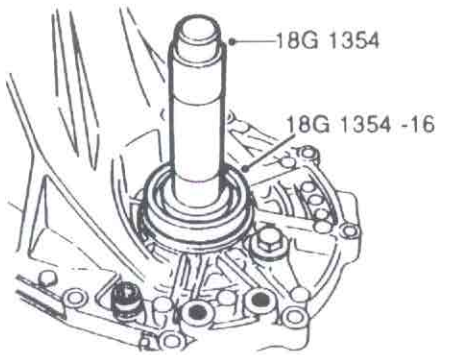
14. Fit seal protector, tool **18G 1269A** to input shaft, or apply masking tape to splines to protect oil seal.
15. Place input and output shafts together and fit assembly in differential housing.

NOTE: Position housing so that when fitted, end of input shaft is clear of bench.

16. Remove tool **18G 1269A**.
17. Ensure output shaft nut is staked.
18. Position gears in neutral.
19. Raise both shafts slightly and fit selector forks assembly ensuring forks are located in grooves in synchro sleeves.
20. Fit reverse idler gear, thrust washer and shaft.

NOTE: Large boss on idler gear must be towards differential housing.

21. Fit reverse selector fork and bracket.
22. Fit and tighten retaining bolts.
23. Fit interlock assembly ensuring base of interlock locates in slot at lower end of 1st/2nd selector shaft.
24. Fit and tighten interlock retaining bolts.



37M1146A

25. Fit new differential oil seals in gear case.



NOTE: Type A oil seal - use 18G1354 and 18G 1354-16

Type B oil seal - use 18G 1354 and 18G 1354-21

- 26. Fit input shaft oil guide plate in gear case.
- 27. Fit a new Belleville washer and selected circlip(s).
- 28. Fit selected circlip(s).
- 29. Fit new output shaft circlip in gear case.
- 30. Fit selected circlip in differential bearing recess in gear case.
- 31. Apply a bead of RTV silicone sealant to mating face of gear case.

- 32. Position gear case over differential housing keeping gear case square to housing.
- 33. Lower gear case into position and at the same time, expand output shaft bearing circlip using tool 18G 1392.
- 34. Push gear case fully down on to differential housing.
- 35. Ensure circlip is fully seated in groove in output shaft bearing, raise output shaft and a click will be heard as circlip enters groove.
- 36. Fit and progressively tighten gear case bolts to 45 Nm.
- 37. Fit reverse idler shaft bolt and tighten to 67 Nm. Use a new washer.
- 38. Apply thread sealant to access plug, fit and tighten plug using tool 18G 1472.
- 39. Fit reverse light switch and new washer, tighten to 25 Nm.
- 40. Fit speedometer drive pinion and housing, use a new 'O' ring; fit retaining plate, fit and tighten bolt to 5 Nm.
- 41. Fit new clutch release shaft oil seal.
- 42. Fit clutch release shaft and fork.
- 43. Fit and tighten bolt to 29 Nm.



DATA

Reverse idler gear to selector fork clearance	0.5 to 1.1 mm
Selector fork prong width	13.0 to 13.3 mm
Selector fork groove to pin clearance:	
Standard	0.05 to 0.35 mm
Service limit	0.5 mm
Selector fork groove width	7.05 to 7.25 mm
Gearshift arm to guide clearance:	
Standard	0.2 to 0.3 mm
Service limit	0.55 mm
Interlock shift guide groove width	8.1 to 8.2 mm
Synchro ring to gear clearance:	
Standard	0.85 to 1.1 mm
Service limit (minimum clearance)	0.4 mm
Selector shaft forks in synchro sleeve grooves clearance:	
Standard	0.45 to 0.65 mm
Service limit	1.0 mm
Gearshift arm guide to selector fork clearance:	
Standard	0.2 to 0.5 mm
Service limit	0.8 mm
Gearshift arm guide tongue width	11.9 to 12.0 mm
Gearshift arm guide to interlock assembly clearance:	
Standard	0.05 to 0.35 mm
Service limit	0.6 mm
Gearshift arm guide groove width	13.05 to 13.25 mm
Interlock ball to gearshift arm guide clearance:	
Standard	0.05 to 0.25 mm
Service limit	0.5 mm
Interlock ball outside diameter	12.05 to 12.15 mm
2nd to 3rd gear clearance:	
Standard	0.06 to 0.21 mm
Service limit	0.3 mm
3rd gear thickness:	
Standard	35.42 to 35.47 mm
Service limit	35.30 mm
4th to 5th gear clearance:	
Standard	0.06 to 0.21 mm
Service limit	0.3 mm
Spacer collar length:	
Standard	26.03 to 26.08 mm
Service limit	26.01 mm
4th gear thickness:	
Standard	30.92 to 30.97 mm
Service limit	30.80 mm
5th gear thickness:	
Standard	30.42 to 30.47 mm
Service limit	30.30 mm

MANUAL GEARBOX

1st gear to thrust washer clearance:

Standard	0.03 to 0.08 mm
Service limit	0.18 mm
2nd to 3rd gear clearance	0.03 to 0.10 mm
Input shaft end thrust	0.14 to 0.21 mm
Planet gear backlash	0.05 to 0.15 mm
Differential bearing to circlip clearance	0.15 mm maximum

TORQUE SETTINGS

Final drive pinion nut	110 Nm
Differential housing to gearcase bolts	45 Nm
Selector shaft guide to selector shaft bolt	28 Nm
Cap bolts - detent balls and springs	22 Nm
Reverse idler shaft bolt	67 Nm
Speedometer drive pinion retaining plate bolt	5 Nm
Reverse light switch	25 Nm
Clutch release shaft pivot bolt	29 Nm
Final drive gear to carrier bolts	110 Nm
Output shaft bearing retainer bolts - if fitted	8 Nm

TOOL NUMBERS

18G 2	General purpose puller
18G 2/3	Adapter - Differential bearing remover
18G 134	Driver handle - main tool
18G 134-12	Adapter - Type B differential oil seal replacer
18G 284	Slide hammer
18G 284-14	Adapter - Slide hammer
18G 1269A	Oil seal protector sleeve
18G 1354	Driver handle (main tool)
18G 1354-4	Input shaft oil seal replacer
18G 1354-5	Bearing replacer
18G 1354-6	Adapter - Input shaft differential bearing
18G 1354-16	Adapter - Type A differential oil seal replacer
18G 1392	Circlip pliers
18G 1397	Bearing puller thrust pad
18G 1472	14 mm Hex key access plug
18G 1473	Anti-spread plate
18G 1675	Differential bearing replacer
18G 1723-1	Clutch release shaft inner bush replacer
18G 1723-2	Clutch release shaft outer bush replacer