






Chapter 7 Part A:

Manual transmission

Contents

General information	1	Manual transmission overhaul - general information	4
Manual transmission - removal and refitting	3	Reversing light switch - testing, removal and refitting	2
Manual transmission oil renewal	See Chapter 1A or 1B		

Degrees of difficulty

<p>Easy, suitable for novice with little experience</p> 	<p>Fairly easy, suitable for beginner with some experience</p> 	<p>Fairly difficult, suitable for competent DIY mechanic</p> 	<p>Difficult, suitable for experienced DIY mechanic</p> 	<p>Very difficult, suitable for expert DIY or professional</p> 
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Specifications

General

Transmission type:	
Up to March 1994	LT77 type transmission; five forward speeds and reverse
March 1994 onwards	R380 type transmission; five forward speeds and reverse

Torque wrench settings

	Nm	lbf ft
Clutch slave cylinder-to-bellhousing bolts	25	18
Transfer gearbox-to-main transmission bolts	45	33
Transmission bellhousing-to-engine flywheel housing bolts and nuts	40	30

1 General information

Two different types of five-speed transmission have been available on the Discovery - models up to March 1994 had the LT77 transmission, while those after this date have the new R380 unit.

Drive from the clutch is picked up by the input shaft, which runs in parallel with the

layshaft and the mainshaft. The input shaft runs on the same axis as the mainshaft, and a bearing between the two shafts allows the shafts to rotate independently. A fixed gear at the rear of the input shaft drives the layshaft. The input shaft and mainshaft gears are in constant mesh, and selection of gears is by sliding synchromesh hubs, which lock the appropriate mainshaft gear to the mainshaft. The direct-drive fourth gear is obtained by locking the input shaft to the mainshaft.

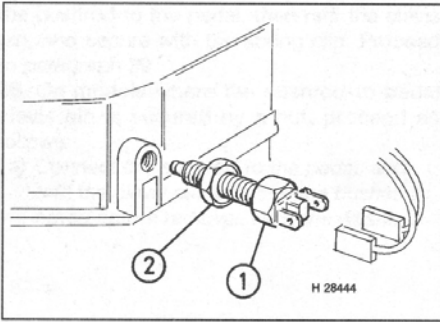
Reverse gear is obtained by sliding an idler

gear into mesh with two straight-cut gears on the mainshaft (the 1st/2nd gear synchro sleeve) and the layshaft.

All the forward gear teeth are helically-cut, to reduce noise and to improve wear characteristics.

The mainshaft provides drive to the transfer gearbox, which is described in part C of this Chapter.

Gear selection is by means of a floor-mounted gearchange lever, acting directly on the gearchange rail in the transmission.



2.1 Reversing light switch (1) and locknut (2) - LT 77 type gearbox

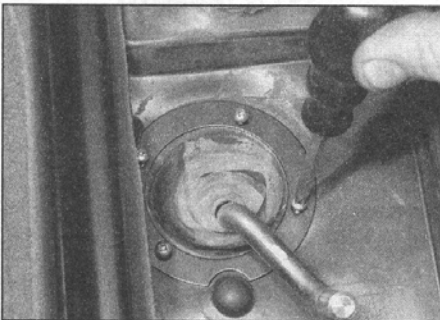
2 Reversing light switch - testing, removal and refitting



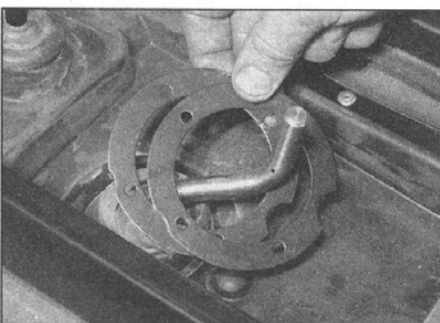
LT77 type transmission

Testing

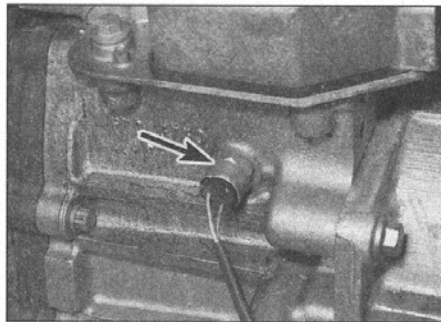
- 1 The reversing light switch is located in the rear of the main transmission selector housing, and is accessible from under the vehicle (see illustration).
- 2 Disconnect the battery negative lead, and disconnect the wiring from the switch.
- 3 Connect a continuity tester or an ohmmeter across the switch terminals. There should be no continuity (infinite resistance) between the switch terminals.
- 4 Engage reverse gear. There should now be continuity (close to zero resistance) between the terminals.



3.6a Remove the securing screws ...



3.6b ... and withdraw the selector lever insulation clamp rings



2.16 Reversing light switch location (arrowed) - R380 type gearbox

5 If the above readings are not as expected, try cleaning the switch terminals. If the readings are still not as expected, it is likely that the switch is faulty or incorrectly positioned. The switch can be tested after it is removed.

Removal

- 6 Disconnect the battery negative lead.
- 7 Disconnect the wires from the terminals on the switch.
- 8 Loosen the switch locknut, then unscrew the switch from the selector housing.

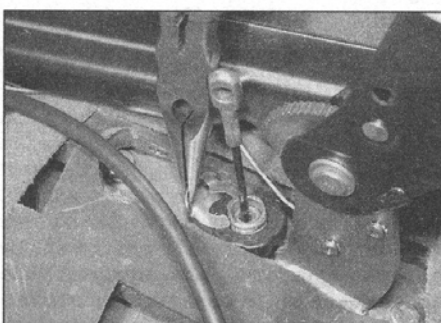
Refitting

- 9 Select reverse gear.
- 10 Loosely screw the switch into position in the selector housing (ensure that the locknut is fitted to the switch).
- 11 Connect a 12-volt supply to one of the switch terminals, and connect a test light between the remaining terminal and earth.
- 12 Screw the switch into the selector housing until the test light illuminates, then screw the switch into the housing a further half-turn.
- 13 Tighten the locknut, ensuring that the switch does not move.
- 14 Disconnect the test light, and reconnect the wiring to the switch.
- 15 Reconnect the battery negative lead.

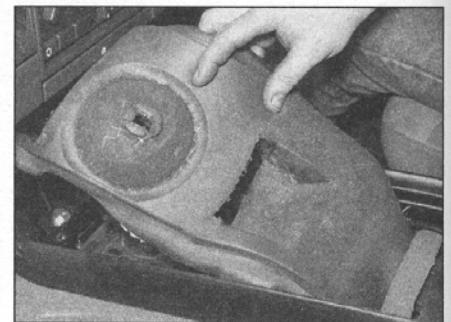
R380 type transmission

Testing

- 16 The switch is located in the left-hand side of the transfer gearbox casing (see illustration).
- 17 Testing is as described in paragraphs 1 to 5.



3.7a Prise off the C-clip ...



3.4 Lifting the sound insulation from the top of the transmission tunnel

Removal

- 18 Disconnect the battery negative lead.
- 19 Separate the two halves of the switch wiring connector.
- 20 Unscrew the switch from the gearbox casing, and recover the sealing ring.
- 21 Examine the condition of the sealing ring, and renew if necessary.

Refitting

- 22 Refitting is a reversal of removal, but use a new sealing ring if necessary.

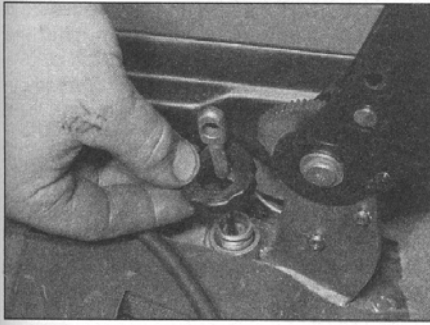
3 Manual transmission - removal and refitting



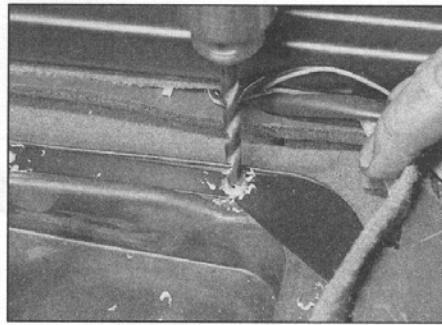
Removal

Note: Although the following procedure is not difficult, the transmission assembly (the main transmission is removed complete with the transfer gearbox) is heavy, and awkward to handle. Read through the entire procedure before proceeding, to familiarise yourself with the steps. The help of an assistant will prove invaluable during this operation. A suitable engine lifting crane and tackle will be required, and (on diesel models) sealing compound will be required to seal the mating faces of the flywheel housing and transmission bellhousing on refitting.

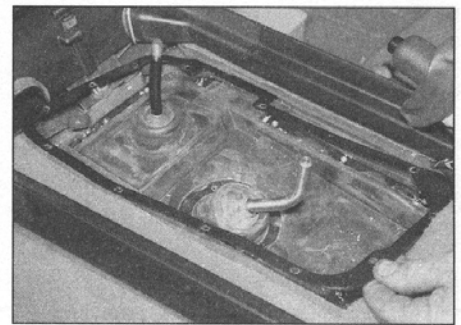
- 1 Disconnect the battery negative lead.
- 2 Jack up the vehicle, and support securely on axle stands placed under the axle tubes (see *Jacking and vehicle support*). Note that the vehicle must be raised sufficiently to give enough clearance for the transmission assembly to be removed from under the vehicle.
- 3 Remove the centre console as described in Chapter 12.
- 4 Lift the sound insulation from the top of the transmission tunnel (see illustration).
- 5 If not already done, unscrew the securing bolt, and remove the upper section of the gear lever.
- 6 Remove the securing screws, and withdraw the main transmission selector lever insulation clamp rings (see illustrations).
- 7 Prise off the C-clip, and withdraw the handbrake cable adjuster (see illustrations).



3.7b ... and withdraw the handbrake cable adjuster



3.8a Drill out the rivets ...



3.8b ... remove the retaining plate ...

Release the handbrake cable from the hole in the transmission tunnel.

8 Remove the securing screws, or drill out the rivets (as applicable), and remove the lever surround from the transmission tunnel (see illustrations).

9 Move the transfer gearbox selector lever to the Low range position, to prevent the selector lever from fouling the transmission tunnel when removing the gearbox.

10 Unscrew the bolt securing the gearbox breather pipe clip to the rear of the engine.

11 Remove the viscous fan unit and cowl, as described in Chapter 3 (this is necessary to allow the engine to tilt during the transmission removal procedure).

12 If work is to be carried out on the main transmission and/or transfer gearbox, drain the oil from the main transmission and/or the transfer gearbox, with reference to the relevant part of Chapter 1 if necessary.

13 Remove the exhaust front section as described in Chapter 4D.

14 Release the exhaust centre section from its mountings, then move the exhaust system to one side. Support it by suspending it from the chassis using wire or string.

15 Unscrew the bolts securing the clutch slave cylinder to the transmission bellhousing.

16 Release the clutch slave cylinder from the bellhousing, and recover the spacer. Move the slave cylinder clear of the bellhousing, but take care not to strain the hydraulic fluid pipe.

17 Remove the propeller shafts as described in Chapter 8 (it is only strictly necessary to

disconnect the propeller shafts from the transfer gearbox, but it is recommended that the shafts are removed completely, to provide additional working space).

18 Working under the vehicle, where applicable, release the securing ring, and disconnect the speedometer cable from the transfer gearbox.

19 Again working under the vehicle, disconnect all electrical wiring connectors from the main transmission and the transfer gearbox, noting their locations. Release the wiring from any clips on the main transmission/transfer gearbox casing, noting its routing.

20 The main transmission/transfer gearbox assembly must now be supported, to enable the support crossmember to be removed from underneath the vehicle. This is most easily and safely accomplished using an engine crane, as follows:

a) Working under the vehicle, unscrew one of the top securing bolts from the power take-off cover at the rear of the transfer gearbox. Make up a lifting bracket, and bolt it to the transfer gearbox using the previously-removed bolt (see illustration).

b) Pass a lifting strap or chain around the main transmission casing. Pass the ends of the strap/chain up through the hole in the transmission tunnel.

c) Attach a second lifting strap/chain to the lifting bracket on the transfer gearbox, and again pass the end of the strap/chain up through the transmission tunnel.

d) Open one of the front doors, and secure the door in the fully-open position using a length of string.

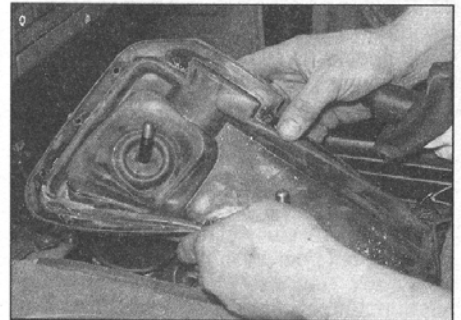
e) Pass the engine lifting crane in through the front door aperture, and position the lifting hook over the transmission tunnel aperture. Attach the previously-positioned lifting straps to the crane (see illustration). Take care not to damage the interior trim when positioning the lifting gear.

f) Raise the crane sufficiently to just take the weight of the transmission assembly.

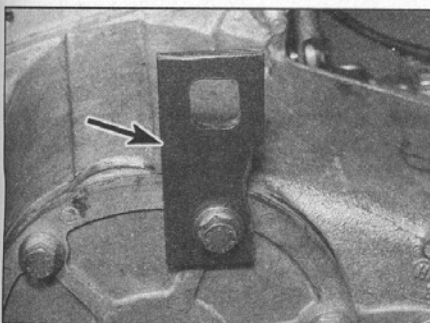
21 Ensure that the transmission assembly is adequately supported before proceeding.

22 Working under the vehicle, unscrew the nuts and through-bolts securing the transmission support crossmember to the chassis (see illustration).

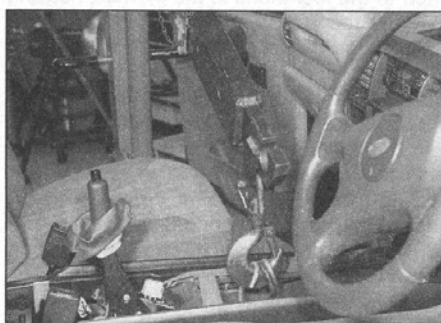
23 Unscrew the bolts securing the mounting brackets to the transfer gearbox, then



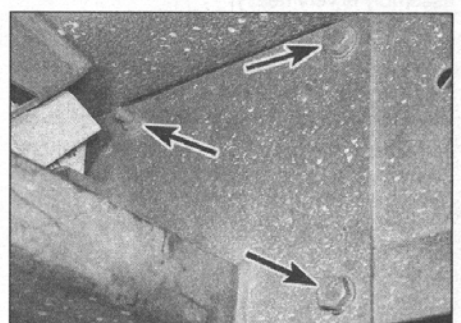
3.8c ... and remove the lever surround



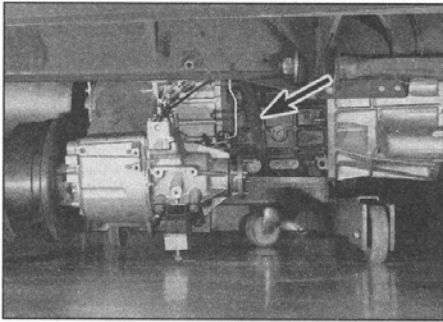
3.20a Lifting bracket (arrowed) bolted to transfer gearbox - viewed with transmission removed



3.20b Engine crane and lifting tackle in position to support transmission assembly



3.22 Three of the transmission support crossmember-to-chassis bolts and nuts (arrowed)



3.28 Lowering the transmission assembly from the vehicle. Note location of lifting strap (arrowed)

withdraw the complete crossmember/mounting bracket assembly from under the vehicle.

24 Lower the transmission assembly slightly, using the engine crane, to gain access to the engine flywheel housing-to-transmission bellhousing nuts and bolts.

25 Unscrew and remove the upper flywheel housing-to-transmission bellhousing nuts.

26 Progressively unscrew the lower flywheel housing-to-transmission bellhousing bolts. Note that the transmission assembly may move backwards from the engine once the bolts are removed - be prepared for this, and do not allow the assembly to swing uncontrolled.

27 If necessary, carefully tap around the flywheel housing-to-bellhousing joint to break the sealant, then slide the transmission assembly back from the engine, taking care not to strain the transmission input shaft.

28 Position a trolley jack and a large block of wood under the transmission assembly (the wood should be suitably shaped to support the transmission when it is lowered), then lower the engine crane to position the transmission assembly on the trolley jack and support block (see illustration).

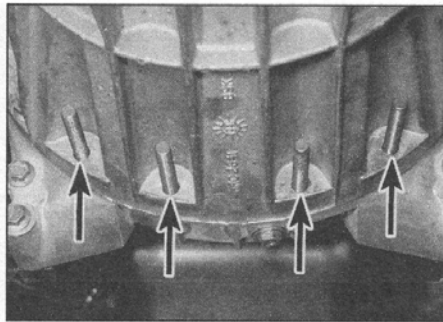
29 Disconnect the lifting straps/chains from the transmission assembly and the engine crane, then carefully slide the transmission assembly out from under the vehicle, using the trolley jack. Take care when moving the transmission, and do not attempt to lift the assembly without suitable lifting tackle - the assembly is very heavy!

30 If desired, the transfer gearbox can be separated from the main gearbox as described in part C of this Chapter.

Refitting

31 Where applicable, refit the transfer gearbox to the main transmission, as described in part C of this Chapter. Ensure that the Low range is selected in the transfer gearbox.

32 On diesel models, thoroughly clean the mating faces of the engine flywheel housing and the transmission bellhousing, then apply sealing compound to the transmission



3.33 Fit four studs (arrowed) to the flywheel housing - viewed with transmission refitted

bellhousing mating face of the engine flywheel housing.

33 Fit four M10 studs (or bolts with the heads cut off) to the lower engine-to-transmission bolt holes in the flywheel housing. The studs should be approximately 100 mm long (see illustration).

34 Position the transmission assembly under the vehicle using the trolley jack and support block, then fit the lifting straps/chains to the transmission (as during removal). Pass the lifting straps/chains up through the transmission tunnel, and connect them to the engine crane.

35 Using the crane, lift the transmission assembly into position, then slide the bellhousing onto the studs previously fitted to the flywheel housing. Ensure that the wiring harness and connectors, and the breather pipes, are not trapped as the transmission is moved into position. Note that it will be necessary to tilt the rear of the engine down to align the engine and transmission (the engine can easily be tilted on its mountings if an assistant pushes the assembly from above). Push the transmission bellhousing onto the studs sufficiently to enable nuts to be fitted to the studs.

36 Manipulate the engine and transmission as necessary to align the transmission input shaft splines with the splines in the clutch friction disc hub (it may be necessary to turn the crankshaft using a spanner or socket on the pulley bolt). Once the input shaft is engaged with the clutch, progressively tighten the nuts fitted to the four studs in the flywheel housing to draw the transmission bellhousing flush against the flywheel housing.

37 Refit and tighten the engine-to-transmission upper nuts, then unscrew the nuts and studs from the lower bolt holes, and refit the four lower bolts. Tighten the bolts, then (on diesel models) wipe any surplus sealing compound from the flywheel housing/bellhousing mating face.

38 Using the crane, raise the transmission assembly sufficiently to enable the crossmember/mounting bracket assembly to be fitted, then fit the assembly and tighten all fixings.

39 The remainder of the refitting procedure is a reversal of removal, bearing in mind the following points:

- a) Ensure that all wiring is routed correctly, and that all plugs are reconnected to their correct locations.
- b) Refit the propeller shafts with reference to Chapter 8.
- c) Refit the exhaust front section with reference to Chapter 4D.
- d) Where applicable, use new pop-rivets to secure the transmission tunnel lever surround.
- e) Before refitting the centre console, check the handbrake cable adjustment as described in the relevant part of Chapter 1.
- f) Where applicable, on completion, refill the main transmission and transfer gearbox with oil of the correct type, as described in the relevant part of Chapter 1.

4 Manual transmission overhaul - general information

Overhauling a manual transmission is a difficult and involved job for the DIY home mechanic. In addition to dismantling and reassembling many small parts, clearances must be precisely measured and, if necessary, changed by selecting shims and spacers. Transmission internal components are also often difficult to obtain, and in many instances, extremely expensive. Because of this, if the transmission develops a fault or becomes noisy, the best course of action is to have the unit overhauled by a specialist repairer, or to obtain an exchange reconditioned unit.

Nevertheless, it is not impossible for the more experienced mechanic to overhaul a transmission, provided the special tools are available, and the job is done in a deliberate step-by-step manner so that nothing is overlooked.

The tools necessary for an overhaul include internal and external circlip pliers, bearing pullers, a slide-hammer, a set of pin punches, a dial test indicator, and possibly a hydraulic press. In addition, a large, sturdy workbench and a vice will be required.

During dismantling of the transmission, make careful notes of how each component is fitted, to make reassembly easier and more accurate.

Before dismantling the transmission, it will help if you have some idea of which area is malfunctioning. Certain problems can be closely related to specific areas in the transmission, which can make component examination and replacement easier. Refer to the *Fault finding* Section at the end of this manual for more information.






Chapter 7 Part B:

Automatic transmission

Contents

Automatic transmission - removal and refitting	6	General information	1
Automatic transmission fluid and oil screen renewal	See Chapter 1A or 1B	Kickdown cable - adjustment, removal and refitting	3
Automatic transmission fluid level check	See Chapter 1A or 1B	Selector assembly - removal and refitting	2
Automatic transmission overhaul - general information	7	Starter inhibitor/reversing light switch - description, removal and refitting	4
Gear selector interlock solenoid - removal and refitting	5		

Degrees of difficulty

Easy, suitable for novice with little experience 	Fairly easy, suitable for beginner with some experience 	Fairly difficult, suitable for competent DIY mechanic 	Difficult, suitable for experienced DIY mechanic 	Very difficult, suitable for expert DIY or professional 
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Specifications

General

Type ZF 4HP22

Kickdown cable

Freeplay 0.25 to 1.25 mm

Torque wrench settings

	Nm	lbf ft
Dipstick tube-to-sump union nut	68	50
Engine-to-transmission bellhousing bolts	42	31
Selector lever-to-gearbox bolts	25	18
Sump drain plug	10	7
Sump securing bolts	8	6
Torque converter-to-driveplate bolts*	39	29

*Use thread-locking compound.

1 General information

A 4-speed fully-automatic transmission is available as an option on certain models. The transmission consists of a torque converter, an epicyclic geartrain, and hydraulically-operated clutches and brakes. The transmission is a customised version of the ZF 4HP22 unit used in many other vehicles.

The torque converter provides a fluid coupling between the engine and transmission, acts as an automatic clutch, and also provides a degree of torque multiplication when accelerating.

The epicyclic geartrain provides either one of the four forward gear ratios, or reverse gear, according to which of its component parts are held stationary or allowed to turn. The components of the geartrain are held or released by brakes and clutches, which are activated by a hydraulic governor. A fluid pump within the transmission provides the necessary hydraulic pressure to operate the brakes and clutches.

First, second and third gears are reduction gears, but fourth gear is an overdrive gear for high-speed cruising. A direct-drive clutch, integral with the torque converter, operates to engage fourth gear.

Due to the complexity of the automatic transmission, any repair or overhaul work

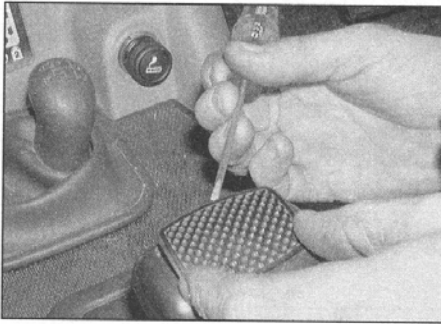
must be entrusted to a Land Rover dealer, or a suitably-qualified transmission specialist, with the necessary specialist equipment and knowledge for fault diagnosis and repair. Refer to the *Fault finding* Section at the end of this manual for further information.

2 Selector assembly - removal and refitting

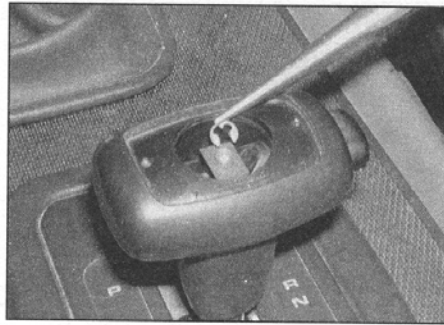


Removal

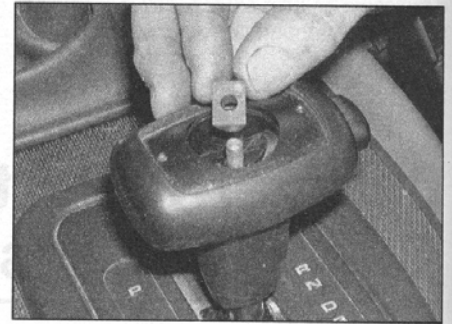
- 1 Disconnect the battery negative lead.



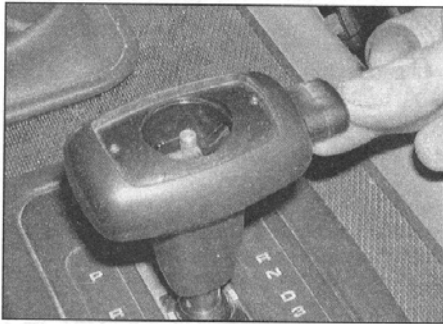
2.4 Prise up the cover from the gear knob



2.5a Remove the E-clip ...



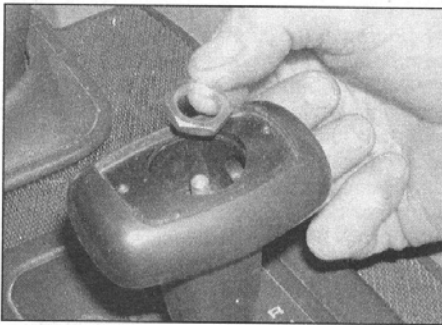
2.5b ... and recover the spacer



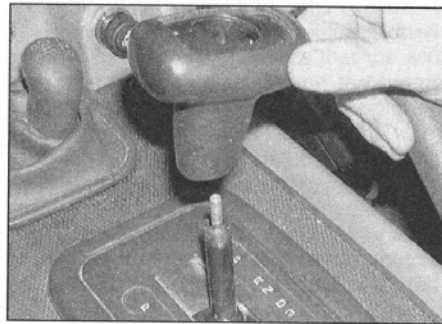
2.6a Pull out the locking button ...



2.6b ... and recover the spring



2.7a Prise out the locking clip, then unscrew the retaining nut ...



2.7b ... and remove the gear knob

2 Working under the vehicle, disconnect the selector cable from the lever on the side of the transmission.

3 Remove the centre console as described in Chapter 12.

4 Carefully prise the cover from the top of the gear knob (see illustration).

5 Using a suitable screwdriver and pliers, prise off and remove the E-clip securing the gear lever locking button to the top of the selector lever, and recover the spacer beneath (see illustrations).

6 Pull the locking button from the side of the gear lever (see illustrations) and (where applicable) recover the two O-rings.

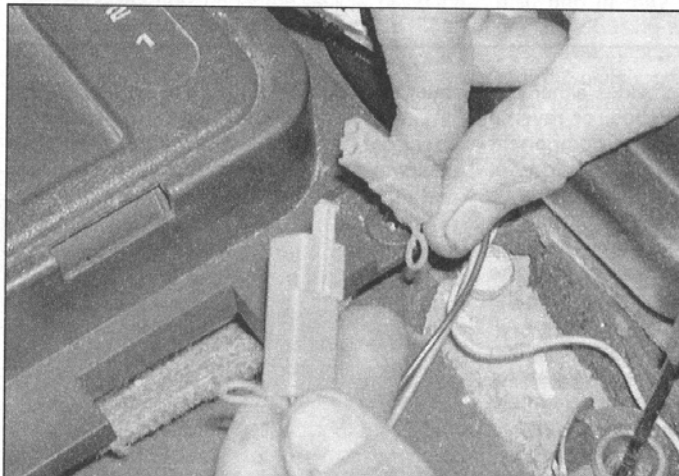
7 Prise off the locking clip, then unscrew the securing nut, and withdraw the gear knob from the top of the lever (see illustrations).

8 Disconnect the selector illumination panel wiring plug at the rear (the plugs at each side can remain connected), then remove the four plastic nuts, and withdraw the illumination housing (see illustrations).

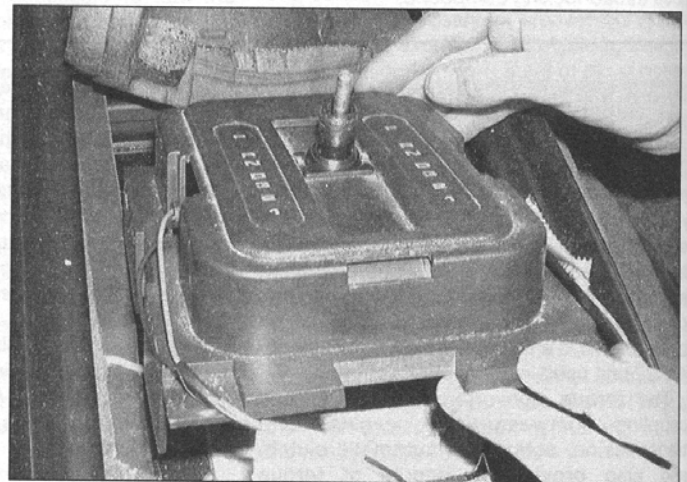
9 Remove the securing screws, and withdraw the selector lever assembly from the body.

Refitting

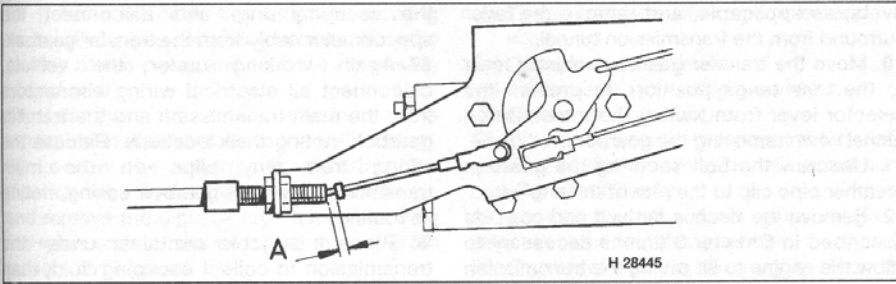
10 Refitting is a reversal of removal.



2.8a Disconnect the illumination wiring plug ...



2.8b ... and remove the illumination housing



3.3 Kickdown cable adjustment

$A = 0.25$ to 1.25 mm

3 Kickdown cable - adjustment, removal and refitting

Adjustment

- 1 Working under the vehicle, loosen the kickdown cable outer locknut at the cable mounting bracket on the transmission.
- 2 Open the bonnet, and ensure that the throttle linkage is fully closed.
- 3 Working at the transmission bracket, adjust the outer cable, by turning the adjuster nut as required, to achieve the desired gap (freeplay) between the end of the cable outer and the crimped collar on the inner cable (see illustration).
- 4 When the gap is correct, tighten the locknut.
- 5 Again, check that the throttle linkage is fully closed, then recheck the gap and re-adjust if necessary.

Removal and refitting

- 6 In order to remove the kickdown cable, it is necessary to remove the transmission fluid pan. It is also necessary to use a special tool to disconnect the cable from the transmission. For these reasons, renewal of the kickdown cable should be entrusted to a Land Rover dealer.

4 Starter inhibitor/reversing light switch - description, removal and refitting

Description

- 1 The starter/inhibitor/reversing light switch is a dual-function switch which is screwed into the transmission casing.
- 2 The inhibitor function of the switch ensures that the engine can only be started with the selector lever in either the N or the P positions, therefore preventing the engine from being started with the transmission in gear. This is achieved by the switch cutting the supply to the starter motor solenoid. If at any time it is noted that the engine can be started with the selector lever in any position other than N or P, then it is likely that the inhibitor function of the switch is faulty.

- 3 The switch also performs the function of the reversing light switch, illuminating the reversing lights whenever the selector lever is in the R position.
- 4 If either function of the switch is faulty, the complete switch must be renewed as a unit.

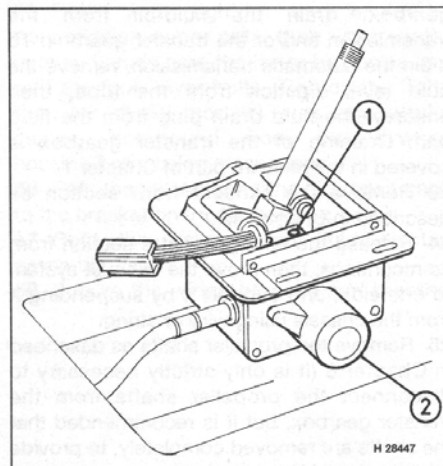
Removal

Note: A new O-ring will be required on refitting.

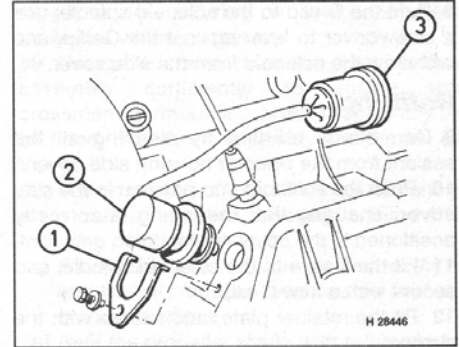
- 5 Disconnect the battery negative lead.
- 6 Jack up the vehicle, and support securely on axle stands placed under the axle tubes (see *Jacking and vehicle support*).
- 7 Working under the vehicle, separate the two halves of the switch wiring connector.
- 8 Unscrew the clamp bolt, and remove the switch retaining plate (see illustration).
- 9 Withdraw the switch from the transmission casing, and recover the O-ring.

Refitting

- 10 Commence refitting by cleaning the switch, and the switch housing in the transmission casing.
- 11 Lubricate a new O-ring with a little clean transmission fluid of the correct type, then fit the seal to the switch.
- 12 Fit the switch to the transmission casing, then refit the retaining plate and secure with the clamp bolt.
- 13 Reconnect the switch wiring plug.



5.3 Gear selector mechanism microswitch support bracket (1) and interlock solenoid (2)



4.8 Starter inhibitor/reversing light switch

- 1 Retaining plate
- 2 Switch
- 3 Wiring connector

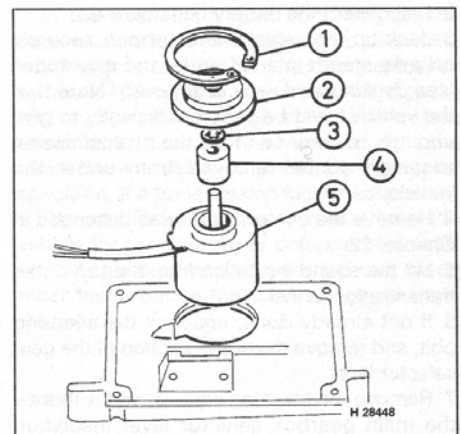
- 14 Lower the vehicle to the ground, and reconnect the battery.

5 Gear selector interlock solenoid - removal and refitting

Removal

Note: Suitable sealant will be required when refitting the selector housing side cover, and a new solenoid spindle C-clip will be required.

- 1 Disconnect the battery negative lead.
- 2 Remove the selector assembly as described in Section 2.
- 3 Remove the screws securing the micro-switch support bracket at the top of the selector assembly (see illustration).
- 4 Remove the screws securing the side cover to the selector assembly, then withdraw the side cover, complete with the solenoid.
- 5 Disconnect the solenoid wiring connector.
- 6 Using a suitable pair of circlip pliers, remove the solenoid retaining circlip, then lift off the retainer plate (see illustration).
- 7 Prise the C-clip from the solenoid spindle, and withdraw the sleeve.



5.6 Gear selector interlock components

- 1 Circlip
- 2 Retainer plate
- 3 C-clip
- 4 Sleeve
- 5 Solenoid

8 Refit the C-clip to the solenoid spindle; use a screwdriver to lever against the C-clip, and withdraw the solenoid from the side cover.

Refitting

- 9 Commence refitting by cleaning all the sealant from the selector housing side cover.
- 10 Push the solenoid into position in the side cover, ensuring that the wiring is correctly positioned in the cover recess.
- 11 Fit the sleeve to the solenoid spindle, and secure with a new C-clip.
- 12 Fit the retainer plate, and secure with the circlip.
- 13 Reconnect the solenoid wiring connector.
- 14 Apply suitable sealant to the mating face of the side cover, then refit the side cover and tighten the securing bolts.
- 15 Lightly grease all the moving parts of the gear selector mechanism.
- 16 Further refitting is a reversal of removal.

6 Automatic transmission - removal and refitting



Removal

Note: Although the following procedure is not difficult, the transmission assembly (the main transmission is removed complete with the transfer gearbox) is heavy, and awkward to handle. Read through the entire procedure before proceeding, to familiarise yourself with the steps. The help of an assistant will prove invaluable during this operation. A suitable engine lifting crane and tackle will be required. Sealing compound to seal the mating faces of the flywheel housing and transmission bellhousing on refitting, and suitable threadlocking compound for the torque converter-to-driveplate bolts, may also be required.

- 1 The automatic transmission is removed with the transfer gearbox as a complete unit.
- 2 Disconnect the battery negative lead.
- 3 Jack up the vehicle, and support securely on axle stands placed under the axle tubes (see *Jacking and vehicle support*). Note that the vehicle must be raised sufficiently to give enough clearance for the transmission assembly to be removed from under the vehicle.
- 4 Remove the centre console as described in Chapter 12.
- 5 Lift the sound insulation from the top of the transmission tunnel.
- 6 If not already done, unscrew the securing bolt, and remove the upper section of the gear selector lever.
- 7 Remove the securing screws, and withdraw the main gearbox selector lever insulation clamp rings.
- 8 Prise off the C-clip, and withdraw the handbrake cable adjuster. Release the handbrake cable from the hole in the transmission tunnel.
- 9 Remove the securing screws, or drill out the

rivets, as applicable, and remove the lever surround from the transmission tunnel.

10 Move the transfer gearbox selector lever to the Low range position, to prevent the selector lever from fouling the transmission tunnel when removing the gearbox.

11 Unscrew the bolt securing the gearbox breather pipe clip to the rear of the engine.

12 Remove the viscous fan unit and cowl, as described in Chapter 3 (this is necessary to allow the engine to tilt during the transmission removal procedure).

13 On left-hand-drive vehicles, disconnect the wiring from the brake fluid level sensor on the top of the fluid reservoir.

14 Release the wiring harness from the clips on the engine compartment bulkhead, and move the harness to one side, clear of the working area.

15 Disconnect the kickdown cable from the throttle linkage.

16 Drain the cooling system as described in the relevant part of Chapter 1, and disconnect the top hose from the radiator.

17 On petrol models, disconnect the large air hose from the side of the plenum chamber, and the by-pass air valve hose at the rear of the plenum chamber.

18 On diesel models, loosen the hose clips, and remove the air trunking connecting the turbocharger to the intercooler.

19 Remove the starter motor, as described in Chapter 5A.

20 Working through the starter motor aperture in the bellhousing, make alignment marks between the torque converter and the driveplate, to ensure that the alignment is maintained on refitting.

21 Again working through the starter motor aperture, unscrew and remove the four torque converter-to-driveplate bolts. It will be necessary to turn the crankshaft to gain access to each bolt in turn, and this can be done using a suitable spanner or socket on the crankshaft pulley bolt.

22 If work is to be carried out on the automatic transmission and/or the transfer gearbox, drain the fluid/oil from the transmission and/or the transfer gearbox. To drain the automatic transmission, remove the fluid level dipstick from the tube, then unscrew the fluid drain plug from the fluid pan. Draining of the transfer gearbox is covered in the relevant part of Chapter 1.

23 Remove the exhaust front section as described in Chapter 4D.

24 Release the exhaust centre section from its mountings, then move the exhaust system to one side, and support it by suspending it from the chassis using wire or string.

25 Remove the propeller shafts as described in Chapter 8 (it is only strictly necessary to disconnect the propeller shafts from the transfer gearbox, but it is recommended that the shafts are removed completely, to provide additional working space).

26 Working under the vehicle, where applicable, remove the heat shield, release

the securing ring, and disconnect the speedometer cable from the transfer gearbox.

27 Again working under the vehicle, disconnect all electrical wiring connectors from the main transmission and the transfer gearbox, noting their locations. Release the wiring from any clips on the main transmission/transfer gearbox casing, noting its routing.

28 Place a suitable container under the transmission to collect escaping fluid, then unscrew the union nuts, and disconnect the transmission fluid cooler pipes from the underside of the transmission. Plug the open ends of the pipes and transmission, to prevent dirt ingress and further fluid loss.

29 Unscrew the bolt securing the fluid cooler pipe bracket to the transmission fluid pan, and move the pipes to one side.

30 Disconnect the selector cable from the lever on the side of the transmission.

31 The main transmission/transfer gearbox assembly must now be supported, to enable the support crossmember to be removed from underneath the vehicle. This is most easily and safely accomplished using an engine crane as follows.

- a) Working under the vehicle, unscrew one of the top securing bolts from the power take-off cover at the rear of the transfer gearbox. Make up a lifting bracket, and bolt it to the transfer gearbox using the previously-removed bolt.
- b) Pass a lifting strap or chain around the main gearbox casing. Pass the ends of the strap/chain up through the hole in the transmission tunnel.
- c) Attach a second lifting strap/chain to the lifting bracket on the transfer gearbox, and again pass the end of the strap/chain up through the transmission tunnel.
- d) Open one of the front doors, and secure the door in the fully-open position using a length of string.
- e) Pass the engine lifting crane in through the front door aperture, and position the lifting hook over the transmission tunnel aperture. Attach the previously-positioned lifting straps to the crane. Take care not to damage the interior trim when positioning the lifting gear.
- f) Raise the crane sufficiently to just take the weight of the transmission assembly.

32 Ensure that the transmission assembly is adequately supported before proceeding.

33 Working under the vehicle, unscrew the nuts and through-bolts securing the transmission support crossmember to the chassis.

34 Unscrew the bolts securing the mounting brackets to the transfer gearbox, then withdraw the complete crossmember and mounting bracket assembly from under the vehicle.

35 Lower the transmission assembly slightly, using the engine crane, to gain access to the engine flywheel housing-to-transmission bellhousing nuts and bolts.

36 Release the cable-ties and clips securing the breather pipes and wiring harness. Note the routing of the pipes and harness, to ensure correct refitting.

37 Unscrew the nut securing the transmission dipstick tube to the bellhousing.

38 Loosen the union nut securing the dipstick tube to the transmission fluid pan, and remove the dipstick tube assembly. Plug the open ends of the tube and the sump, to prevent dirt ingress.

39 Unscrew the nut securing the kickdown cable bracket to the bellhousing.

40 Working at the top of the transmission, unscrew the two bolts securing the top of the transmission bellhousing to the flywheel housing.

41 Progressively unscrew the remaining bellhousing-to-flywheel housing securing nuts and bolts. Note that the transmission assembly may move backwards from the engine once the bolts are removed - be prepared for this, and do not allow the assembly to swing uncontrolled.

42 Where necessary, carefully tap around the bellhousing-to-flywheel housing joint to break the sealant, then slide the transmission assembly back from the engine.

43 Fit a suitable strip of metal across the bellhousing, to retain the torque converter. **Do not** allow the torque converter to fall out of the transmission.

44 Position a trolley jack and a large block of wood under the transmission assembly (the wood should be suitably shaped to support the transmission when it is lowered), then lower the engine crane to position the transmission assembly on the trolley jack and support block.

45 Disconnect the lifting straps/chains from the transmission assembly and the engine crane, then carefully slide the transmission assembly out from under the vehicle, using the trolley jack. Take care when moving the transmission, and do not attempt to lift the assembly without suitable lifting tackle - the assembly is very heavy!

46 If desired, the transfer gearbox can be separated from the main gearbox as described in part C of this Chapter.

Refitting

47 If a new transmission is to be fitted, it will be necessary to transfer the following components from the existing assembly to the new unit. Take great care to prevent dirt from entering the transmission - plug all openings to prevent dirt ingress.

a) *Extension shaft spacer - this is vital!*

b) *Transmission breather pipe union and washers.*

c) *Gearbox selector lever.*

d) *Transmission mounting assemblies.*

e) *Fluid cooler pipe unions.*

48 Where applicable, reconnect the transfer gearbox to the transmission as described in part C of this Chapter.

49 Ensure that the Low gear range is selected in the transfer gearbox.

50 On diesel models, thoroughly clean the mating faces of the engine flywheel housing and the transmission bellhousing, then apply sealing compound to the transmission bellhousing mating face of the engine flywheel housing.

51 Fit four M10 studs (or bolts with the heads cut off) to the lower engine-to-transmission bolt holes in the flywheel housing. The studs should be approximately 100 mm long.

52 Position the transmission assembly under the vehicle using the trolley jack and support block, then fit the lifting straps/chains to the transmission (as during removal). Pass the lifting straps/chains up through the transmission tunnel, and connect them to the engine crane. Remove the torque converter retaining strap from the bellhousing.

53 Using the crane, lift the transmission assembly into position, then slide the bellhousing onto the studs previously fitted to the flywheel housing. Ensure that the wiring harness and connectors, and the breather pipes, are not trapped as the transmission is moved into position. Note that it will be necessary to tilt the rear of the engine down to align the engine and transmission (the engine can easily be tilted on its mountings if an assistant pushes the assembly from above). Push the gearbox bellhousing onto the studs sufficiently to enable nuts to be fitted to the studs.

54 Progressively tighten the nuts fitted to the four studs in the flywheel housing, to draw the transmission bellhousing flush against the flywheel housing.

55 Refit and tighten the engine-to-transmission upper nuts, then unscrew the nuts and studs from the lower bolt holes, and refit the four lower bolts. Tighten the bolts, then (on diesel models) wipe any surplus sealing compound from the flywheel housing/bellhousing mating face.

56 Refit the nut securing the kickdown cable to the bracket on the bellhousing.

57 Refit the transmission fluid dipstick assembly.

58 Secure the wiring harness and breather

pipes, as noted during removal, using new cable-ties where necessary.

59 Using the crane, raise the transmission assembly sufficiently to enable the crossmember/mounting bracket assembly to be fitted, then fit the assembly and tighten all fixings.

60 The remainder of the refitting procedure is a reversal of removal, bearing in mind the following points:

a) *Ensure that all wiring is routed correctly, and that all plugs are reconnected to their correct locations.*

b) *Refit the propeller shafts with reference to Chapter 8.*

c) *Refit the exhaust front section with reference to Chapter 4D.*

d) *Apply suitable thread-locking compound to the threads of the torque converter-to-driveplate bolts.*

e) *If the original torque converter and driveplate components are being refitted, ensure that the marks made on the torque converter and the driveplate before removal are aligned. Tighten the bolts to the specified torque.*

f) *Check the kickdown cable adjustment as described in Section 3.*

g) *Where applicable, use new pop-rivets to secure the transmission tunnel lever surround.*

h) *Before refitting the centre console, check the handbrake cable adjustment as described in the relevant part of Chapter 1.*

i) *Where applicable, on completion, refill the main transmission and transfer gearbox with fluid and oil of the correct type, as described in the relevant part of Chapter 1.*

7 Automatic transmission overhaul - general information

In the event of a fault occurring on the transmission, it is first necessary to determine whether it is of an electrical, mechanical or hydraulic nature, and to achieve this, special test equipment is required. It is therefore essential to have the work carried out by a Land Rover dealer, or a suitably-equipped specialist, if a transmission fault is suspected.






Do not remove the transmission from the vehicle for possible repair before professional fault diagnosis has been carried out, since most tests require the transmission to be in the vehicle.

Chapter 7 Part C: Transfer gearbox

Contents

General information	1	Transfer gearbox oil renewal	See Chapter 1A or 1B
Transfer gearbox - removal and refitting	2	Transfer gearbox overhaul - general information	3
Transfer gearbox oil level check	See Chapter 1A or 1B		

Degrees of difficulty

<p>Easy, suitable for novice with little experience</p> 	<p>Fairly easy, suitable for beginner with some experience</p> 	<p>Fairly difficult, suitable for competent DIY mechanic</p> 	<p>Difficult, suitable for experienced DIY mechanic</p> 	<p>Very difficult, suitable for expert DIY or professional</p> 
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Specifications

Overall gear ratios (final drive to axles)	High range	Low range
First	15.962:1	43.367:1
Second	9.218:1	25.040:1
Third	6.040:1	16.406:1
Fourth	4.324:1	11.747:1
Fifth	3.331:1	9.049:1
Reverse	14.827:1	40.276:1
Torque wrench settings	Nm	lbf ft
Breather pipe union nut	15	11
Transfer gearbox-to-main gearbox/transmission bolts and nuts	45	33

1 General information

The transfer gearbox is mounted in-line with the main manual gearbox/automatic transmission. The transfer gearbox is a two-speed ratio-reducing gearbox, and provides drive to the front and rear axles via the propeller shafts.

Permanent four-wheel-drive is provided, and the unit incorporates a differential assembly to allow for any difference in the rotational speed of the front and rear wheels (and a resulting difference in speed between the front and rear propeller shafts). This centre differential (the axles also incorporate differentials, to allow for the difference in rotational speed between left- and right-hand wheels on the same axle) can be locked by mechanical means, to provide increased traction in particularly slippery conditions.

Selection of the High/Low ranges and the differential lock is made using a selector lever mounted forward of the main gear lever.

2 Transfer gearbox - removal and refitting



Removal

1 The transfer gearbox is most easily removed complete with the manual gearbox/automatic transmission as an assembly. This procedure is described in part A or B of this Chapter, as applicable.

2 To separate the transfer gearbox from the manual gearbox/automatic transmission, proceed as follows.

3 Position the transmission assembly securely on a bench or a suitable stand, or rest the assembly on wooden blocks on the workshop floor.

4 Where applicable, unbolt the bracing bar connecting the transfer box to the main gearbox/transmission.

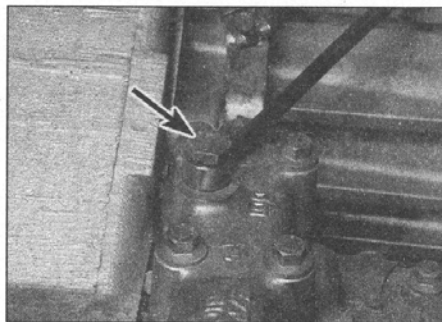
5 Unscrew the union bolt, and disconnect the breather pipe from the top of the transfer gearbox casing (see illustration). Recover the sealing washers.

6 Remove the split-pin, or the spring clip (as applicable), securing the differential lock connecting rod to the lever on the transfer gearbox, and disconnect the rod from the lever (see illustration). Where applicable, recover the washers.

7 Select the Low range by moving the transfer gear selector lever fully forwards.

8 Unscrew the transfer gear selector rod lower locknut, and withdraw the rod from the yoke (see illustration).

9 Ensure that the main gearbox/transmission and the transfer gearbox are adequately



2.5 Unscrew the breather pipe union bolt (arrowed)

supported, then remove the transfer gearbox-to-main gearbox/transmission securing bolts, and slide the transfer gearbox rearwards from the main gearbox/transmission (see illustration).

Refitting

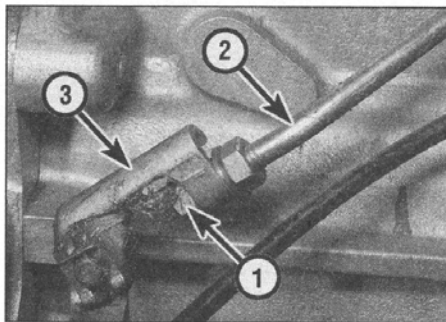
10 Refitting is a reversal of removal, bearing in mind the following points:

- Thoroughly clean the mating faces of the transfer gearbox and the main gearbox/transmission.
- On models with automatic transmission, before attempting to mate the main transmission and transfer gearbox together, select P in the main transmission.
- Before attempting to mate the main gearbox and the transfer gearbox together, select the Low range, and engage the differential lock in the transfer gearbox.
- As the two assemblies are mated together, engage the transfer gear selector rod with the yoke.
- Refit the complete transmission assembly as described in Chapter 7A or B, as applicable.

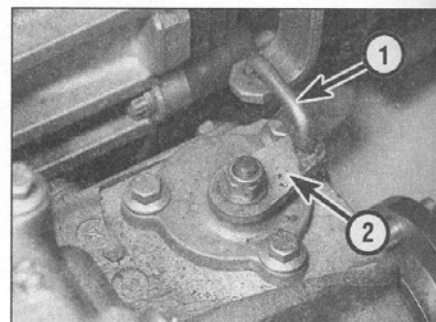
3 Transfer gearbox overhaul - general information



Overhauling a transfer gearbox is a difficult and involved job for the DIY home mechanic.



2.8 Unscrew the locknut (1) and withdraw the rod (2) from the yoke (3)



2.6 Disconnect the differential lock connecting rod (1) from the lever (2)

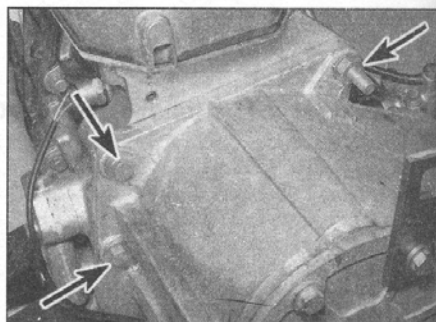
In addition to dismantling and reassembling many small parts, clearances must be precisely measured and, if necessary, changed by selecting shims and spacers. Gearbox internal components are also often difficult to obtain, and in many instances, extremely expensive. Because of this, if the gearbox develops a fault or becomes noisy, the best course of action is to have the unit overhauled by a specialist repairer, or to obtain an exchange reconditioned unit.

Nevertheless, it is not impossible for the more experienced mechanic to overhaul a gearbox, provided the special tools are available, and the job is done in a deliberate step-by-step manner so that nothing is overlooked.

The tools necessary for an overhaul include internal and external circlip pliers, bearing pullers, a slide-hammer, a set of pin punches, a dial test indicator, and possibly a hydraulic press. In addition, a large, sturdy workbench and a vice will be required. Certain Land Rover special tools will be required for work on the differential assembly.

During dismantling of the gearbox, make careful notes of how each component is fitted, to make reassembly easier and more accurate.

Before dismantling the gearbox, it will help if you have some idea of which area is malfunctioning. Certain problems can be closely related to specific areas in the gearbox, which can make component examination and replacement easier. Refer to the *Fault finding* Section at the end of this manual for more information.



2.9 Three of the transfer gearbox-to-main gearbox bolts and nuts (arrowed)