Transmission

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Introduction

The torque converter transmission is a fully automatic unit, consisting primarily of a three-element hydraulic torque converter and a compound planetary gear train. Three multiple-disc clutches, one roller clutch, one sprag clutch, and two friction bands, provide the elements which are required to obtain the desired functions of the gear train.

A name plate is fitted to the right-hand side of the transmission, toward the centre of the case. The serial number is prefixed by either the letters RHA, RJA, RNA, or RNAB, and the year in numerals.

On 1989 model year transmissions, the serial number is prefixed by either the letters RDA, RKA, RLA, RMA, or RMAB, and the year in numerals.

The torque converter, clutches, and rollers connect the engine to the planetary gears with the aid of pressurized transmission fluid. Three forward gears and reverse are provided. When necessary, the torque converter will supplement the gears by multiplying engine torque.

The torque converter is of welded steel construction and cannot be dismantled. The unit is made up of two vaned sections which face each other across a fluid filled housing. The pump half of the converter is connected to the engine and the turbine half is connected to the transmission.

When the engine is running the converter pump rotates and throws fluid against the turbine, causing the turbine to rotate. The fluid then returns to the pump in a circular flow and continues this cycle as long as the engine is running.

The converter also has a smaller vaned section, called a stator, which directs the fluid back to the pump through smaller openings at greater speed. The speeded-up fluid imparts additional force to the engine driven converter pump, thus multiplying engine torque.

A hydraulic system pressurized by an internal/external gear type of pump provides the working pressure required to operate the friction elements and automatic controls.

External control connections

The external control connections to the transmission are.

1. An electric gearchange actuator, connecting rod, and levers. The actuator responds to an electrical signal from a switch on the steering column, then moves the gear change lever on the transmission to the required position.
2. Engine vacuum which operates a vacuum modulator unit.
3. 12 volt electrical signals to operate an electrical detent solenoid.

Gear and torque ratios

The gear or torque ratios of the transmission are.

First	–	2.5:1
Second	–	1.5:1
Third	–	1.0:1
Reverse	–	2.0:1

Each gear ratio can be multiplied by as much as 2.2, depending upon the slip speed of the converter pump and turbine.

Vacuum modulator

A vacuum modulator is used to automatically sense engine torque input to the transmission. The modulator transmits this signal to the pressure regulator which controls main line pressure. This ensures that all the torque requirements of the transmission are met and that the correct gear change spacing is obtained at all throttle openings.

Detent solenoid

The detent solenoid is activated by the throttle position switch, mounted on the end of the primary throttle spindle. When the pedal is in the kick-down position, the switch is closed; the solenoid in the transmission is then activated and a down-change will occur at speeds below 129 km/h (80 mile/h). At lower speeds a down-change will occur at smaller throttle openings without the aid of the throttle position switch assembly, or the solenoid.

Heat exchanger

The heat exchanger for the transmission fluid is situated in the bottom of the radiator matrix (see fig. T2-1).

Selector positions

The transmission quadrant has six selector positions which enable the driver to control the operation of the transmission under varying driving conditions. The six selector positions appear in the following sequence, from left to right; P – Park, R – Reverse, N – Neutral, D – Drive, I – Intermediate, and L – Low. The engine can only be started in the park and neutral positions.

P – Park position positively locks the output shaft to the transmission case by means of a locking pawl and prevents the car from rolling either backward or forward when parked on a steep incline.

R – Reverse enables the car to operate in a reverse direction.

N – Neutral enables the engine to be started and run without the car moving.

D – Drive is used for all normal driving conditions and maximum economy. Drive range has three gear ratios, from starting to direct drive. Forced down-

changes are available for safe and rapid overtaking, by fully depressing the accelerator pedal.

I – Intermediate adds new performance for congested traffic conditions or hilly terrain. This range has the same starting ratio as D, but prevents the transmission from changing above second gear; acceleration is retained when extra performance is required.

The engine can be used to assist braking in this range.

L – Low range permits operation at a lower gear ratio and should be used when maximum torque multiplication is required or, when descending a steep gradient. When the selector lever is moved from drive (D) to low (L) at normal road speeds, the transmission will change to second gear and remain in second gear until the speed of the car is reduced to the normal 2-1 down-change speed. The transmission will then change down to first gear and remain in first gear regardless of car speed or engine revolutions, until the selector lever is moved into either the drive (D) or the intermediate (I) position.

Hydraulic system

Pressure control

The transmission is controlled automatically by a hydraulic system. Hydraulic pressure is supplied by the transmission oil pump, which is engine driven.

Main line oil pressure is controlled by a pressure regulator valve train which is located in the pump and by the vacuum modulator which is connected to engine vacuum.

The pressure regulator controls main line oil pressure automatically, in response to a pressure signal from a modulator valve. This is done in such a manner, that the torque requirements of the transmission clutches are met and correct gearchange spacing is obtained at all throttle openings.

To control line pressure, a modulator pressure is used. This pressure varies in the same manner as torque input to the transmission. Since the torque input to the clutches is the product of engine torque and converter ratio, modulator pressure must compensate for changes in either or both of these.

To meet these requirements, modulator pressure is regulated by engine vacuum, which is an indicator of engine torque and throttle opening. It will decrease as the car speed increases to compensate for the changing converter torque ratio.

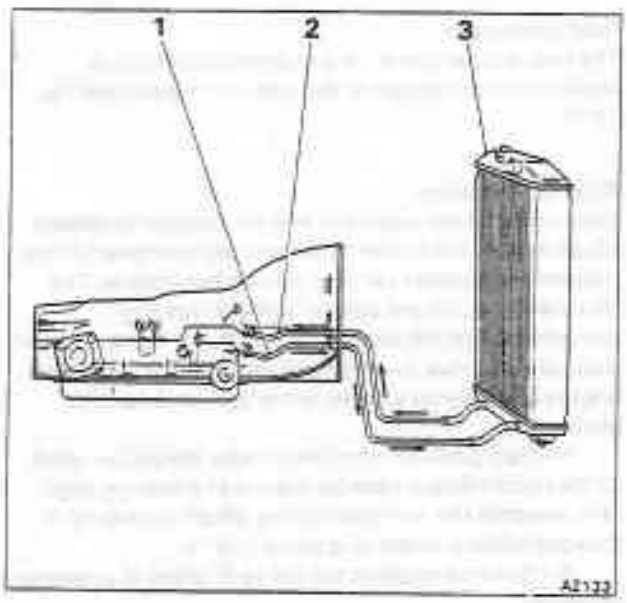


Fig. T2-1 Heat exchanger system
1 Transmission fluid to heat exchanger
2 Transmission fluid from heat exchanger
3 Coolant radiator with heat exchanger in bottom tank

Vacuum modulator assembly

The engine vacuum signal is received by the vacuum modulator, which comprises an evacuated metal bellows, a diaphragm, and two springs. The assembly is so arranged that the bellows and external spring apply a force that acts on the modulator valve so that it increases modulator pressure. To control modulator pressure, engine vacuum and an internal spring oppose the bellows and external spring.

To reduce the effect of altitude on change points, the effective area of the diaphragm is different than that of the bellows. Atmospheric pressure acts on the resulting differential area to reduce modulator pressure.

Governor assembly

The speed of the car is signalled to the transmission by a governor which is driven by the transmission output shaft. The governor is comprised basically of a valve body, a regulator valve, and flyweights.

Centrifugal force causes the flyweights to act on the regulator valve. The valve then regulates a pressure signal which increases with road speed.

Governor pressure acts on the modulator valve to cause modulator pressure to decrease as the speed of the car increases.

Servicing

Careful and regular maintenance of the transmission is necessary to ensure maximum reliability.

For details of the servicing and maintenance requirements of the transmission, refer to the Service Schedule Manual – TSD 4702.

It is absolutely essential that attention be paid to cleanliness whenever the interior of the transmission is exposed and when work is being carried out on a particular unit belonging to the transmission. The smallest particle of dirt in the oil may interfere with the correct operation of the valves, particularly in the control valve unit.

A list of approved transmission fluids is given in Chapter D.

Fluid level – To check and top-up

The fluid level in the torque converter transmission can be checked accurately only when the car is standing on a level surface, the engine is running at the idle speed, and the transmission fluid is at normal operating temperature, approximately 77°C (170°F). This is only obtained after 24 kilometres (15 miles) of highway/motorway driving or after 16 kilometres (10 miles) of city driving.

As an initial check, the fluid level may be checked after starting from cold as follows.

1. With the car on a level surface, apply the parking brake and chock the road wheels.
2. On four door cars, remove the protective cover from the windscreen wiper mechanism to gain access to the dipstick. Ensure that the following safety procedure is undertaken to isolate the mechanism prior to removing the cover.

Ensure that the windscreen wiper control switch situated on the facia is in the off position. Remove a windscreen wiper relay, preferably number three (see fig. T3-1). To remove the relay pull it vertically from its mounting.

Always clean the top of the dipstick before removing it from the filler tube.

3. Start and run the engine for three to four minutes with the gear range selector in the park position. Allow the engine to achieve a normal idle speed.
4. Whilst sitting in the driving seat, **firmly apply the footbrake** and move the gear range selector through the full range of gear positions pausing briefly in each range. Return the selector to the park position.
5. Immediately check the fluid level with the engine running at idle speed.

The level should be 25 mm (1 in) below the FULL HOT mark on the dipstick.

Top-up to this level if necessary.

Important When checking the fluid level with the engine running, take care to avoid any moving parts such as drive belts, pulleys, fan blades, etc. Care should also be taken to avoid contact with hot engine components.

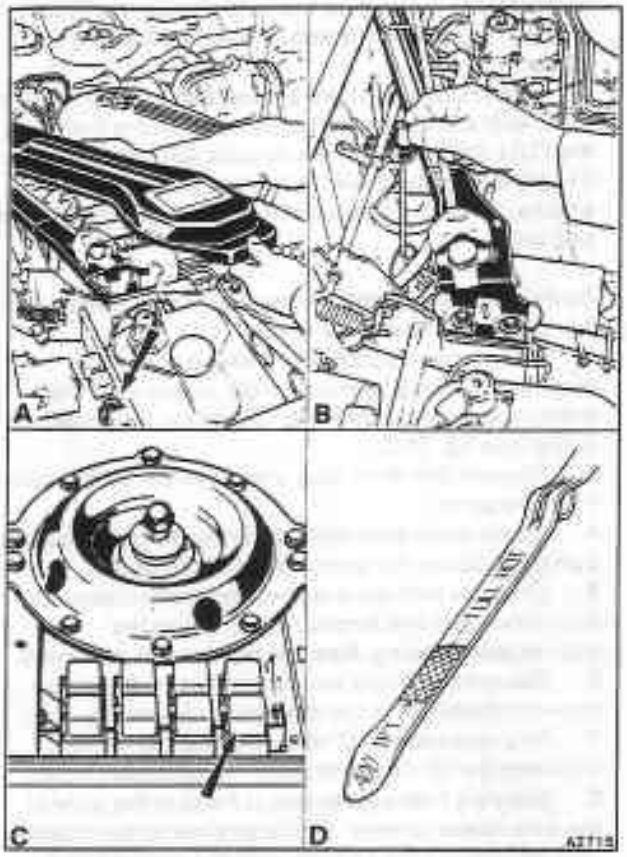


Fig. T3-1 Transmission filler tube and dipstick

- A Removing the windscreen wiper mechanism cover. The arrow indicates the wiper motor relay removed
- B Withdrawing the dipstick from the filler tube
- C Wiper motor relay location (1989 model year four door cars)
- D Dipstick markings

After this initial check a further check should be carried out as follows.

6. Drive the car for approximately 24 kilometres (15 miles) of highway/motorway driving or 16 kilometres (10 miles) of city driving. This should ensure the transmission has reached normal operating temperature.

It is essential that this temperature is attained. Do not top-up the fluid level to the FULL HOT mark on the dipstick when the fluid is only warm, as this will result in an overflow situation when the normal operating temperature is attained. Overfilling will result in fluid being discharged from the transmission breather pipe.

7. Position the car on a level surface, firmly apply the parking brake and select park with the gear selector lever.
8. Carry out the procedure described for the initial check (Operations 2 to 5 inclusive).
9. With the transmission fluid at normal operating temperature the level of the fluid should be within the cross hatched area marked on the dipstick (see fig. T3-1).
10. If necessary add fluid by pouring it down the filler tube, with the engine still running, until the fluid is to the FULL HOT mark on the dipstick. **Do not overfill.**
11. When the fluid level is correct, switch off the engine and fit the windscreen wiper mechanism cover and relay.

To drain the sump and renew the intake strainer
1. Position the car on a ramp.
2. Place a clean container having a minimum capacity of 3 litres (5 Imp pt, 6 US pt) beneath the drain plug situated on the corner of the transmission sump (see fig. T3-2).
3. Remove the drain plug and allow the oil to drain from the sump.
4. Remove the setscrews securing the transmission sump and lower the sump. Discard the gasket.
5. Unscrew and remove the stepped bolt securing the intake pipe and strainer assembly to the transmission casing. Remove the strainer assembly.
6. Discard the intake strainer but retain the intake pipe which connects the strainer to the casing.
7. Fit a new rubber 'O' ring onto the intake pipe, lubricate the 'O' ring with clean transmission fluid.
8. Ensure a new rubber seal is fitted to the bore in the new intake strainer. Fit the strainer to the intake pipe and secure the strainer with the stepped bolt.
9. Torque tighten the bolt to 14 Nm (1,4 kgf m, 10 lbf ft).
10. Fit the transmission sump using a new gasket. Torque tighten the setscrews to between 8 Nm and 14 Nm (0,9 kgf m and 1,4 kgf m; 6 lbf ft and 10 lbf ft).
11. Add 4,5 litres (8 Imp pt, 9.6 US pt) of an approved fluid to the sump, pouring the fluid down the filler tube.

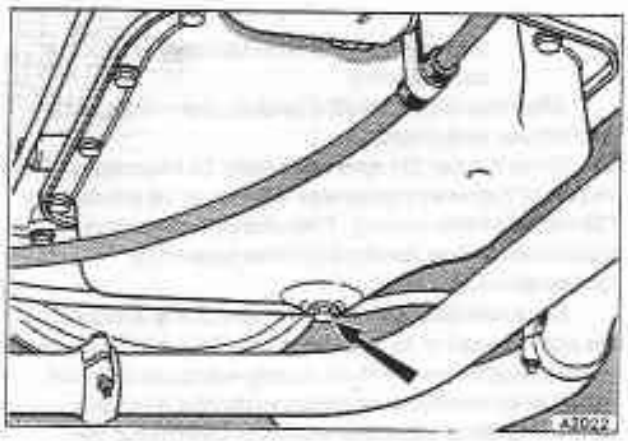


Fig. T3-2 Transmission sump drain plug

Note When draining the sump but not renewing the intake strainer, add only 2,8 litres (5 Imp pt, 6 US pt).
12. Check the fluid level as described under the heading, Fluid level – To check and top-up.

Transmission unit (dry) – To fill
The fluid capacity of the torque converter transmission, including the torque converter, is approximately 10,6 litres (18.75 Imp pt, 22.5 US pt), but the correct level is determined by the marks on the dipstick rather than by the quantity of fluid added.

It is important that the correct level is maintained. When the transmission has been overhauled or a new one fitted and a complete fill is required, including the torque converter, proceed as follows.
1. Pour approximately 6,5 litres (11.5 Imp pt, 14 US pt) down through the filler tube.
2. With the car on a level surface, apply the parking brake and chock the road wheels.
3. Start and run the engine for three to four minutes with the gear range selector in the park position. Allow the engine to achieve a normal idle speed.
4. Whilst sitting in the driving seat, **firmly apply the footbrake** and move the gear range selector through the full range of gear positions pausing briefly in each range. Return the selector to the park position.
5. Immediately check the fluid level with the engine running at idle speed.

The level should be 25 mm (1 in) below the FULL HOT mark on the dipstick.

Top-up to this level if necessary.
6. Drive the car for approximately 24 kilometres (15 miles) of highway/motorway driving or 16 kilometres (10 miles) of city driving. This should ensure the transmission has reached normal operating temperature.

It is essential that this temperature is attained. Do not top-up the fluid level to the FULL HOT mark on the dipstick when the fluid is only warm, as this will result in an overflow situation when the normal operating temperature is attained. Overfilling will result in fluid being discharged from the transmission breather pipe.

Top-up if necessary, as described under the heading, Fluid level – To check and top-up.

The transmission sump should be drained at the intervals specified in the Service Schedule Manual – TSD 4702. New fluid should be added to maintain the correct level on the dipstick.

The fluid intake system incorporates an intake strainer. This strainer should be renewed at the intervals specified in the Service Schedule Manual. In the event of a major failure in the transmission, the strainer must be renewed.

Transmission unit – To check for leaks
Whenever the transmission has been dismantled, completely or partially, the following procedure must be observed to minimise the possibility of fluid leakage.
1. Always fit new gaskets and 'O' ring seals.

2. Use a small amount of petroleum jelly to hold a gasket in position during assembly.
3. Do not use a sealing compound (e.g. Wellseal) with a gasket.
4. Ensure that the cork and paper gaskets are not wrinkled or creased when fitted, or have distorted during storage.
5. Ensure that the square-sectioned 'O' rings are correctly fitted and are not twisted.
6. Ensure that all mating faces are clean and free from burrs and damage.
7. Torque tighten bolts, setscrews, etc., to the torque figures given in Section T23 and Chapter P.
8. When examining the transmission for leaks, determine whether the fluid originates from the transmission or the engine. The original factory fill fluid is red in colour, this assists in locating the source of leakage. If however, the colour cannot be detected in the transmission fluid, add a red aniline dye preparation to the fluid. Red dye appearing in the leaking fluid will positively identify the source of the leak.

If the fluid is known to be leaking from the transmission, examine the following areas.

Front end

It will be necessary to remove the bell housing bottom cover and the lower front cover plate in order to examine the transmission for leakage at the front end.

To correct a leak at the front end, the transmission will have to be removed from the car.

1. If the pump oil seal is suspected of leaking fluid, ensure that the seal has been correctly fitted and is not damaged.

When fitting a new seal (see Section T17) ensure that the seal bore in the case is clean. Examine the finish on the converter neck and the bearing surface in the pump body.

2. Examine the pump square-sectioned 'O' ring and the gasket for damage, renew if necessary.
3. Ensure that the 'O' rings on the pump securing setscrews are not damaged.
4. Examine the torque converter for leakage (see Section T8).

Rear extension

1. Examine the rear extension housing oil seal for damage.
2. Examine the finish on the sliding coupling.
3. Ensure that the gasket fitted between the joint faces has been correctly fitted and is not damaged.
4. Check the securing setscrews for correct torque tightness (see Section T23).
5. Examine the housing for cracks or porosity.

Transmission case

1. Examine the speedometer electronic impulse transmitter drive 'O' ring and lip-type seal. Ensure that the securing setscrew is torque tightened.
2. Examine the governor cover gasket. Ensure that the setscrews are torque tightened (see Section T23).
3. Examine the electrical connector 'O' ring for damage.
4. Examine the parking pawl shaft cup plug for damage.
5. Examine the manual shaft lip seal for damage.
6. Examine the vacuum modulator 'O' ring for damage. Ensure the retaining setscrew is torque tightened (see Section T23).
7. Examine the vacuum modulator for possible damage to the diaphragm.

Note If the transmission is found to be consistently low on fluid, check the modulator to ensure that there is no split in the diaphragm. Apply suction to the vacuum tube and check for leaks. A split diaphragm would allow transmission fluid to be drawn into the engine induction manifold and vacuum line. This condition can usually be detected because the exhaust will be excessively smokey due to the transmission fluid being added to the combustion mixture.

8. Examine the sump gasket. Check the torque tightness of the securing setscrews (see Section T23).
9. Check the torque tightness of the main line pressure tapping plug (see Section T23).
10. Examine the breather pipe for damage.
11. Ensure that the transmission has not been overfilled.
12. Check for coolant in the transmission fluid.
13. Examine the case for cracks or porosity.
14. Ensure that the pump to case gasket is not incorrectly positioned.
15. Ensure that foreign matter is not between the pump and case, or between the pump cover and body.
16. Ensure that the breather hole in the pump cover is not obstructed.
17. Ensure that the 'O' ring on the filter assembly is not cut.

Heat exchanger connections

Ensure that the heat exchanger transmission fluid pipes are correctly fitted and are not damaged. Ensure that the nuts are tight.

Dipstick and filler tube

Examine the rubber grommet for leaks.

Internal leaks

Ensure that the manual linkage is set correctly before removing the sump, as incorrect settings can cause internal leaks at the valves.

If the manual linkage is set correctly, remove the sump.

1. Check the governor pipes for security and damage.
2. Examine the rear servo cover gasket for damage. Ensure that the square-sectioned 'O' ring is fitted correctly and is not damaged. Torque tighten the cover securing setscrews (see Section T23).
3. Examine the control valve unit assembly and oil spacer (guide) plate gaskets.

Check the torque tightness of the unit securing setscrews (see Section T23).

4. Check the torque tightness of the solenoid securing setscrews (see Section T23).
5. Check that the case valve body mounting face is not distorted.

Control joints – To lubricate

During initial assembly, the clevis pins in the control linkage are lubricated with Rocol MTS 1000 grease and should be similarly treated whenever they are removed.

When a car is being serviced, the opportunity should be taken to check the controls for correct operation and to lubricate all the control joints with a few drops of engine oil.

Manual shaft – To lubricate

As part of the linkage maintenance procedure, it is recommended that the manual shaft be lubricated with a few drops of oil at the point where it enters the transmission case.

Testing

Before road testing the car to check the functioning of the transmission, carry out the following.

The car can then be road tested, using all the selector ranges. Note any operating faults.

Check the gearchange pattern as follows.

1. Check the fluid level, top-up if necessary.
2. Ensure that the engine and transmission are at normal operating temperature 77°C (170°F).
3. Ensure that the gearchange actuator is operating satisfactorily.
4. Check the operation of the throttle position switch, adjust if necessary, refer to the Engine Management Systems Manual — TSD 4737.
5. If the oil pressure is to be checked, fit a gauge.
6. Check the manual linkage.

Gearchange pattern check

Drive range

1. Select D range, then accelerate the car from standstill.
2. A 1-2 and a 2-3 up-change should occur at all throttle openings.

Note The change points will vary according to throttle opening.

3. As the speed of the car decreases to a stop, the 3-2 and the 2-1 down-changes should occur.

Intermediate range

1. Select I range.
2. Accelerate the car from standstill.
3. A 1-2 up-change should occur at all throttle openings.
4. A 2-3 up-change cannot be obtained in this range.
5. The 1-2 up-change point will vary according to throttle opening.
6. As the speed of the car decreases to a stop, the 2-1 down-change should occur.

Low range

1. Select L range.
2. No up-change should occur in this range, regardless of throttle opening.

2nd gear – overrun braking

1. Select D range.
2. When a speed of approximately 56 km/h (35 mile/h) has been reached, move the selector lever to the I range position.
3. The transmission should change down to 2nd gear.
4. An increase in the speed of the engine as well as an engine braking effect should be observed.
5. Line pressure should change from between 4,1 bar and 6,2 bar (60 lbf/in² and 90 lbf/in²) to approximately 10,3 bar (150 lbf/in²).

1st gear – downhill or overrun engine braking

1. Select I range.
2. When the speed of the car is approximately 48 km/h (30 mile/h), and at constant throttle, move the selector to L range.

Note Ensure that the speed of the car does not exceed 64 km/h (40 mile/h).

3. An increase in engine rev/min and a braking effect should be noticed as the down-change occurs.

Oil pressure – To check

Before attempting to check the oil pressure or to road test the car, always ensure that the level of fluid in the transmission is correct (see Section T3).

The pressure can be checked by using an oil pressure gauge coupled to the main line tapping in the left-hand side of the transmission case.

1. Clean any dirt from around the line pressure plug; remove the plug.
2. Fit the adapter RH 7914 into the main line tapping; tighten the adapter.
3. Screw a pressure gauge, capable of reading between 0 bar and 20,6 bar (0 lbf/in² and 300 lbf/in²) onto the adapter. Then, position the gauge so that it can be seen from the driver's seat.
4. Connect a tachometer to the engine; this will enable the gear change points to be positively identified.
5. Drive the car until the transmission has reached normal operating temperature 77°C (170°F).
6. Check the fluid level, top-up if necessary.

Road testing the car

The following checks should be carried out during road testing.

Engine idle pressure check

1. Select D range. Drive the car at approximately 48 km/h (30 mile/h) with the throttle eased back. The line pressure should be 4,8 bar (70 lbf/in²).
2. Select I range. Drive the car to obtain a steady road speed of 40 km/h (25 mile/h). Line pressure should be between 10,0 bar and 10,7 bar (145 lbf/in² and 155 lbf/in²).

Full throttle pressure check

1. Jack up the rear of the car and position blocks so that the rear wheels are clear of the ground.
2. Disconnect the vacuum line at the induction manifold.
3. Blank off the orifice in the manifold.
4. Run the engine at fast-idle (between 800 rev/min and 1000 rev/min) in neutral. The oil pressure should be 10,0 bar (145 lbf/in²).
5. Repeat the procedure in reverse. Reverse

pressure should be between 10,0 bar and 10,7 bar (145 lbf/in² and 155 lbf/in²).

6. Connect the vacuum pipe.

Towing

The car must not be towed if any mechanical damage to the transmission components is suspected, or if the torque converter transmission fluid level is low.

Before towing, check the fluid level in the transmission. The level must be **above** the FULL HOT mark on the dipstick when the engine is **not running**.

Should it be necessary to tow the car, even for a short distance, a solid tow bar must be used. This is important, as without the engine running to maintain the pressure in the hydraulic systems, the efficiency of the braking systems is reduced.

If the pressure in the hydraulic systems has been exhausted by operating the footbrake pedal without the engine running, the footbrake would not stop the car. If a solid tow bar is not available, the car must be transported.

Always tow the car with the torque converter transmission in neutral.

To select neutral it is first necessary to turn the ignition key in the switchbox to the RUN position. Providing that the battery is in a charged condition, this action will energize the gearchange actuator mechanism and neutral can then be selected by operating the gear range selector lever. Should the battery be in a discharged condition however, turning the ignition key will not energize the gearchange mechanism and operating the gear range selector lever therefore will not activate the actuator mechanism. In this event, it will not be possible to move the transmission out of the park position and it will be necessary to disconnect the gearchange actuator linkage at the manual shaft lever. Then, before the car can be towed or transported, engage neutral by moving the manual shaft lever two positions rearwards from the fully forward position.

Normally, when the ignition key is removed from the switchbox, park position is automatically engaged and the parking pawl locks the transmission. If it is required to remove the ignition key and still leave the car in neutral for towing, this can be accomplished by first removing the gearchange fuse (fuse A6 on fuse panel F2 on the main fuseboard) and then remove the key from the switchbox.

The car should only be towed for distances of up to 80 kilometres (50 miles) and the maximum towing speed must not exceed 56 km/h (35 mile/h). For greater distances the propeller shaft must be disconnected or the car transported.

Removal of units

Removable units – Transmission in car
The following units can be removed from the transmission without the transmission being removed from the car.

The removal procedure for all units is described in the appropriate section, with the exception of the pressure regulator valve, details of which are included in this section.

Gearchange actuator (Section T6).
Vacuum modulator and valve (Section T9).
Governor assembly (Section T10).
Speedometer drive (Section T11).
Sump, strainer, and intake pipe (Section T12).
Control valve unit (Section T13).
Rear servo (Section T14).
Detent solenoid, control valve spacer, and front servo (Section T15).
Rear extension (Section T16).
Control rods, levers, and parking linkage (Section T18).

Pressure regulator valve – To remove
The pressure regulator valve is a solid type (see fig. T5-1) and must only be used in the pump cover with the squared pressure regulator boss (see fig. T5-2).

1. Run the car onto a ramp. Drain the oil from the sump.
2. Remove the sump as described in Section T12.
3. Withdraw the intake pipe and strainer assembly.
4. Remove and discard the intake pipe 'O' ring.
5. Remove the setscrew which secures the detent roller spring; remove the spring and roller.
6. Slacken the lock-nut which secures the detent lever to the manual shaft.
7. Remove the manual shaft pin from the case.
8. Remove the gearchange lever from the manual shaft.
9. Prise the detent lever from the manual shaft then remove the parking actuator rod and detent lever.
10. Ensure that the manual valve does not slide out of its bore in the control valve unit.
11. Push the manual shaft through the bore in the case to gain access to the pressure regulator valve bore.
12. Using a screwdriver or a steel rod, push the regulator boost valve sleeve against the pressure regulator spring (see fig. T5-3).

Caution The pressure regulator spring is under extreme pressure and will force the valve sleeve out of its bore when the circlip is removed unless the sleeve is firmly held.

13. Continue to exert pressure on the valve sleeve then remove the circlip. Gradually relax the pressure on the valve sleeve until the spring pressure is released.
14. Carefully remove the regulator boost valve sleeve and valve, then withdraw the regulator spring. Take care not to drop the valves.
15. Remove the pressure regulator valve and spring retainer. Remove the spacers (if fitted).

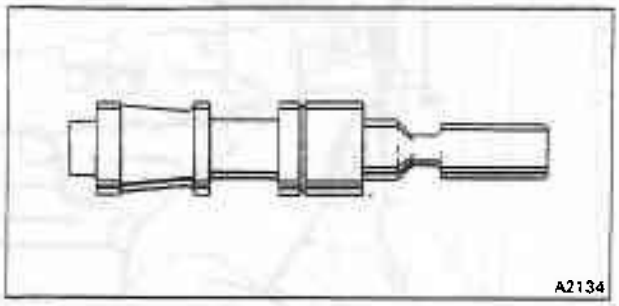


Fig. T5-1 Pressure regulator valve

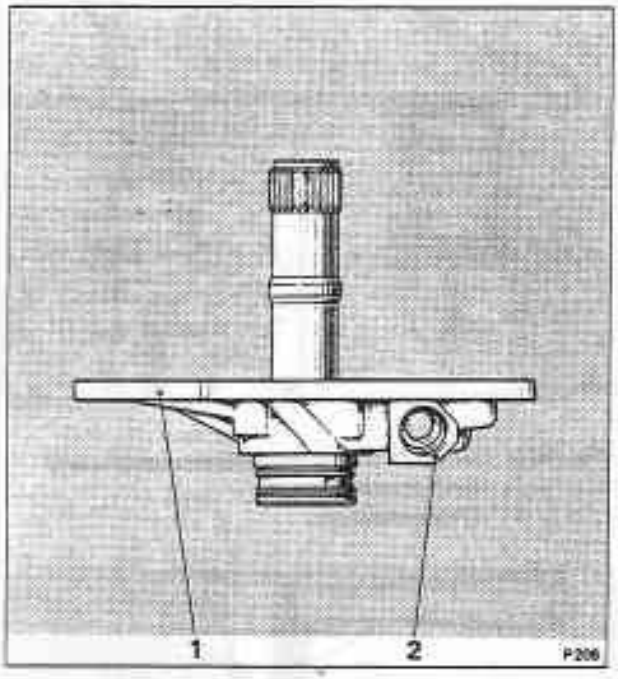


Fig. T5-2 Pump cover assembly
1 Pump cover
2 Pressure regulator boss

Pressure regulator valve – To fit
Before fitting, wash and examine all parts.

1. Fit the spring retainer onto the pressure regulator spring. Fit any spacers which were previously removed.
2. Fit the pressure regulator valve, stem end first, onto the spring.
3. Fit the boost valve into the sleeve with the valve

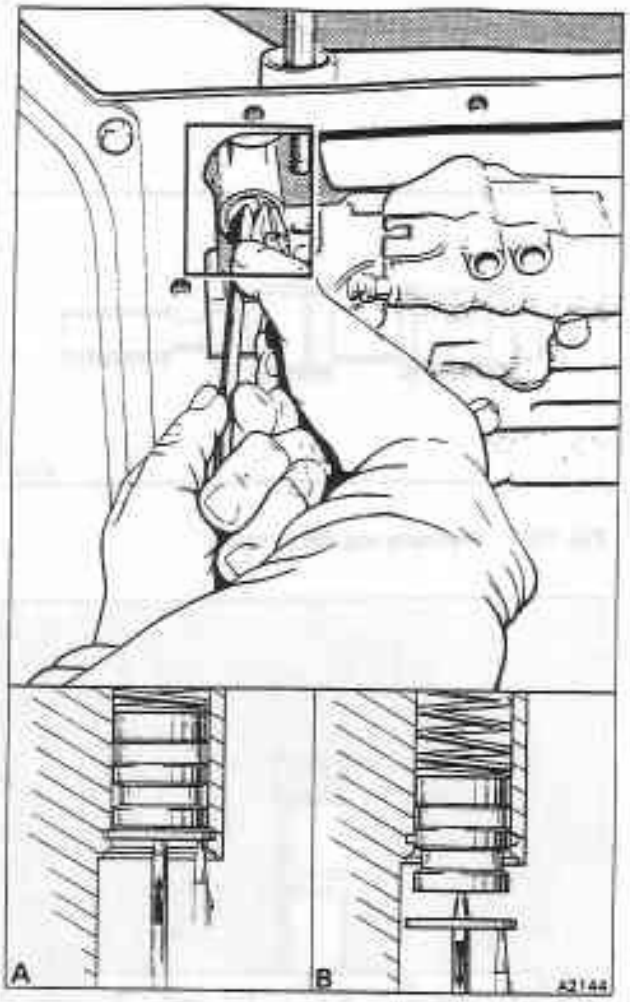


Fig. T5-3 Removing the pressure regulator valve
A Spring compressed
B Circlip removed

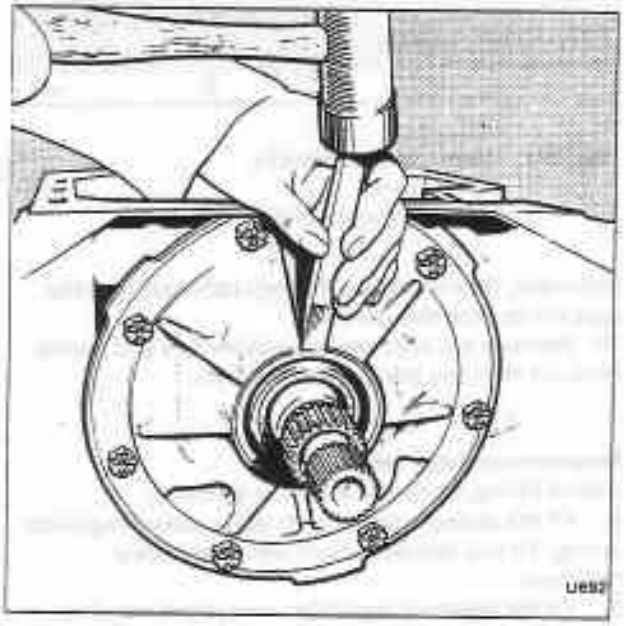


Fig. T5-4 Removing the oil pump seal

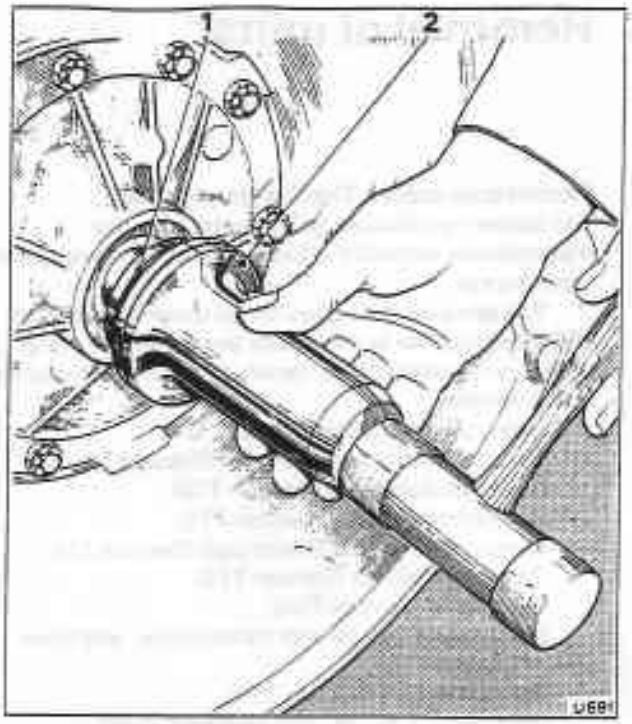


Fig. T5-5 Fitting the oil pump seal
1 Oil seal
2 Seal fitting tool

stem outward. Then, hold together all the parts so that the pressure regulator spring is against the valve sleeve.

4. Fit the complete assembly into the pressure regulator valve bore, taking care that the parts do not fall.
5. Using a screwdriver or a steel rod, push the regulator boost valve sleeve against the spring pressure of the regulator until the end of the sleeve has passed beyond the circlip groove.
6. Fit the circlip then relax the pressure on the sleeve.
7. Fit the parking actuator rod and detent lever, ensuring that the rod plunger is under the parking brake bracket and over the parking pawl.
8. Slide the manual shaft into the case and through the detent lever.
9. Fit the gearchange lever.
10. Fit the lock-nut onto the manual shaft. Torque tighten the nut.
11. Ensure that the manual valve is engaging with the pin on the detent lever.
12. Retain the manual shaft with the pin. Straighten the pin to lock it into position.
13. Fit the detent spring and roller assembly; torque tighten the setscrew.
14. Fit the intake pipe and strainer assembly, also the sump as described in Section T12.
15. Top-up the transmission with an approved fluid (see Chapter D).

Oil pump seal – To renew

1. Remove the transmission from the car (see Section T7).
2. Carefully drive the point of a chisel under the lip of the seal then prise the seal out of the pump body (see fig. T5-4).
3. Before fitting a new seal, ensure that the body bore is clean and free from burrs and that the garter ring is on the seal.
4. Check the finish of the converter neck and the bearing surface in the pump body.
5. Lightly smear the outer edge of the seal case with Wellseal. Then, fit the seal to the pump using tool RH 7953 as shown in figure T5-5.
6. Fit the transmission to the car (see Section T7).

Gearchange actuator

The electric gearchange actuator (see fig. T6-1) is mounted on a bracket secured to the transmission rear extension.

When the ignition is switched on and the selector lever on the steering column is moved to one of the gear range positions, current is allowed to flow to the actuator motor via a relay.

The motor rotates and turns the wormshaft through the flexible coupling. As the worm gear rotates, the slip ring, which is secured to the worm gear also rotates until an insulated slot in the slip ring is aligned with the live contact. When this position is reached, the current is cut off and the motor ceases to rotate.

The electric actuator is wired such that the transmission can be locked by moving the selector lever to the park position, with the ignition switched either on or off. However, to move the transmission out of the park position, the ignition has to be switched on, with the battery in a charged condition.

Note The actuator will also lock the transmission when the ignition key is removed from the switchbox.

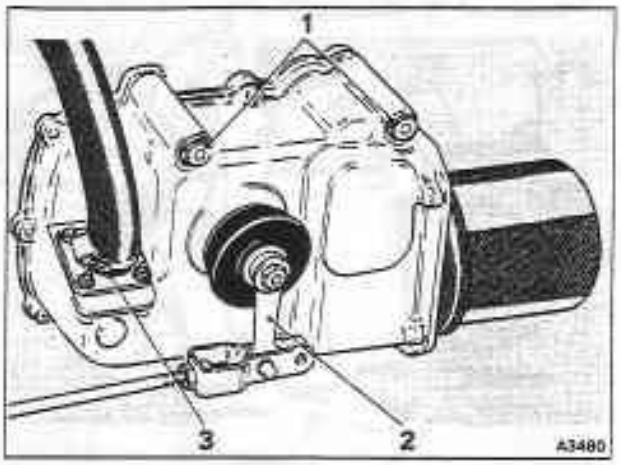


Fig. T6-1 Electric gearchange actuator
1 Actuator securing bolts
2 Actuating lever
3 Cable entry

Gearchange electric actuator – To remove

It is recommended that the easiest and quickest method of dealing with actuator failure, is by substituting the faulty actuator for a service exchange unit.

If a service exchange unit is not obtainable proceed as follows.

1. Disconnect the battery.
2. Remove the retaining ring and grooved pin from the actuating lever on the electric actuator; disconnect the rod from the lever.
3. Pull the carpet to one side and disconnect the electrical plugs from the left-hand side of the lower facia. Unclip the actuator cables from the loom. Remove the setscrew securing the electrical cable to the transmission tunnel. Also, the three nuts securing the loom/breather connection. Lower the electrical lead, plugs, etc., down through the transmission tunnel opening.
4. Remove the three bolts which secure the actuator to the rear extension bracket, then remove the actuator.

Gearchange electric actuator – To dismantle

1. Disconnect the transmission linkage and the actuator loom plugs. Remove the actuator.
2. Withdraw the side casing by carefuly removing the nuts and washers.
3. Remove the cam securing nut and washer and withdraw the cam.
4. Disconnect all terminals on the contact plate and micro-switches.
5. Withdraw the contact plate by removing the nuts and washers. Remove the relay connections.
6. Remove the nuts and bolts which secure the micro-switches, relay mounting bracket, relays, and motor cable connection posts.
7. Remove the securing setscrew and washer and withdraw the output lever.
8. Withdraw the washer and the rubber boot.
9. Remove the circlip and thrust washer.
10. Withdraw the slip ring and gear assembly from the actuator case.
11. Remove the contact segments from the slip ring.
12. Remove the setscrews and washers from the side of the actuator casing and remove the motor assembly and drive coupling. Remove the sealing ring from the actuator case.
13. Remove the internal circlip holding the wormshaft; push the wormshaft and bearings out of the casing.
14. Carefully cut and remove the tie wrap from around the electrical wiring.
15. Remove the securing clips from around both ends of the conduit; withdraw the conduit from the cast elbows.
16. Push out the electrical leads from the loom plugs. Collect the loom plugs, conduit elbow (tunnel connection), securing clips, and conduit.
17. Fasten together the electrical cables with tape and pull them back through the cable exit of the actuator casing.

Gearchange electric actuator – To inspect

1. Examine the aluminium casing for cracks or other damage.

2. Ensure that the joint faces are clean and free from burrs.

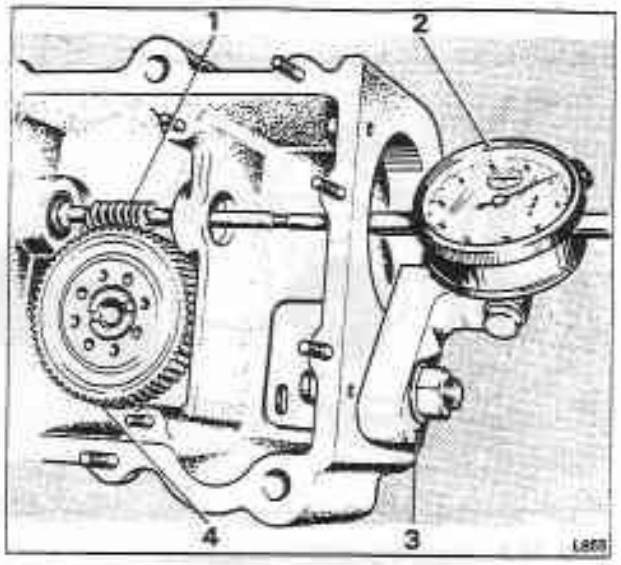


Fig. T6-2 Checking wormshaft end-float
1 Wormshaft
2 Dial indicator gauge
3 Gauge arm
4 Slave gear

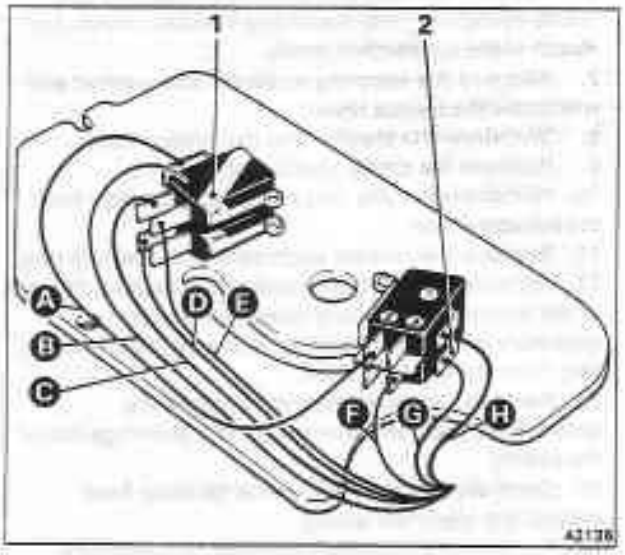


Fig. T6-3 Micro-switch connections
1 Reverse micro-switch
2 Neutral start switch
A Green/yellow cable
B Blue/brown cable
C White/brown cable
D Brown/slate cable
E Green/blue cable
F White/red cable
G White/yellow cable
H Light green/green cable

3. Examine the driving dog slot for excessive wear, also the mating shaft on the drive end of the motor armature shaft. The dog should be an easy sliding fit on the shaft but without excessive side play.
4. Examine the general condition of the plugs.
5. Examine the eight spring contacts for security on the insulated base.

Care must be taken when handling the assembled base plate so that the contacts and the relays are not damaged.

6. Check the height of the contacts from the base plate. The contact point should be approximately 12,32 mm (0.485 in) from the contact (lower) side of the base. If excessive wear has occured on the contact points the base assembly should be renewed.
7. If a Bosch relay assembly is faulty, it is recommended that a new assembly be fitted.
8. Ensure that the terminals and the terminal blocks are secure on the insulated base.
9. Examine the general condition of the wiring.
10. If the components are satisfactory, retain them with adhesive tape until they are required for final assembly.
11. Check the tightness of the setscrews which secure the slip ring assembly to the shaft.
12. Ensure that a 0,64 mm (0.025 in) air gap exists on each side of the silver plated segments which are secured to the slip ring.
13. Ensure that the edges of the slip ring around the air gap are free from burrs.
14. Examine the slip ring face for signs of tracking. This should not normally occur but, if signs of tracking are found, the slip ring assembly must be renewed.
15. Examine the teeth on the worm gear and the worm for damage or uneven wear.
16. Examine the bearing bores in the main casing for signs of fretting. The bearing should be a light push fit in the casing. Reject the casing if the push fit cannot be obtained.
17. Examine the bush which supports the output shaft for wear. The shaft should be a running fit in the bush, without excessive clearance i.e. the shaft should not rock in the bush.

Actuator plugs and cable assembly
1. Inspect the cables where they enter the plugs.
2. Ensure that no corrosion exists and that none of the individual cable strands are broken.

Actuator casing
1. Inspect all the sealing faces, also the actuator casing and the side cover.
2. Remove all traces of sealing joint and sealing compound.

Wormwheel
1. Inspect the wormwheel for abnormal wear of the teeth.

Wormshaft bearing
1. Inspect the bearings for undue wear or signs of roughness when rotated.

Micro-switch contacts – To set

1. Remove the starter relay. Then, switch on the ignition and check that the actuator will select all six gear stations correctly.
2. Move the gear selector lever to D and fit the micro-switch cam to the actuator output shaft. When tightening the nut, the torque reaction should be taken by gripping the output lever such that the tightening force is not absorbed by the nylon teeth of the wormwheel.
3. Move the gear range selector lever to the park position.
4. Locate the two right-hand micro-switches (see fig. T6-3).

Move the switches towards the peak of the cam until the switch plungers are in the centre of the peak and are depressed to within 0,38 mm (0.015 in) of the switch body as shown in figure T6-5. When both switches are in the correct position, tighten the mounting bolts.

5. Repeat this procedure on the left-hand micro-switches keeping the switch body on the reverse micro-switch parallel to the bottom micro-switch body.
6. Select reverse gear and check that all the other three switches are clear of the cams.
7. Select neutral and ensure that the right-hand pair of switch plungers are correctly depressed and that the reverse micro-switch is clear of the cam.
8. Switch off the ignition and fit the starter relay.
9. Remove the actuator from the car and fit the casing side cover, painting both sides of the new gasket provided with a suitable jointing compound. Fit the actuator to the transmission, connecting the loom plugs and the actuator linkage.

Gearchange electric actuator – To assemble

1. Fit the main output shaft bearing into the actuator casing. The bearing should be fitted such that it is slightly proud on both the inside and outside of the casing.
2. Inspect the inside edge of the cable entry hole and ensure that it is free from burrs and sharp edges.
3. Check the gear form on the wormshaft is free from burrs and that no foreign particles are trapped between the gear teeth.
4. Fit the bearings to the wormshaft ensuring they are lubricated with Retinax A grease. These should be a push fit.
5. Assemble the wormshaft and bearings into the actuator case. The bearings must be a push fit in the casing bores; on no account should they require a hammer load to assemble them.
6. Adjust the end-float of the wormshaft to between 0,005 mm and 0,012 mm (0.002 in and 0.005 in) using a suitable washer. Fit the circlip. Check the end-float on the end of the shaft using a dial indicator gauge (see fig. T6-2).
7. Check the gear form on the nylon gear is good and free from blow holes and burrs. Check that the shaft bearing area is free from burrs.
8. Fit the nylon gear onto the output shaft using four

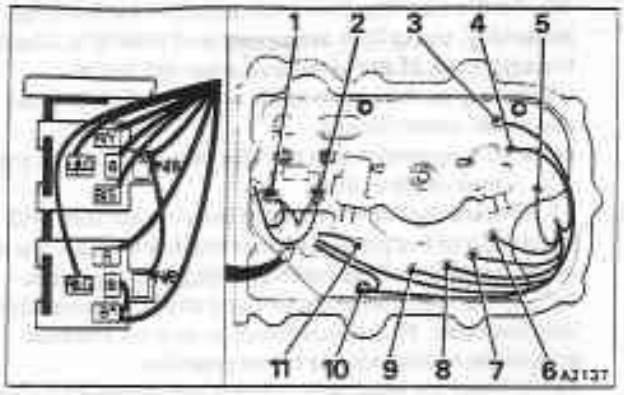


Fig. T6-4 Cable connections

1 Red/light green to motor
2 Blue/light green to motor
3 Red to relay
4 Black/brown to loom
5 Black/red to loom
6 Black/blue to loom
7 Black/green to loom
8 Black/yellow to loom
9 Black/white to loom
10 Black to earth terminal
11 Red/yellow to relay

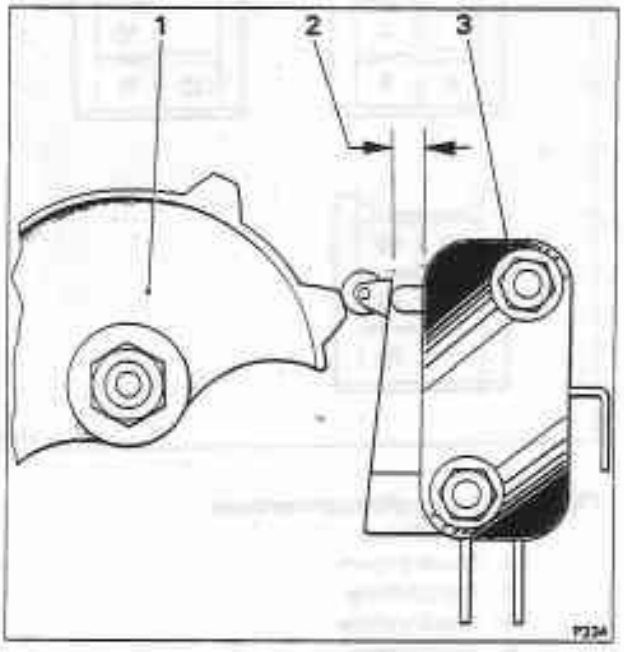


Fig. T6-5 Adjustment of micro-switches

1 Cam
2 Gap 0,38 mm (0.015 in)
3 Micro-switch

setscrews so that the holes used are at the end of the 'double D' machined flats.

9. Fit the silver plated segments onto the slip ring base. The corners of the segments must be completely free from burrs.

10. Fit the slip ring assembly onto the output shaft assembly, using four setscrews and washers. Check the tightness of the setscrews after the initial tightening as the nylon tends to settle slightly after the initial compression.

Note It is essential that the slip ring runs true to the main output shaft.

11. Ensure that both the shaft bearing surface and the inside of the porous bronze bush are clean. **Do not** clean the bronze bush with any degreasing agent.
12. Fit the main output shaft and slip ring assembly into the bush. This should slide in and no attempt should be made to force it into position.
13. Lift out the shaft and check it has received a smear of oil from the porous bronze bush. Lubricate the nylon gear with Retinax A grease and then fit the assembly into the casing.
14. Fit a bronze washer onto the outside of the shaft and then fit the circlip.

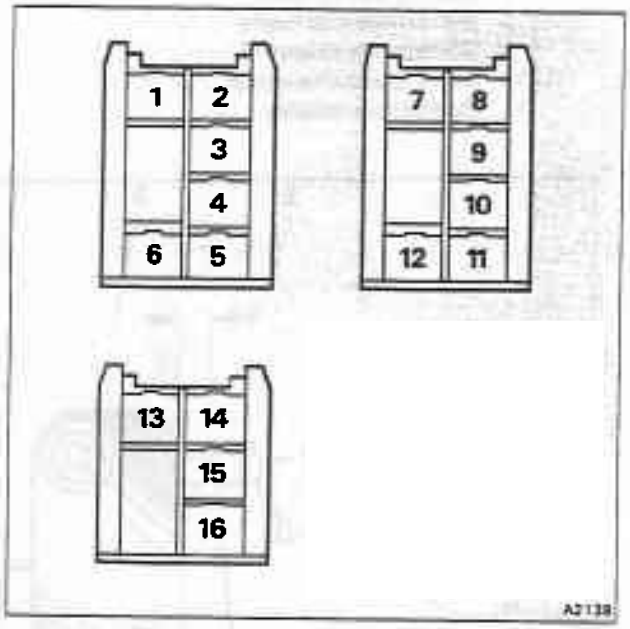


Fig. T6-6 Loom plug connections

1 Black/blue
2 Black/brown
3 Black/white
4 Black/yellow
5 Black/green
6 Black/red
7 Light green/green
8 Green/blue
9 White/brown
10 Brown/black
11 Black/slate
12 Blue/brown
13 Brown/slate
14 Black
15 White/yellow
16 White/red

Note Ensure the wormshaft can turn freely. Rotate the assembly until the slip ring open circuit sections are approximately at 90° to the wormshaft, and the flat side of the 'D' on the shaft is uppermost.

15. Fit the rubber gaiter to the outside of the casing and over the shaft. Then fit a bronze washer, connecting shaft, securing setscrew, and washer.
16. Fit the nylon coupling onto the driving dog of the wormshaft.
17. Seat the 'O' ring in its groove in the actuator casing and pass the motor feed wires through the hole in the casing. Mate the nylon coupling on the wormshaft with the motor shaft and hold the motor in position.
18. Fit the three mounting setscrews and washers and tighten evenly. Check that the wormshaft can be rotated easily.
19. Fit the sealing gasket and outlet elbow to the cable exit of the casing; secure with nuts and spring washers.
20. Feed the loom cables through the actuator casing from the inside. A strip of tape around the cable ends may assist in this operation. Pull the loom through until sufficient length of cable is left inside the casing to connect to the contact plate assembly.
21. Check the inside edges of the conduit elbow (tunnel connection) are free of burrs. Feed the loom through the conduit and elbow; push the conduit over the cable exit connection of the casing and the conduit elbow, secure both ends with clips. Remove the tape from the cable ends; connect the cables into the plugs (see fig. T6-6).
22. At the inside of the actuator casing fit a tie wrap to the loom at the cable exit. This should be passed through the centre of the loom and then wrapped around the loom 1½ times and fixed tightly. The position of the tie wrap must be such that when the actuator is suspended by the loom, the tie wrap takes the load and no electrical connections are under stress.
23. Connect the electrical connections to the relays on the underneath of the contact plate assembly. Fit a tie wrap around the cables and bracket to avoid a foul between the wires and motor shaft.
24. Loosely fit the contact plate assembly into the casing, taking care not to damage the relays. Guide the motor feed wires between the casing and the indentation in the contact plate tufnol base.
25. Fit the four nuts and washers, tightening them evenly.
26. View the layout of the contacts onto the slip ring through the elongated hole in the contact plate, and ensure that there is a minimum of 1,27 mm (0.050 in) between adjacent contacts. Also, ensure that there is approximately 1,58 mm (0.062 in) from either the edge of the segments or the countersinks for the retaining screws.
27. Fit the electrical connections, starting with the longest connections on the contact base, progressing to the shorter wires and then finally the micro-switches, suppressor, and motor terminations (see figs. T6-3 and T6-4).

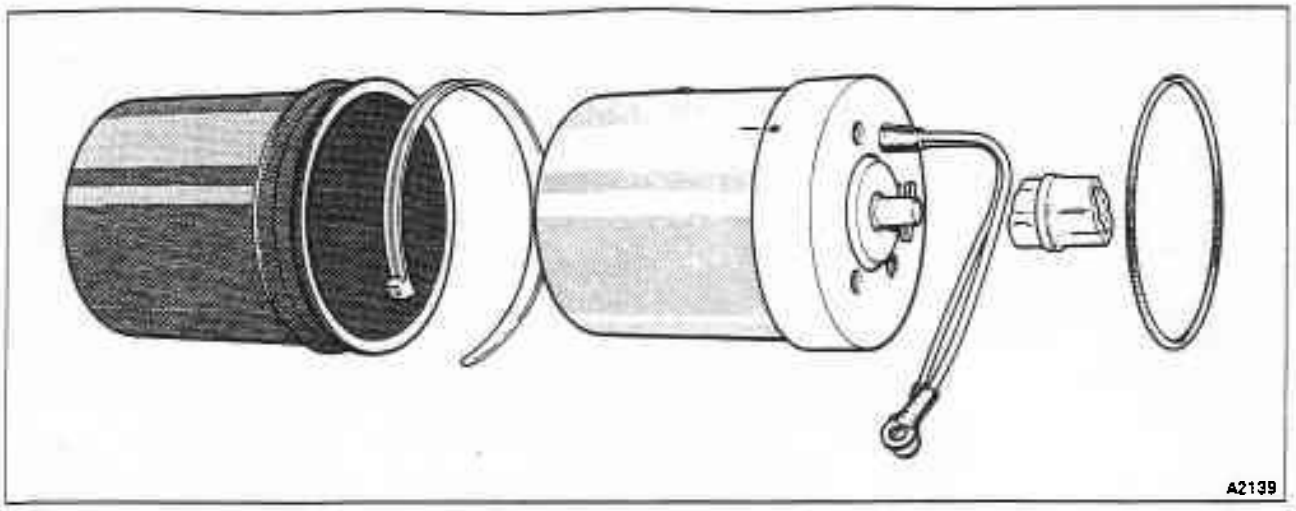


Fig. T6-7 Gearchange actuator motor

28. Fit the casing lid, with its gasket painted with Wellseal on both sides. Tighten down using nuts and spring washers.
29. Fit the rubber boot over the motor. A smear of grease inside the leading edge of the boot assists the fitting. Retain the boot onto the motor using a plastic clip, which, while needing reasonable tightening should not be allowed to cut into the rubber.

Gearchange actuator motor – To dismantle

1. Tap out the driving pin from the driving shaft (see fig. T6-7). Remove the rubber boot.
2. Unscrew and withdraw the two bolts securing the motor housing, remove the housing.
3. Remove the armature from the end plate.

Gearchange actuator motor – To inspect

1. Examine the magnets for any damage, cracks, or fractures.
2. Examine the brushes for wear; fit new brushes if necessary.
3. Examine the armature commutator for wear or damage; if scored polish with fine emery cloth. If the score marks are heavy and cannot be removed with light polishing, fit a new armature.
4. After polishing carefully clean the commutator slots to remove particles of carbon.
5. Examine the bearing bushes for wear, replace if necessary.
6. Examine the armature shaft for wear on the bearing diameter.

Gearchange actuator motor – To assemble

Assemble the actuator motor by reversing the procedure given for dismantling, ensuring the marks on the casing are in line (see fig. T6-7). Test the motor after assembly, if the current consumption exceeds 1.5 A, the armature has an electrical fault and should be renewed.

Gearchange electric actuator – To fit

1. Fit the actuator to the rear extension of the transmission.
2. Torque tighten the bolts.
3. Feed the plugs through the hole in the transmission tunnel. Secure the elbow to the tunnel ensuring that a new gasket is fitted. Clip the cables to the loom and connect the electrical plugs.
4. Connect and adjust the linkage, ensuring a new retaining ring is fitted.
5. Connect the battery.

Transmission – To remove and fit

Transmission - To remove

1. Drive the car onto a ramp.
2. Ensure that both front wheels and one rear road wheel are suitably chocked to prevent the car moving.
3. Switch on the ignition and select neutral position with the gearchange selector lever. This ensures that the transmission and propeller shaft are not locked in the park position.
4. Switch off the ignition and remove the gearchange fuse (fuse A6 on fuse panel F2) from the fuse board.
5. Disconnect the battery.
6. Jack up the un-chocked rear road wheel to enable the propeller shaft to be rotated.
7. Remove the centre body crossmember and disconnect the propeller shaft at the gearbox end.
8. Lower the rear road wheel and suitably chock.
9. Raise the bonnet.
10. Drain the transmission fluid (see Section T3).
11. Remove the dipstick and filler tube clip. Disconnect the vacuum modulator pipe.
12. Disconnect the speedometer electronic impulse transmitter electrical connections, noting the cable colours to assist when fitting. Slacken and remove the transmitter retaining nut and withdraw the transmitter.
13. Disconnect the detent solenoid electrical connection.
14. Disconnect the operating rod from the side of the transmission case.
15. Remove the bolts securing the gearchange actuator to the rear extension and remove the actuator.
16. Remove the front section of the exhaust system and catalytic converter. Also the grass-fire shields (if fitted).

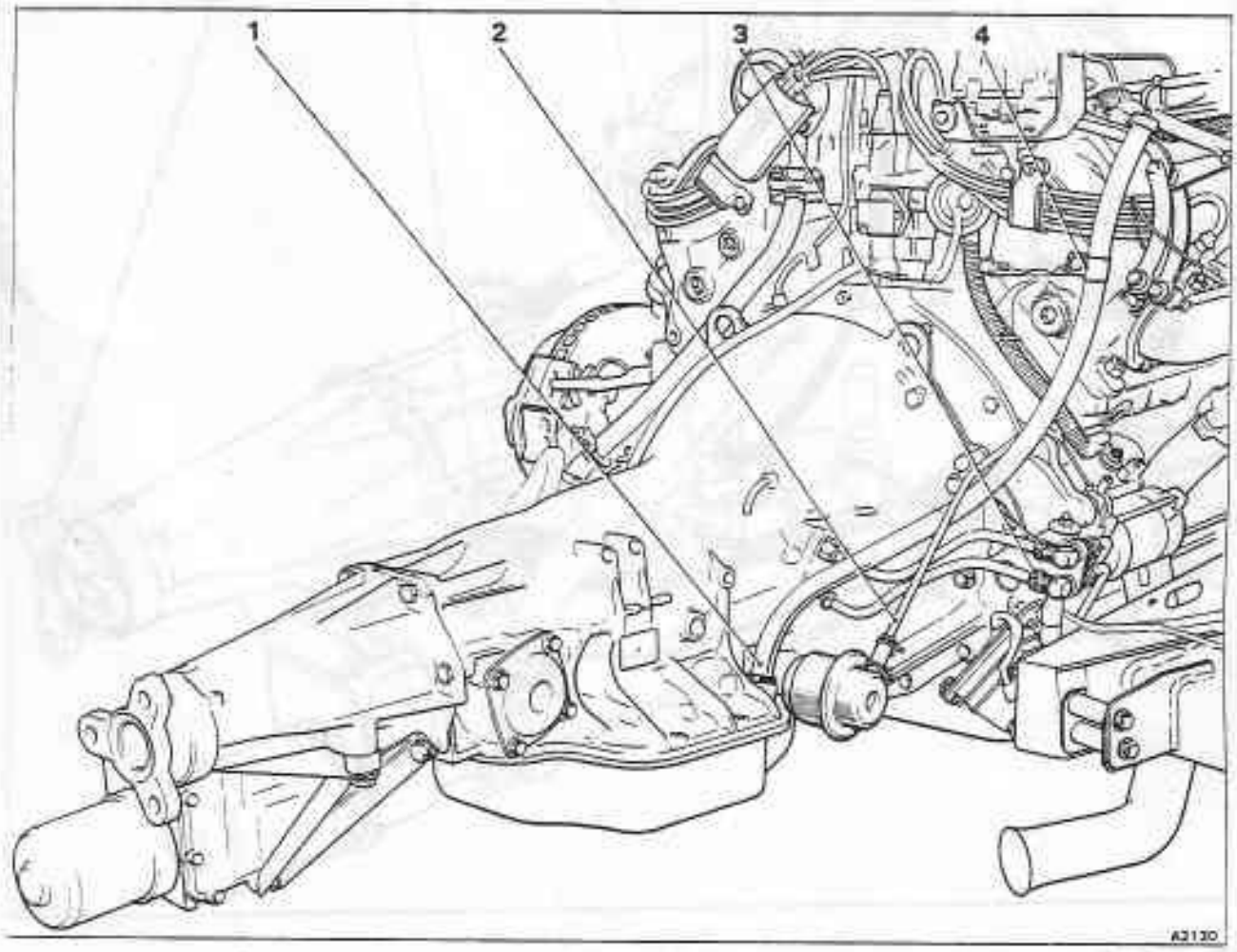


Fig. T7-1 Transmission disconnecting points – Right-hand side

1 Dipstick/filler tube
2 Modulator pipe
3 Transmission oil cooler pipe connections
4 Dipstick/filler tube clip

17. Remove the EGR feed pipe (if fitted).
18. On left-hand drive cars remove the throttle linkage cross-shaft.
19. Disconnect the two transmission fluid pipes from the rear engine mounting plate, leading to and from the heat exchanger situated in the engine coolant radiator.
Note There may be a small quantity of transmission fluid in the pipes which will drain out when the pipes are disconnected. Therefore, ensure a suitable container is available.
20. Remove the engine speed sensor (1989 model year Bentley Turbo R).
21. Remove the setscrews which secure the front cover plate and bell housing bottom cover. Remove the plate and cover.
22. Scribe correlation marks onto the converter and flexplate/four segment timing wheel (as applicable). Then, remove the setscrews which secure the engine flexplate/timing wheel to the converter.
Note Take care not to damage the flexplate/four segment timing wheel or starter ring when turning the torque converter to gain access to the setscrews.
23. Using a suitable platform to fit around the transmission sump, support the transmission with the aid of a trolley jack and extension.
24. Remove the setscrews which secure the transmission to the adapter.
25. Carefully move the transmission towards the rear of the car until the dowels in the transmission are clear of the mounting plate. Remove the dipstick/filler tube.
26. Fit the retaining clamp RH 7952 to prevent the converter from becoming disengaged from the transmission.
Note The retaining clamp must be used, otherwise the converter may fall as the transmission is being removed.
27. Lower the jack until the transmission is clear of the body. Then, remove the transmission from beneath the car.
28. If overhaul work is to be carried out, remove the retaining clamp and withdraw the converter.

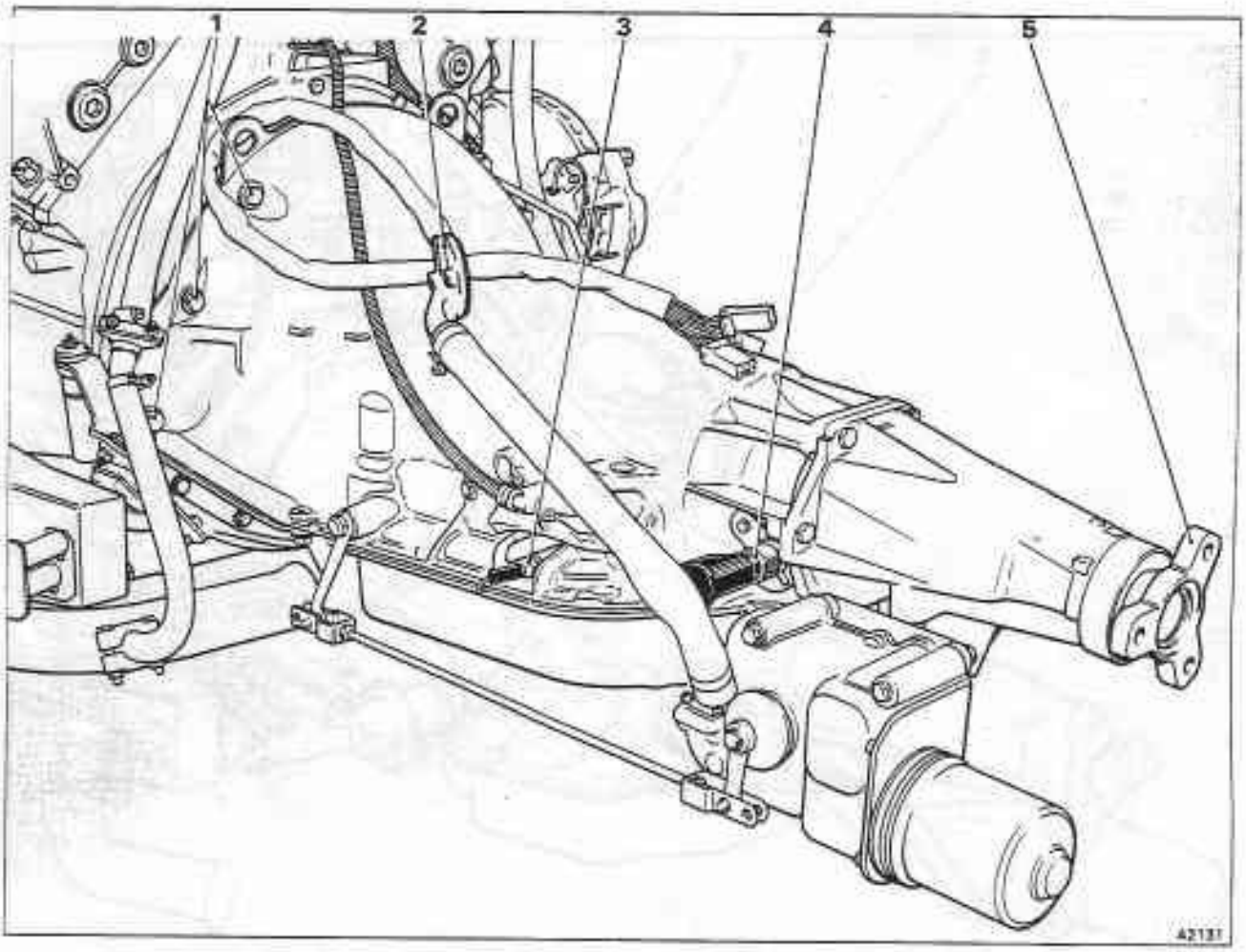


Fig. T7-2 Transmission disconnecting points – Left-hand side
1 Transmission securing setscrews
2 Gearchange actuator connections
3 Detent solenoid connection
4 Electronic impulse transmitter
5 Coupling flange

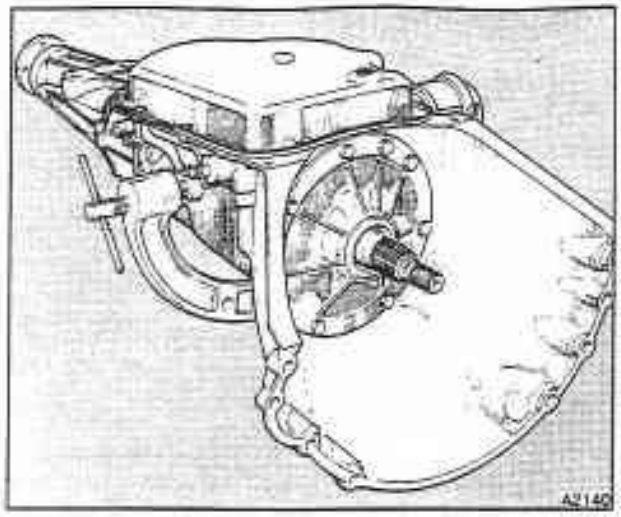


Fig. T7-3 Transmission in holding fixture

Note A converter containing oil weighs approximately 23 kg (50 lb).

29. Fit the transmission into the holding fixture RH 7955 as shown in figure T7-3.

Transmission - To fit

Fit the transmission by reversing the procedure given for removal, noting the following.

1. Ensure the mating faces of the transmission and the mounting plate are clean and free from damage.
2. Torque tighten the various nuts, bolts, and setscrews to the figures quoted in Section T23 and Chapter P.
3. A liberal coating of Retinax A grease should be applied all over the converter pilot spigot prior to fitting the converter.
4. Rotate the converter until the correlation marks (scribed during removal) are aligned. Then, fit the setscrews. **Do not** lever on the rotating the converter.
5. If a new transmission is be marked on the rear face of the timing wheel by a radial line of paint, must be positioned as close as possible to the light spot (white letter L) on the converter.
6. After completion of the fitting operation, fill the transmission with fluid (see Section T3).
7. Finally, road test the car for satisfactory operation.

Remark:

The painted mark "L" denotes the light side of the torque converter after balancing.

The painted mark "H" denotes the heavy side of the flywheel after balancing.

Although the units are balanced individually, the machinist marks them L and H indicating the small residual imbalance. By matching the light side of the torque converter to the heavy side of the flywheel, the nett imbalance is minimised.

Torque converter

The torque converter serves two primary functions. It acts as a fluid coupling to transmit engine torque smoothly to the transmission. It also multiples the engine torque when additional performance is required.

The torque converter comprises three basic elements; a pump, a turbine, and a stator (see fig. T8-1).

The converter cover is welded to the pump to seal all three members in an oil filled housing.

On turbocharged cars, the vanes are welded to the outer casing and the converter to flexplate securing lugs are more positively secured for added strength.

An engine driven flexplate/four segment timing wheel bolts directly onto the converter cover in six places. Therefore, the converter pump is mechanically connected to the engine and turns whenever the engine rotates.

When the engine is running and the converter pump is rotating, oil is picked up at the centre of the pump and discharged at the rim, between the pump blades.

The pump shell and blades are designed so that the oil leaves the pump rotating clockwise, towards the turbine blades. As the oil strikes the turbine blades, it causes the turbine to rotate.

When the engine is idling, the converter pump rotates slowly and the force of oil is not sufficient to rotate the turbine with any efficiency. This situation enables the car to stand in gear with the engine idling. As the engine throttle is opened, the pump speed increases and the force of oil striking the turbine causes it to transmit torque to the gear train. After the oil has imparted its force to the turbine, the oil follows the contour of the turbine shell and blades, leaving the centre of the turbine, rotating anti-clockwise.

Because the turbine member has absorbed the force required to reverse the direction of the clockwise rotating oil it now has greater torque than is being delivered by the engine.

To prevent the anti-clockwise spinning oil from striking the pump blades at an angle that would hinder its rotation, a stator assembly is interposed between the pump and the turbine. The purpose of the stator is to redirect the oil returning from the turbine so that its direction is altered to suit that of the pump.

The energy of the oil is then used to assist the engine in turning the pump. This increases the force of the oil driving the turbine and as a result, multiplies the torque.

The force of the oil flowing from the turbine to the stator blades tends to rotate the stator anti-clockwise. However, a clutch on which the stator is mounted, prevents this.

As both turbine and car speeds increase, the direction of the oil leaving the turbine changes. The oil flows clockwise against the rear side of the stator vanes. If the stator was fixed, the flow of the oil would be impeded, but the clutch allows the stator to rotate on its shaft. Once the stator becomes inactive there is no further torque multiplication and the converter functions as a fluid coupling at a ratio of 1:1.

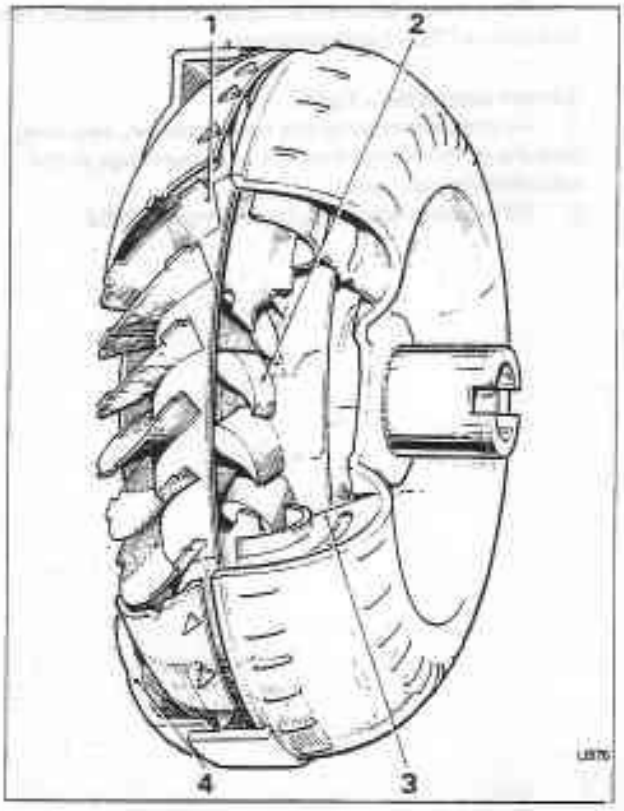


Fig. T8-1 Torque converter
1 Turbine
2 Stator
3 Pump
4 Converter cover

Torque converter – To remove

1. Remove the transmission as described in Section T7.

Note Ensure that the converter holding clamp RH 7952 is fitted otherwise the converter may fall when the transmission is removed.

2. Position a drip tray underneath the converter.
3. Remove the converter retaining clamp from the bell housing end of the transmission casing; remove the converter.

Caution The converter and oil weigh approximately 23 kg (50 lb). Therefore, care should be taken when removing the converter to ensure that it is not dropped or damaged.

Torque converter – To inspect

After removing the torque converter from the transmission visually inspect as follows.

1. Examine the converter for signs of damage.
2. Examine the neck of the converter for wear.
3. Examine the pump drive slots for wear.

For a more detailed procedure of inspection refer to Section T22 – Fault diagnosis.

Torque converter – To fit

1. Fit the converter to the transmission, ensuring that the driving slots engage with the tangs in the transmission oil pump.
2. Fit the converter holding clamp RH 7952.

Vacuum modulator and valve

The vacuum modulator is secured to the right-hand side of the transmission case and is connected by a pipe to the engine induction system. The modulator consists of a metal case which encloses an evacuated metal bellows, a diaphragm, and two springs. These components are arranged so that when fitted, the bellows and an external spring apply a force that acts on the modulator valve to increase modulator pressure. Engine vacuum and an internal spring act in the opposite direction to decrease modulator pressure.

To reduce the effect of altitude on shift points, the effective area of the diaphragm is different than that of the bellows. Atmospheric pressure acts on the resulting differential area to reduce modulator pressure.

The vacuum modulator fitted to a transmission can vary dependent upon 'model year' and original build specification of the car. It is therefore, of utmost importance to ensure that the correct parts are fitted to a transmission should replacement parts be required.

To identify the modulator check the prefix letters of the tranmsission i.e. RHA, RKA, RMAB, and RNAB (blue modulator); RDA, RJA, RLA, RMA, and RNA (brown modulator).

On naturally aspirated cars only, a restrictor is fitted at the bottom of the modulator pipe and an error in assembly at this point could result in a blocked signal line. Especially, on cars fitted with emission control systems.

On turbocharged cars, a 'T' piece and a one-way valve are used in the vacuum modulator line to prevent pressure build-up. With normal vacuum the system works as other modulator systems, but when pressure builds-up, the one-way valve opens and allows pressure relief into the compressor side of the turbocharger.

Modulator pressure is directed to the 1-2 regulator valve which reduces it proportionally. This tends to hold the 1-2 shift valve in the closed or down-change position. Modulator pressure is directed also to the 2-3 modulator valve to apply a variable pressure proportional to modulator pressure. This tends to hold the 2-3 shift valve in the closed, or down-change position. As a result, the gearchange points can be delayed to take place at higher road speeds with heavy throttle application.

Main line oil pressure is controlled in drive range so that it will vary with torque input to the transmission. Since torque input is a product of engine torque and converter ratio, modulator pressure is directed to a pressure regulator boost valve, to adjust main line (pump) pressure for changes in either engine torque or converter ratio.

To regulate modulator pressure (and in turn line pressure), with the torque converter ratio (which decreases as car speed increases), governor pressure is directed to the modulator valve to reduce modulator pressure with increases in car speed. In this way, line pressure is regulated to vary with torque input to the transmission for smooth changes with sufficient capacity for both heavy and light acceleration.

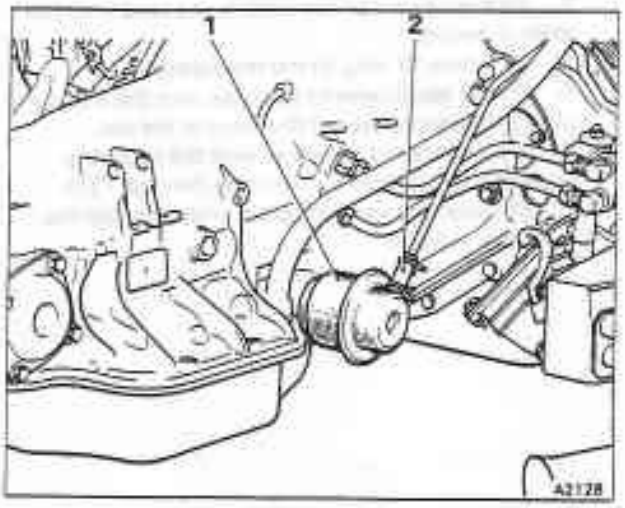


Fig. T9-1 Vacuum modulator and vacuum pipe
1 Vacuum modulator
2 Vacuum pipe

Vacuum modulator and valve – To remove

The vacuum modulator can be removed from the transmission without removing the transmission from the car. The following instructions apply whether or not the transmission has been removed.

1. Place a drip tray beneath the vacuum modulator.
2. Disconnect the vacuum pipe at the modulator end if the transmission is in the car (see fig. T9-1).
3. Remove the setscrew and retainer which secure the modulator to the transmission.
4. Remove the modulator and 'O' ring; discard the 'O' ring.
5. Remove the modulator valve from the transmission case.

Vacuum modulator and valve – To inspect

1. Examine the vacuum modulator for signs of distortion.
2. Examine the 'O' ring seat for damage.
3. Apply suction to the vacuum tube on the modulator and check for leakage.
4. Examine the modulator valve for scores or damage.
5. Ensure that the valve will move freely in the case bore.

6. Examine the modulator for damaged bellows. The modulator plunger is under approximately 71 N (16 lbf) pressure. If the bellows are damaged, very little pressure will be applied to the plunger.

Vacuum modulator and valve – To fit

1. Fit the valve into the bore in the case with the stem outward.
2. Fit a new 'O' ring to the modulator.
3. Fit the modulator to the case with the vacuum pipe connection toward the front of the car.
4. Fit the retainer together with the retaining setscrew and torque tighten (see Section T23).
5. Connect the vacuum pipe, ensuring that the restrictor is fitted.

Governor assembly

The governor assembly (see fig. T10-1) fits into the rear of the transmission casing on the right-hand side. The car speed signal for the gear changes is supplied by the governor, which is driven by a gear on the transmission output shaft.

The assembly comprises a regulating valve, two primary weights, two secondary weights, secondary springs, body, and driven gear. The weights are arranged so that only the secondary weights act on the valve. The primary weights contribute to the secondary weights through the secondary springs.

On turbocharged cars, the governor springs and weights are uprated, and therefore should not be interchanged with any other transmissions.

Slight changes in output shaft rev/min at low speeds result in small governor pressure changes.

The primary weights add additional force to the secondary weights to obtain greater changes in pressure as road speed and output shaft rev/min increase. As the primary weights move out at higher car speeds they reach a stop and no longer become effective. From this point, the secondary weights and springs only are used to apply pressure on the governor valve.

Drive oil pressure is fed to the governor where it is regulated by the governor and gives an oil pressure that is proportional to the road speed of the car.

To initiate the gear change from first to second, governor oil pressure is directed to the end of the 1-2 shift valve. It then acts against spring pressure which is holding the valve in the down-change (closed) position.

As the road speed of the car and subsequently the governor oil pressure increases sufficiently to overcome the spring resistance, the 1-2 shift valve train moves, allowing drive oil to flow into the intermediate clutch passage and through an orifice to apply the intermediate clutch. This makes the intermediate clutch effective which moves the transmission into second gear. Further increases in road speed and governor pressure will cause the transmission to change into third gear when governor pressure overcomes the 2-3 shift valve spring pressure.

Governor pressure is directed also to the modulator valve to regulate modulator pressure as described in Section T9.

Governor lubrication is provided by a flat in the governor sleeve which allows oil to pass to the moving parts of the governor.

Governor assembly – To remove

The governor assembly can be removed from the transmission whether the transmission is fitted to the car or not.

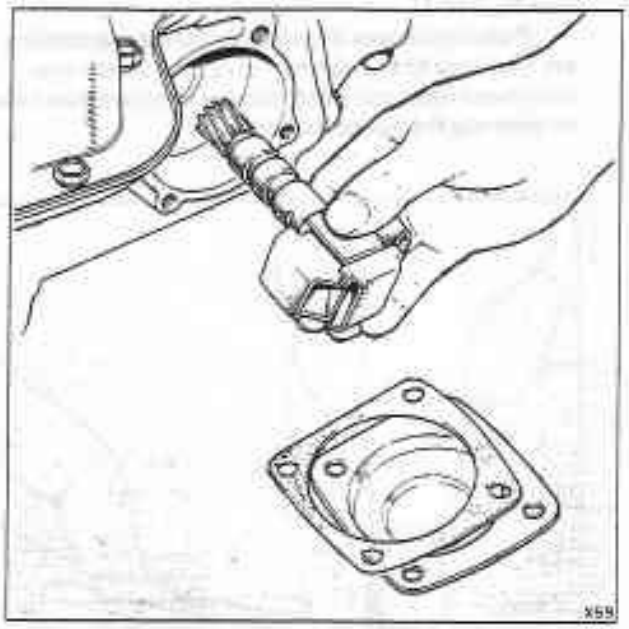


Fig. T10-1 Removing the governor assembly

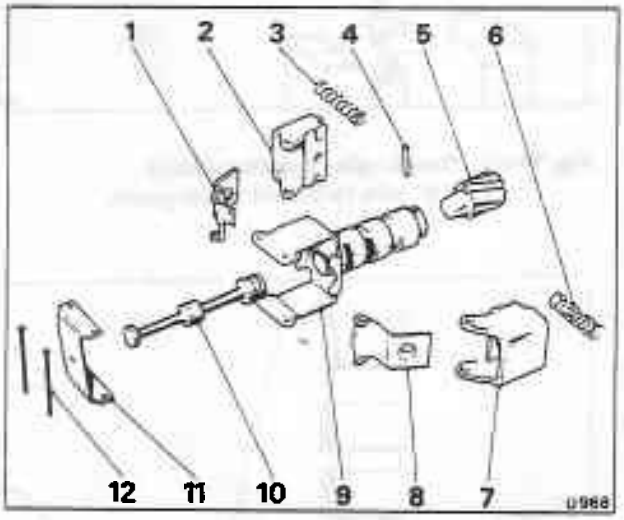


Fig. T10-2 Governor assembly – exploded

1 Spring retainer (secondary weight)
2 Weight (primary)
3 Spring
4 Gear retaining pin
5 Driven gear
6 Spring
7 Weight (primary)
8 Spring retainer (secondary weight)
9 Sleeve and carrier assembly
10 Valve
11 Thrust cap
12 Retaining pins

1. Position a drip tray beneath the governor cover plate.
2. Remove the four setscrews which secure the plate to the case; remove the plate and discard the gasket.
3. Withdraw the governor assembly from the case (see fig. T10-1).

Possible causes of governor binding or locking are the pipes to the control valve unit. These may have been fitted too deep into the transmission case, so entering the governor bore.

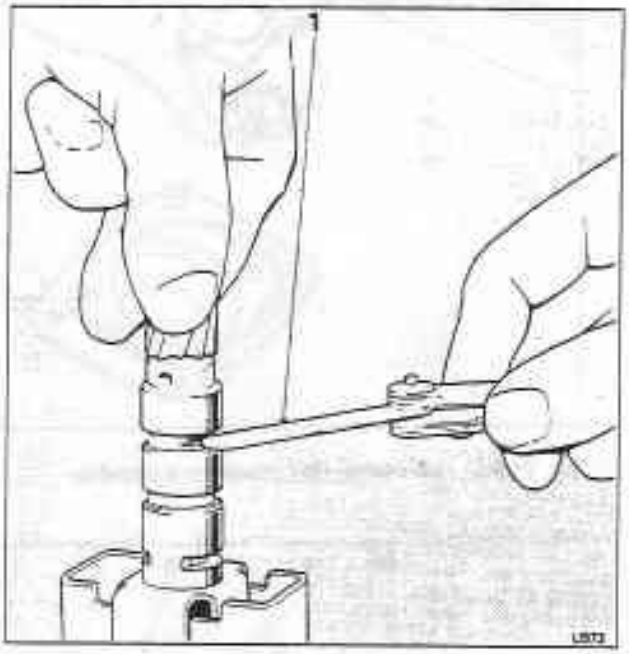


Fig. T10-3 Check valve opening (inlet)
1 0,51 mm (0.020 in) feeler gauge

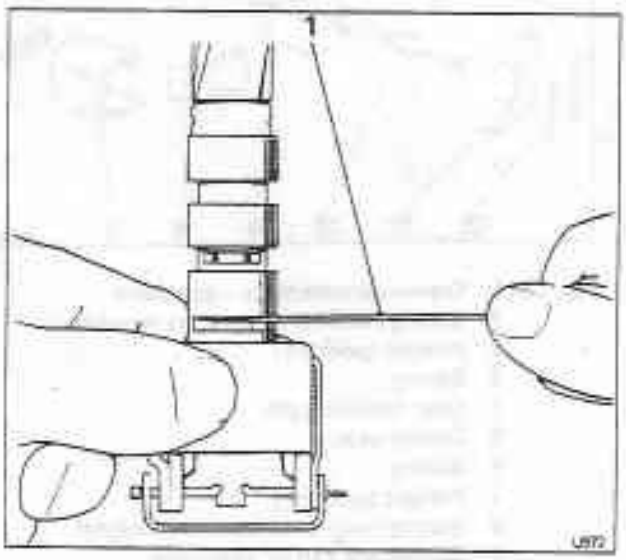


Fig. T10-4 Check valve opening (exhaust)
1 0,51 mm (0.020 in) feeler gauge

Therefore, if difficulties are experienced when removing the governor assembly, withdraw the pipes approximately 3,17 mm (0.125 in).

Governor assembly – To dismantle

All the governor assembly components, with the exception of the driven gear, are selectively assembled and each assembly is calibrated. Therefore, it is recommended that if the governor assembly becomes unserviceable, it can be renewed as an assembly. If the driven gear is damaged, it can be renewed separately.

It is necessary to dismantle the governor assembly in order to renew the driven gear. Dismantling may be necessary also to thoroughly clean the governor should dirt cause it to malfunction. In such cases proceed as follows.

1. Cut off one end from each of the governor weight retaining pins.
2. Remove the pins, thrust cap, governor weights, and springs (see fig. T10-2). The weights are interchangeable and need not be marked for identification.
3. Carefully remove the governor valve from the sleeve.

Governor assembly – To inspect

1. Wash all the components in clean paraffin, then dry them with compressed air.
2. Examine the governor sleeve for scores or burrs.
3. Ensure that the governor sleeve will slide freely into its bore in the transmission casing.
4. Examine the valve for scores and burrs.
5. Ensure that the valve will slide freely in the governor sleeve bore.
6. Examine the driven gear for damage. Ensure that the gear is secure on the shaft.
7. Examine the springs for damage or distortion.
8. Ensure that the weights operate freely in their retainers.
9. Hold the governor as shown in figures T10-3 and T10-4. Then, check that there is a minimum of 0,51 mm (0.020 in) at the inlet and exhaust openings.

Governor driven gear – To renew

1. Drive out the gear retaining pin as shown in figure T10-5.
2. Support the governor sleeve on two 2,77 mm (0.109 in) thick plates inserted in the exhaust slots in the sleeve.
3. Position the plates on the bed of a press with provision for the gear to pass through. Then, using a long drift, press the gear out of the sleeve.
4. Thoroughly clean the governor sleeve to remove any swarf which may be present from the original gear assembly operation.

Note Ensure that the new gear is the correct one for the transmission casing in which it is to be fitted.

5. Support the governor sleeve on the two 2,77 mm (0.109 in) plates.

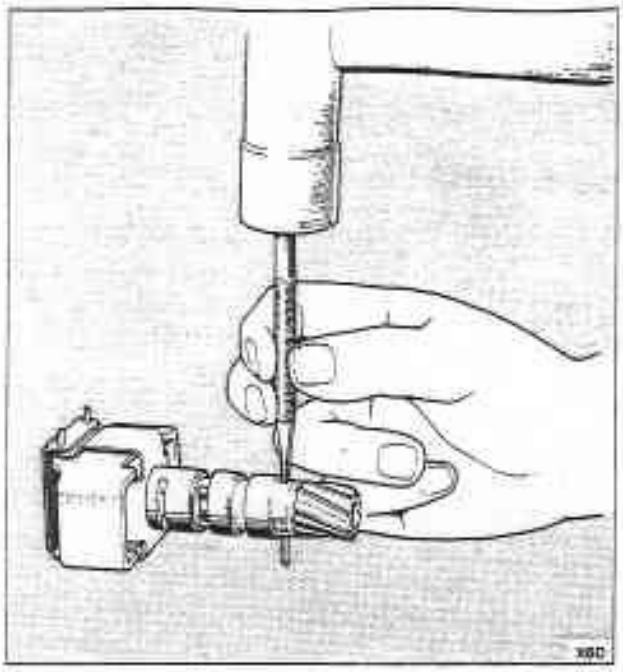


Fig. T10-5 Removing governor driven gear retaining pin

6. Position the new gear in the sleeve. Then, using a suitable drift, press the gear into the sleeve until it is nearly seated.
7. Carefully remove any swarf which may have shaved off the gear hub. Then, press the gear down until it abuts the sleeve.
8. Mark the position of a new hole on the sleeve at 90° to the original hole, then using a drill of 3,17 mm (0.125 in) diameter, drill a new hole through the sleeve and gear.
9. Fit the gear retaining pin.
10. Thoroughly wash the gear and sleeve assembly in clean paraffin and dry with compressed air.

Governor assembly – To assemble

1. Lightly oil the valve then fit it into the governor sleeve.
2. Fit the governor weights, springs, and thrust cap onto the governor sleeve.
3. Align the pin holes in the thrust cap, governor weight assemblies, and governor sleeve.
4. Fit new pins and crimp both ends of the pins.
5. Ensure that the governor weights are free to operate on the pins and check that the valve moves freely in the sleeve bore.

Governor assembly – To fit

Ensure that the oil feed hole to the rear extension bush is not obstructed.
1. Lightly lubricate the governor sleeve and gear. Fit the governor assembly into the transmission case.
2. Fit the cover, together with a new gasket.
3. Fit the four setscrews and torque tighten (see Section T23).
4. When installing the governor assembly ensure that a clearance of approximately 6,35 mm (0.250 in) is maintained between the governor pipes and transmission case, at a point 25,40 mm (1 in) from the right-angle bend of the pipes.

Speedometer drive

The speedometer drive is secured to the left-hand side of the tranmission casing by a setscrew and retainer. It is driven by a gear on the transmission output shaft at a ratio of 38:19. The driven gear has 38 teeth and is colour coded blue for identification purposes.

On turbocharged cars prior to 1989 model year, the drive ratio changes to either 35:21 or 36:21 to suit the 18/41 axle ratio and the type of tyres fitted. If Avon tyres are fitted, the driven gear has 35 teeth and is colour coded pink. If Pirelli tyres are fitted, the driven gear has 36 teeth and is colour coded white.

On 1989 model year turbocharged cars, the axle ratio is either 18/41 (non-catalyst exhaust system) or 16/43 (catalyst exhaust system). Avon tyres are the standard fitment, therefore, on non-catalyst cars the driven gear has 35 teeth (35:21 ratio) and is colour coded pink. On catalyst cars, the driven gear has 41 teeth (41:21 ratio) and is colour coded yellow.

Speedometer drive - To remove

1. Slacken and withdraw the hexagon nut securing the electronic impulse transmitter to the speedometer drive assembly.
2. Remove the setscrew and retainer; then withdraw the speedometer drive. Discard the 'O' ring.

Speedometer drive - To dismantle

1. Withdraw the driven gear.
2. Remove the circlip from within the housing.
3. Tap out the oil seal from the housing. Discard the oil seal.

Speedometer drive - To assemble

To assemble the speedometer drive, reverse the procedure given for dismantling noting the following.

1. The housing and driven gear are clean and free from any defects.
2. Lightly lubricate the gear shaft before passing it through the oil seal.

Speedometer drive - To fit

1. Fit a new 'O' ring to the groove in the speedometer drive housing.
2. Lightly lubricate the 'O' ring to ease the fitting of the speedometer drive; fit the drive to the case.
3. Fit the retainer and setscrew. Torque tighten the setscrew to the figures quoted in Section T23.
4. Connect the electronic impulse transmitter.

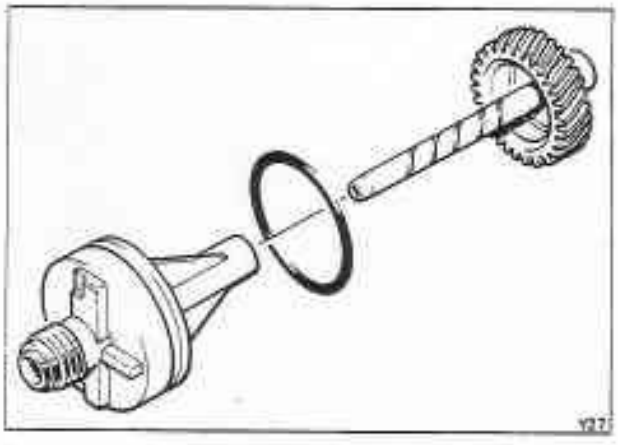


Fig. T11-1 Speedometer drive

Sump and intake strainer

Sump – To remove

Transmission fitted in the car

1. Position the car on a ramp and raise to a suitable working height.
2. Place a clean container having a minimum capacity of 3 litres (5 Imp pt, 6 US pt) beneath the drain plug.
3. Remove the drain plug and allow the oil to drain from the sump.
4. Remove the setscrews securing the sump and lower the sump. Discard the gasket.
5. Clean the sump with paraffin and dry with compressed air.

Transmission removed from the car

1. Position the transmission in the holding fixture RH 7955 with the sump upwards.
2. Carry out Operations 4 and 5 as described with the transmission fitted in the car.

Sump – To fit

To fit the sump reverse the procedure given for removal noting the following.

1. Ensure a new gasket is fitted.
2. Torque tighten the setscrews to between 8 Nm and 14 Nm (0,9 kgf m and 1,4 kgf m; 6 lbf ft and 10 lbf ft).
3. When filling the transmission with fluid refer to Section T3.

Note The amount of fluid added depends on whether the intake strainer has been removed.

Intake strainer – To remove

1. Remove the sump.
2. Remove the setscrew securing the intake strainer to the valve body assembly.
3. Remove the intake strainer assembly (see fig. T12-1).
4. Remove the intake pipe from the strainer and discard the strainer and 'O' ring.

Intake strainer – To fit

1. Fit a new 'O' ring to the intake pipe and lubricate the 'O' ring with clean transmission fluid.
2. Ensure that a new rubber seal is fitted to the pipe bore in the new intake strainer. Then, fit the intake pipe into the strainer.
3. Fit the intake strainer assembly to the transmission and torque tighten the setscrew to 14 Nm (1,4 kgf m; 10 lbf ft).
4. Fit the sump and fill with fluid. When filling the transmission with fluid refer to Section T3.

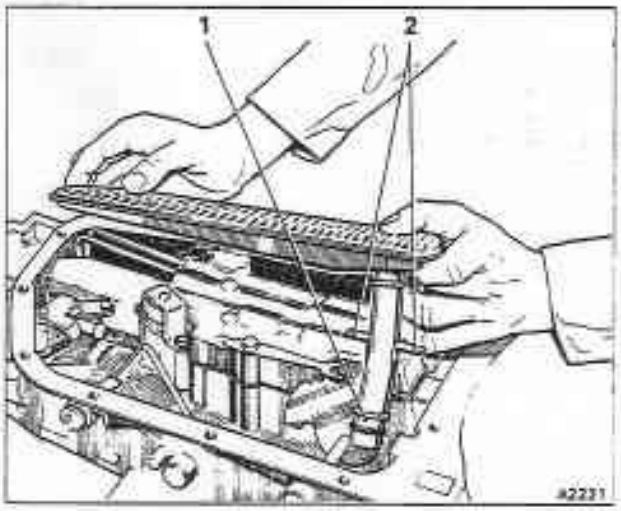


Fig. T12-1 Removing intake pipe and strainer assembly

1 Intake pipe with 'O' ring
2 Location tabs

Control valve unit

The control valve unit comprises a cast iron body containing shift valves and regulator valves that control the gear changes. The unit is secured to an oil spacer (guide) plate on the bottom face of the transmission.

Control valve unit – To remove

Before removing the control valve unit from a transmission installed in a vehicle, **take extreme care,** as the front servo piston and related parts may fall from the transmission due to the normal freeness of the Teflon oil sealing rings.

The control valve unit may be removed with the transmission in the car. The oil must be drained and the sump removed to gain access to the control valve unit.

1. Unscrew the setscrew which secures the detent spring and roller assembly. Remove the spring and roller assembly.
2. Remove the setscrews that secure the control valve unit to the transmission case.

Do not remove the solenoid securing screws, as the solenoid holds the spacer (guide) plate and gasket in position, therefore, keeping the check balls in their correct positions.

3. Remove the control valve unit, together with the two governor pipes (see fig. T13-1).

Caution Ensure that the manual valve does not slide out of its bore. Take care to retain the front servo piston, should it come out with the control valve assembly.

Remove the governor screen assembly from the end of the governor feed pipe or governor feed pipe hole.

4. Withdraw the governor pipes from the control valve assembly; the pipes are interchangeable and need not be marked for identification.

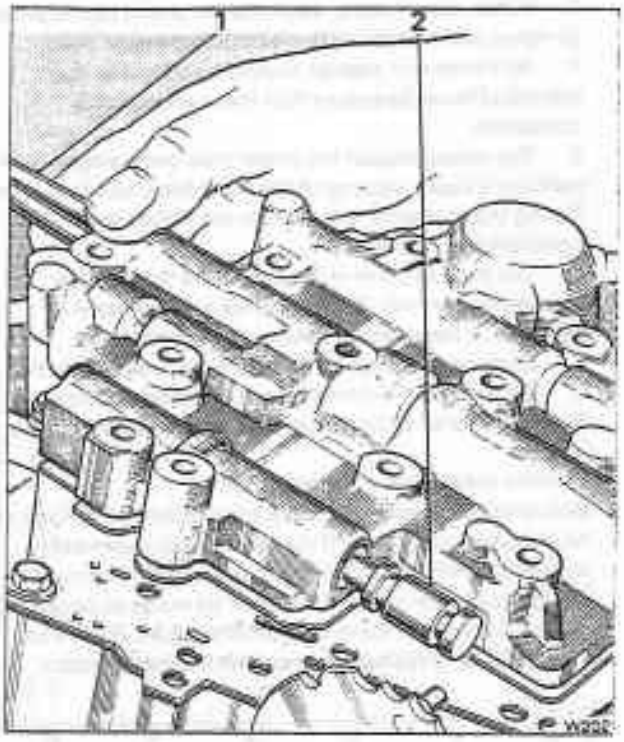


Fig. T13-1 Removing the control valve unit
1 Governor pipes
2 Manual valve

Control valve unit – To dismantle

1. Hold the control valve unit with the cored passages uppermost and the accumulator piston bore to the front, as shown in figure T13-2.
2. Remove the manual valve from its bore.
3. Fit the control valve accumulator installing tool J-21885 onto the accumulator piston.
4. Compress the accumulator piston and remove the 'E' ring retainer.
5. Remove the accumulator control valve and spring.
6. Remove the retaining pin, 1-2 sleeve, regulator valve, and spring from the upper right-hand bore.
7. Remove the 1-2 detent valve and the 1-2 valve.
8. Remove the retaining pin, 2-3 valve spring, 2-3 sleeve, 2-3 modulator valve, and the 3-2 intermediate spring from the middle right-hand bore.
9. Remove the 2-3 shift valve.
10. Remove the retaining pin, bore plug, and the 2-3 spring together with the spacer. Also remove the 3-2 valve from the lower bore.
11. Remove the retaining pin and bore plug from the upper left-hand bore, adjacent to the manual valve bore.
12. Remove the detent valve, detent regulator valve, spring, and spacer.
13. Ensure that the 1-2 accumulator valve in the remaining bore is free, by moving the valve against the spring.
14. Remove the 1-2 accumulator valve retaining pin from the machined surface of the valve body; remove the plug.
15. **RDA, RHA, RJA, RKA, and RLA transmissions**
Remove the 1-2 accumulator secondary spring and 1-2 valve. Then, remove the 1-2 accumulator sleeve, 1-2 primary valve, and spring.
RMA, RMAB, RNA, and RNAB transmissions
Remove the 1-2 accumulator valve and spring.

Control valve unit – To inspect

1. Wash the control valve unit body, valves, and the remainder of the parts in Genklene. **Do not allow the**

valves to knock together as this may cause burrs, or damage to the shoulders of the valves.

2. Examine all valves and sleeves to ensure that they are free from dirt. Any burrs should be carefully removed with a fine stone, or fine emery paper slightly moistened with oil. Do not round-off the shoulders of the valves.
3. When satisfactory, wash the parts and lightly smear all valves and sleeves with clean transmission fluid.
4. All valves and sleeves should be tested in their individual bores to ensure that free movement is obtainable.
5. The valves should fall under their own weight, with perhaps a slight tapping of the valve body to assist them. During these checks, ensure that the valves and valve bores are not damaged.
6. The manual valve is the only valve that can be renewed separately. If other valves are damaged or defective, a new control valve unit must be fitted.
7. Examine the valve body for cracks or scored bores.
8. Ensure that the cored face is free from damage.
9. Examine all springs for collapsed or distorted coils.

Control valve unit – To assemble

Before commencing assembly, ensure that all springs can be positively identified. If the springs are assembled incorrectly the transmission will not function correctly. During assembly reference should be made to figure T13-2.

Note The control valve units of RHA, RJA, RNA, and RNAB transmissions are not interchangeable.

1. Lightly lubricate all parts with clean transmission fluid before assembly.
2. Fit the front accumulator spring and piston into the valve body.
3. Fit the valve body accumulator installing tool J-21885. Align the piston and spring with the bore then compress the spring and piston (see fig. T13-3).
4. Secure the piston with the 'E' ring retainer.
5. **RDA, RHA, RJA, RKA, and RLA transmissions**

a. Fit the 1-2 primary spring into the primary 1-2 accumulator valve.

b. Fit the spring and valve (items 20 and 21) into the lower left-hand bore. Use a retaining pin to hold the valve in its position.

c. Fit the 1-2 accumulator secondary valve and spring into the 1-2 accumulator sleeve. Fit the sleeve into its bore.

d. Fit the bore plug and retaining pin.

5. **RMA, RMAB, RNA, and RNAB transmissions**

a. Fit the 1-2 accumulator primary spring (item 30) and 1-2 accumulator valve.

b. Fit the bore plug and retaining pin.

6. Fit the detent spring and spacer into the top left-hand bore.
7. Compress the spring and hold it with a small screwdriver.
8. Fit the detent regulator valve, wide land first.
9. Fit the detent valve, small land first.
10. Fit the bore plug with the hole facing outwards.

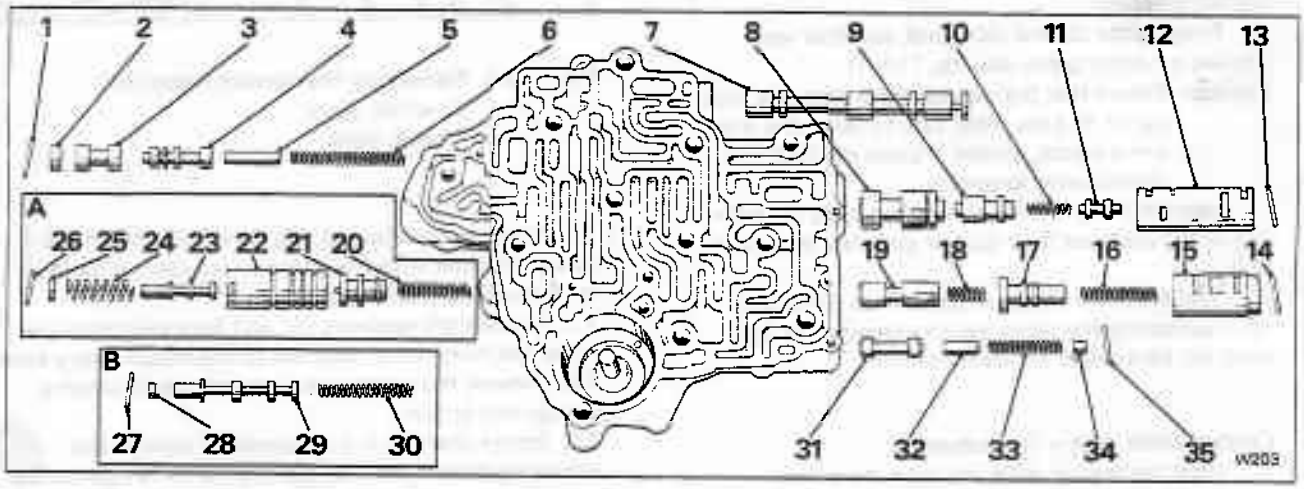


Fig. T13-2 Control valve unit

1 Retaining pin
2 Bore plug
3 Detent valve
4 Detent regulator valve
5 Spacer
6 Detent spring
7 Manual valve
8 1-2 valve
9 1-2 detent valve
10 1-2 regulator spring
11 1-2 regulator valve
12 1-2 sleeve
13 Retaining pin
14 Retaining pin
15 2-3 sleeve
16 2-3 valve spring
17 2-3 modulator valve
18 3-2 intermediate spring
19 2-3 valve
20 1-2 accumulator primary spring
21 1-2 accumulator primary valve
22 1-2 accumulator sleeve
23 1-2 accumulator secondary valve
24 1-2 accumulator secondary spring
25 Bore plug
26 Retaining pin
27 Retaining pin
28 Bore plug
29 1-2 accumulator valve
30 1-2 accumulator primary spring
31 3-2 valve
32 Spacer
33 3-2 spring
34 Bore plug
35 Retaining pin
A RDA, RHA, RJA, RKA, and RLA transmissions
B RMA, RMAB, RNA, and RNAB transmissions

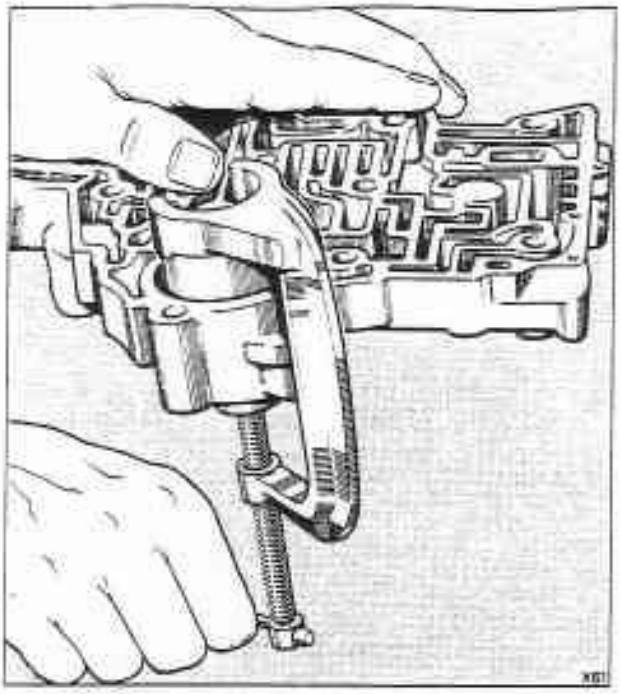


Fig. T13-3 Fitting the front accumulator piston and spring

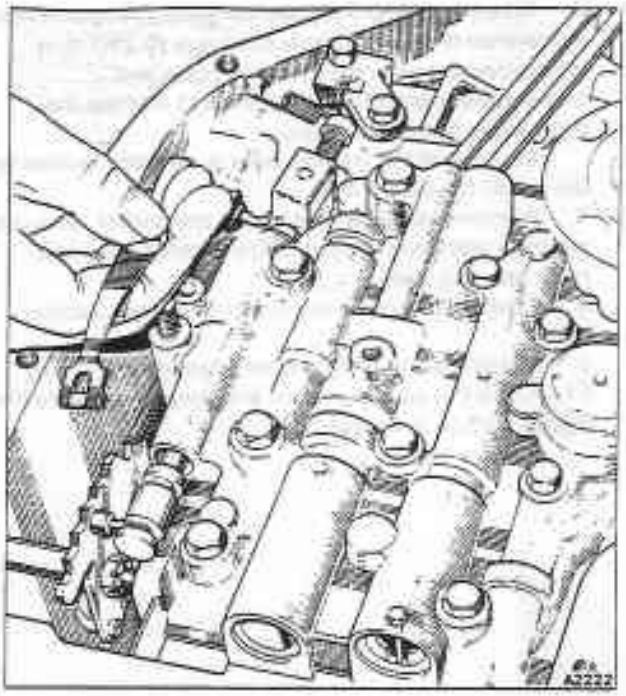


Fig. T13-5 Fitting the detent spring and roller

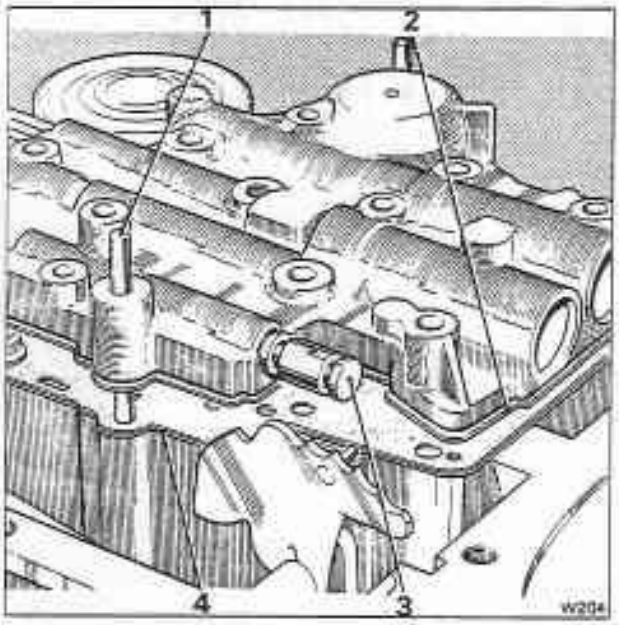


Fig. T13-4 Fitting the control valve unit
1 Guide pin
2 Control valve gasket
3 Manual valve
4 Spacer (guide) plate gasket

and fit the retaining pin. Remove the screwdriver.
11. Fit the 3-2 valve (item 31) into the lower right-hand bore.
12. Fit the spacer, the 3-2 spring, and bore plug with the hole facing outwards; secure with the retaining pin.
13. Fit the 2-3 shift valve (item 19) with the open end outwards, in the second right-hand bore from the bottom.
14. Fit the 3-2 intermediate spring (item 18).
15. Fit the 2-3 modulator valve into the sleeve, then fit both parts into the valve bore.
16. Fit the 2-3 valve spring and the retaining pin.
17. Fit the 1-2 shift valve (item 8), stem end out, into the third right-hand bore from the bottom.
18. Fit the 1-2 regulator valve, larger stem first, spring, and detent valve into the sleeve. Align the spring in the bore of the detent valve. Fit the parts into the valve bore.
19. Push the sleeve inwards against spring pressure and fit the retaining pin.
20. Fit the manual valve (item 7) with the detent pin groove to the right-hand side.

Control valve unit – To fit

1. Fit the governor pipes to the control valve unit.

Note Fit the governor screen assembly, **open end first** into the governor feed pipe hole (hole nearest the centre of transmission).

2. Fit the front servo piston (if removed) ensuring it is correctly aligned in the bore.
3. Using two guide pins screwed into the casing, fit the control valve unit into position (see fig. T13-4), with a new valve body/spacer plate gasket.
4. Ensure that the gasket and oil spacer (guide) plate are correctly positioned.

Note It is important that only a gasket which is a genuine service part be used.

5. Ensure that the governor pipes are correctly aligned and the feed pipe fits over the governor screen.

6. When installing the governor assembly ensure that a clearance of approximately 6,40 mm (0.250 in) is maintained between the governor pipes and transmission case, at a point 25mm (1 in) from the right-angle bend of the pipes.

Ensure that the manual valve is correctly located by the pin on the detent lever.

7. Remove the guide pins and fit the control valve unit securing setscrews; do not fit the detent spring and roller securing screw.

8. Torque tighten the securing screws (see Section T23).

9. Fit the detent spring and roller assembly (see fig. T13-5). Fit the securing screw and torque tighten to the figures quoted in Section T23.

Rear servo

The rear servo comprises an assembly of pistons and springs. It fits onto the bottom face of the transmission casing, adjacent to the control valve unit and is secured by six setscrews. The purpose of the servo is to act as an accumulator to absorb an amount of intermediate clutch oil, thus cushioning the application of the clutch. It also applies the rear friction band when the transmission is in low range or reverse.

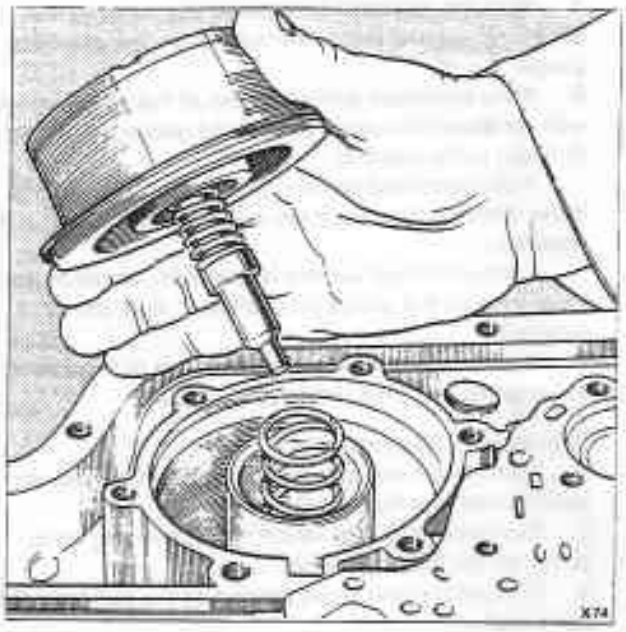


Fig. T14-1 Removing the rear servo

Rear servo – To remove

The rear servo can be removed whether the transmission is fitted to the car or not.

1. Remove the sump (see Section T12).
2. Remove the control valve unit (see Section T13).
3. Remove the setscrews that secure the servo cover to the transmission casing.
4. Remove the cover and discard the gasket.
5. Remove the servo unit from the casing (see fig. T14-1).
6. Remove the servo accumulator spring.

To ensure that the rear band is correctly adjusted when the rear servo is fitted, the apply pin must be checked as follows.

Rear band apply pin – To select

1. Fit the band apply pin selector gauge J-21370-6, onto the bottom face of the transmission casing. The gauge must fit over the rear servo bore with the hexagonal nut on the side of the gauge facing the parking linkage. The smaller diameter end of the gauge pin J-21370-5, should be positioned in the servo pin bore (see fig. T14-2).
2. Secure the gauge with two suitable setscrews (e.g. rear servo cover screws) and torque tighten them to the figures quoted in Section T23.
3. Ensure that the stepped gauge pin moves freely in the tool and in the servo pin bore. The stepped side of the pin must face the front of the transmission case.
4. Band apply pins are available in three lengths as shown in the following chart.

Identification	Length
Three rings	Long
Two rings	Medium
One ring	Short

5. The identification ring is located on the band lug end of the pin. Selecting the correct pin is the equivalent of adjusting the rear band.

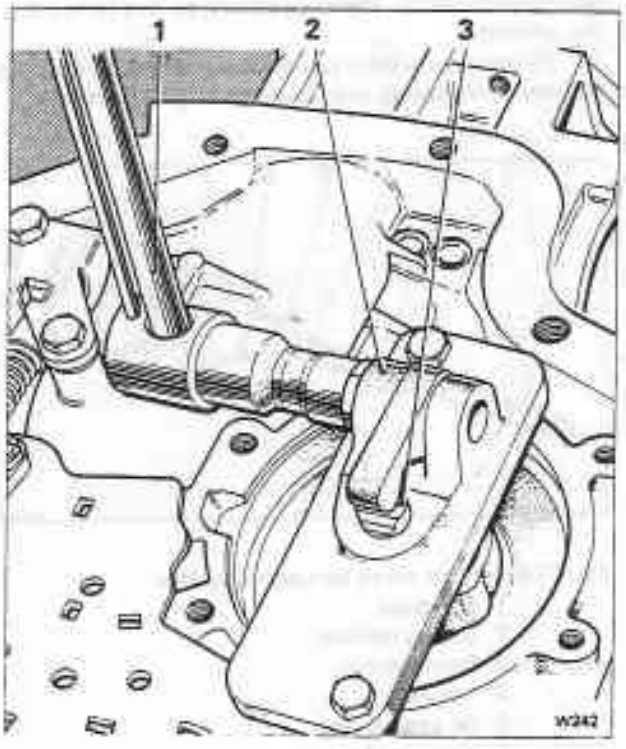


Fig. T14-2 Selecting the band apply pin
1 Torque spanner
2 Gauge
3 Gauge pin

6. To determine the correct size pin to use, apply 34 Nm (3,5 kgf m; 25 lbf ft) to the hexagonal nut on the side of the gauge (see fig. T14-2). This will cause the lever on top of the gauge to depress the stepped gauge pin into the servo pin bore, simulating the actual operation of the servo.
7. Note the relationship between the steps on the gauge pin and the machined surface on the top of the gauge.
8. If the machined surface on top of the gauge is level with, or above the upper step on the gauge pin, a long (3 rings) pin is required.

If the machined surface is between the upper and lower steps on the gauge pin, a medium pin (2 rings) is required.

If the machined surface is level with, or below the lower step on the gauge pin, a short (1 ring) pin is required.
9. If a new pin is required, make a note of the size of the required pin, then remove the gauge.

Rear servo – To dismantle
1. Remove the rear accumulator piston from the rear servo piston (see fig. T14-3).
2. Remove the 'E' ring which retains the rear servo piston on the band apply pin.
3. Remove the rear servo piston and the seal from the band apply pin.
4. Remove the washer, spring, and retainer.

Rear servo – To inspect
1. Check the fit of the oil sealing rings in the accumulator piston. The rings should be free to turn in the grooves.
2. Fit the accumulator piston lower oil sealing ring into its bore in the casing and check the ring-to-bore fit.

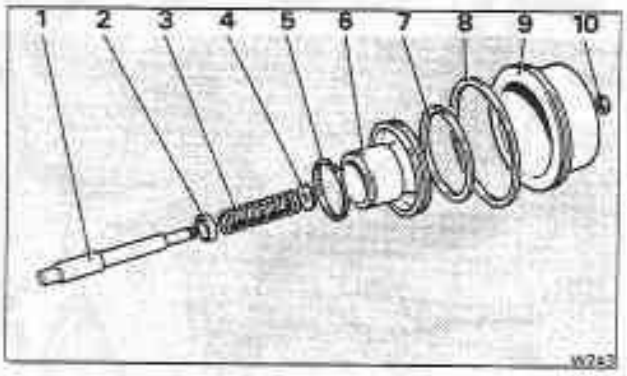


Fig. T14-3 Rear servo and accumulator
1 Servo pin
2 Spring retainer
3 Servo spring
4 Washer
5 Oil sealing ring
6 Accumulator piston
7 Oil sealing ring
8 Servo oil seal
9 Servo piston
10 'E' ring

3. Check the fit of the band apply pin in each piston.
4. Examine the band apply pin for scores, cracks, or the opening of drilled passages.
5. Examine the accumulator piston for an open bleed passage.
6. Ensure that the pin is the correct size as determined in the procedure described under the heading Rear band apply pin – To select.

Rear servo – To assemble
1. Fit the spring retainer, spring, and washer onto the band apply pin.
2. Fit the servo piston onto the pin and secure it with the 'E' ring.
3. If necessary, fit a new oil seal ring onto the servo piston.
4. Fit the accumulator piston into the servo piston.

Do not remove the Teflon oil seal rings from the rear accumulator piston, unless they require replacement.

If the Teflon inner oil seal ring (small diameter) requires replacement, use the aluminium oil seal ring.

The rear accumulator piston (large diameter) ring groove depth is machined shallower to take the Teflon oil seal ring. Therefore, if replacement is necessary, use only the Teflon oil seal ring.

Rear servo – To fit
1. Using clean transmission fluid, lightly lubricate the inner and outer rear servo bores in the transmission casing.
2. Fit the servo accumulator spring into the servo inner bore.

Note Before fitting the rear servo to the casing, ensure that the rear band apply lug is aligned with the servo pin bore in the transmission casing. If the lug is not aligned, the servo will not apply the rear band.

3. Position the rear servo assembly in the transmission casing.
4. Using hand pressure, push the servo into the transmission casing, ensuring that the servo piston sealing ring is correctly seated in the bore.
5. Fit the cover together with a new gasket.
6. Torque tighten the setscrews to the figures quoted in Section T23.

Detent solenoid, control valve spacer, and front servo

The detent solenoid is secured to the lower face of the transmission casing. It is connected by a cable to a connector on the left-hand side of the transmission. When the solenoid receives a signal from the throttle position switch, an exhaust port is opened. This allows oil at high pressure to be fed to the shift valves to oppose governor pressure (see Section T13).

The control valve spacer fits between the control valve unit and the transmission casing. It forms part of the hydraulic system which contains restrictors and check balls.

The front servo is an assembly of pistons and springs, similar to the rear servo. It fits partly in the transmission casing and partly in the control valve unit. The servo applies the front band in intermediate range (second gear) and low range to provide engine braking. It is used also as an accumulator for the application of the direct clutch and in conjunction with the check balls and orifices, is part of the timing for the release of the direct clutch.

Detent solenoid, control valve spacer, and front servo – To remove

These units may be removed from the transmission whether or not the transmission is fitted to the car.

1. Drain the transmission fluid and remove the sump.
2. Remove the control valve unit and governor pipes (see Section T13).
3. Disconnect the cable from the connector terminal.
4. Remove the setscrews that secure the detent solenoid.
5. Remove the solenoid.
6. Remove the control valve spacer plate and gasket.

Note If the last operation is being carried out with the transmission in the car, lower the control valve spacer plate in a level plane so that the check balls do not fall out. Remove the check balls from the spacer plate.

7. Remove the six check balls (seven on 1988 and 1989 model year cars) from the cored passages in the transmission case (see fig. T15-1).
8. Lift the front servo piston, retaining ring, pin, retainer, and spring from the transmission case. An exploded view of the front servo is shown in figure T15-3.

Front servo – To inspect

1. Examine the servo pin for damage.
2. Examine the oil seal ring groove in the piston for damage.
3. Ensure that the ring is free in the groove.
4. Examine the piston for cracks and other damage.
5. Check the fit of the servo pin in the piston.

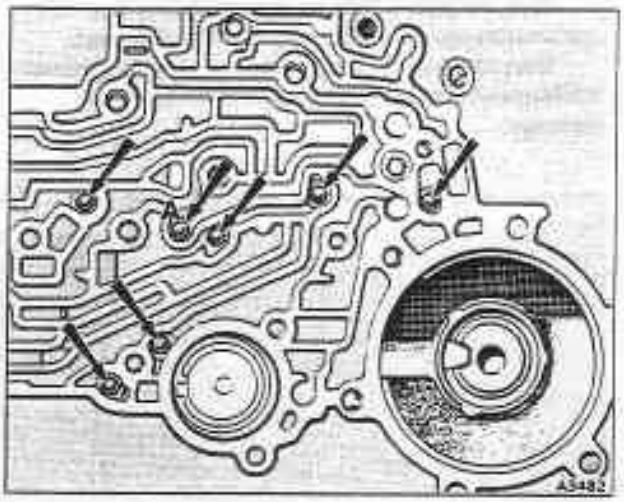


Fig. T15-1 Location of check balls – transmission case
A Additional check ball (1988 and 1989 model year cars)

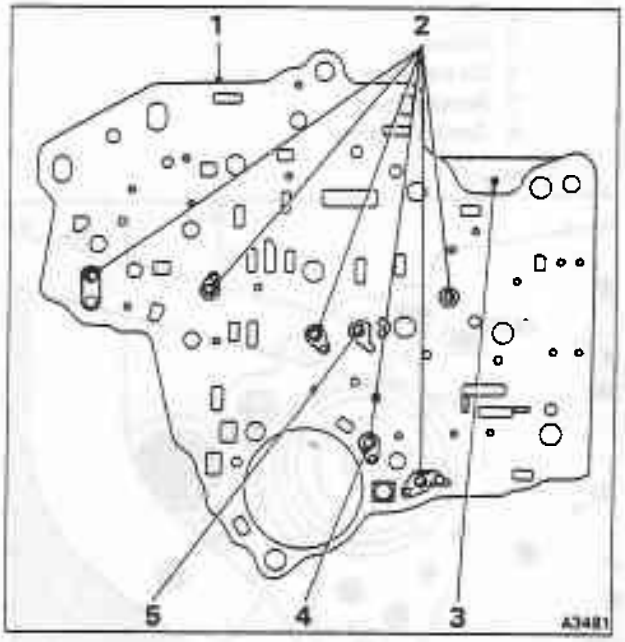


Fig. T15-2 Location of check balls – spacer plate
1 Spacer plate to case gasket
2 Check balls
3 Spacer plate
4 Non-functional ball (omit on RMA, RMAB, RNA, and RNAB transmissions)
5 Non-functional ball – 1988 and 1989 model year cars (omit as item 4)

Detent solenoid, control valve spacer, and front servo – To fit

When overhauling the front servo or front

accumulator piston it will be noticed that the Teflon ring allows the piston to slide very freely in its bore. This is a normal characteristic of the ring and does not indicate leakage during operation.

When servicing pistons, the following points should be noted.

Only remove a Teflon oil sealing ring from a piston ring groove if the ring is to be renewed.

Only renew a Teflon oil sealing ring if it shows evidence of leaking during operation or visual damage.

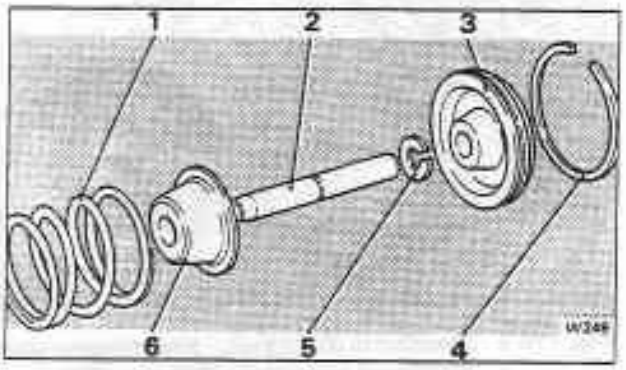


Fig. T15-3 Front servo

1 Spring
2 Pin
3 Piston
4 Oil seal ring
5 Retainer ring
6 Spring retainer

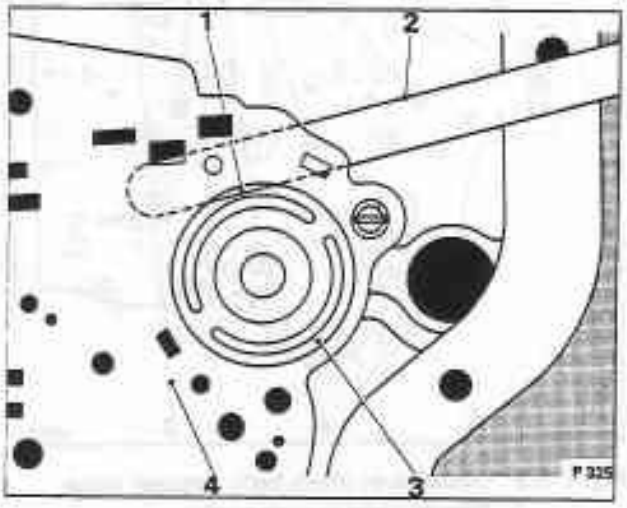


Fig. T15-4 Method of temporarily holding front servo piston in position (transmission in car)

1 Correct position of feeler gauge, allowing the accumulator piston to enter the front servo bore before the feeler gauge is withdrawn
2 Feeler gauge
3 Front servo piston
4 Spacer plate

When changing a front servo Teflon oil sealing ring, renew with an aluminium sealing ring.

1. Fit two guide bolts into the transmission case.
2. Place the six/seven check balls into the ball seat pockets in the case.
3. If the transmission is in the car, place the check balls into the ball seat pockets in the spacer plate.

Note One or two check balls are non-functional, therefore, **on RMA, RMAB, RNA, and RNAB transmissions** omit either one or two balls as shown in figure T15-2.

4. Fit the control valve spacer plate to case gasket (gasket with extension for detent solenoid).
5. Fit the control valve spacer plate.
6. Fit the detent solenoid. Do not tighten the setscrews at this time.
7. Fit the front servo spring and retainer into the bore of the transmission case.
8. Fit the retainer ring onto the front servo pin and install the pin into the case so that the tapered end contacts the forward band. Ensure that the retainer ring is installed in the servo pin groove.
9. Fit a new piston sealing ring to the servo piston, if the ring has been removed.
10. Fit the servo piston onto the band apply pin with the flat side of the piston positioned towards the transmission sump.

If the transmission is in the car, the parts should be assembled as a group (see fig.T15-3) and fitted into the servo bore. A length of straight clean feeler gauge [approximately 0,51 mm (0.020 in)] should be used to hold the servo assembly temporarily in position as shown in figure T15-4. Withdraw the feeler gauge before tightening the control valve body setscrews.

11. Connect the electrical cable from the detent solenoid onto the connector.
12. Fit the control valve as described in Section T13, then torque tighten the setscrews and the detent solenoid setscrews to the figures quoted in Section T23.

Rear extension

Rear extension – To remove

The procedure describes removal of the rear extension when the transmission is fitted to the car.

The procedure is the same when the transmission is removed from the car except that the gearchange actuator and propeller shaft will have been removed.

1. Remove the gearchange electric actuator as described in Section T6.
2. Remove the body crossmember and disconnect the propeller shaft at the gearbox end.
3. Place a drip tray beneath the rear extension.
4. Remove the coupling flange by withdrawing it from the output shaft.
5. Remove the setscrews that secure the rear extension to the transmission casing.
6. Slide the rear extension rearward and downward until it clears the output shaft.

Caution Make certain that the output shaft splines do not damage the oil seal in the end of the rear extension.

7. Remove and discard the gasket from the rear extension.

Rear extension – To inspect

1. Examine the rear extension for cracks or damage.
2. Examine the bush for excessive wear or damage.
3. Examine the oil seal for damage.
4. If a new oil seal is to be fitted, push out the old seal using a suitable drift.
5. Ensure that the seal bore in the rear extension is clean and free from damage and that the seal drainback port is not obstructed.
6. Lightly smear the outer edge of the new seal with Wellseal. Drive in the seal using tool RH 7953.

Note The webbing on the seal installation tool RH 7953 must be undercut by approximately 3,17 mm (0.125 in) as shown in figure T16-1.

7. Fill the space between the seal lips with Shell Retinax A grease, ensuring that the lip edges are coated with grease.
8. Ensure that the rear face of the transmission casing and the front face of the extension are clean and free from burrs.
9. Ensure that the oil feed hole to the rear extension bush is not obstructed.

Rear extension – To fit

1. Fit a new gasket onto the extension housing.
2. Carefully fit the extension casing over the output shaft until the extension abuts the rear of the transmission casing.
3. Ensure that the splines on the output shaft do not touch the oil seal in the end of the extension casing otherwise the seal lip may be damaged.

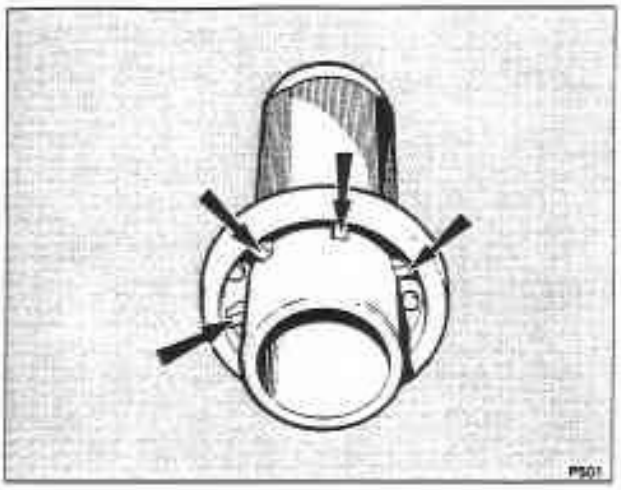


Fig. T16-1 Seal installation tool RH 7953

4. Fit the setscrews and torque tighten them to the figures quoted in Section T23.
5. Fit the coupling flange.
6. Connect the propeller shaft.
7. Fit the body crossmember.
8. Fit the gearchange electric actuator.

Oil pump

The oil pump is an internal/external gear type which is secured to the front face of the transmission casing. Contained within the oil pump cover is an oil pressure regulator valve train. The pump is mechanically connected to the engine flexplate and operates whenever the engine is running.

As the engine flexplate rotates it turns the torque converter pump which is keyed to the inner gear of the oil pump. The inner gear turns the outer gear which causes oil to be lifted from the transmission sump via an oil strainer.

As the gears turn, the oil is carried in pockets formed by the gear teeth, past a crescent shaped projection of the pump. Beyond the crescent, the gear teeth move closer together causing the oil to be forced out at pressure from between the teeth. At this point the oil is delivered through the pump outlet to the pressure system.

The oil pressure is controlled by a pressure regulator valve. As the pressure builds up, the oil is directed through an orifice to the top of the pressure regulator valve. When the correct pressure is reached, the valve moves against spring pressure, opening a passage which feeds the torque converter.

When the torque converter is full, oil passes to the transmission heat exchanger by way of an external pipe. Upon leaving the heat exchanger, the oil is fed by way of a second external pipe to the transmission lubricating system.

As the pressure continues to increase from the pump, the pressure regulator valve moves further to expose a port which directs excess oil back to the suction side of the pump. The pressure regulator valve is spring balanced to regulate line pressure at approximately 4,8 bar (70 lbf/in^2).

Oil pump – To remove

1. Remove the transmission from the car (see Section T7).
2. Remove the retaining clamp RH 7952 and withdraw the converter.

Note The converter and oil weigh approximately 23 kg (50 lb). Therefore care should be taken when removing it to ensure it is not dropped or damaged.

3. Install the transmission in the holding fixture RH 7955 with the pump upwards.
4. Remove the pump attaching setscrews.
5. Fit either the threaded slide hammers J-7004 or removal tool RH 12556 (as applicable) as shown in figure T17-1. Then, remove the pump assembly from the transmission case.

Note If using the slide hammers, operate them simultaneously otherwise the pump will tilt and jam in the case.

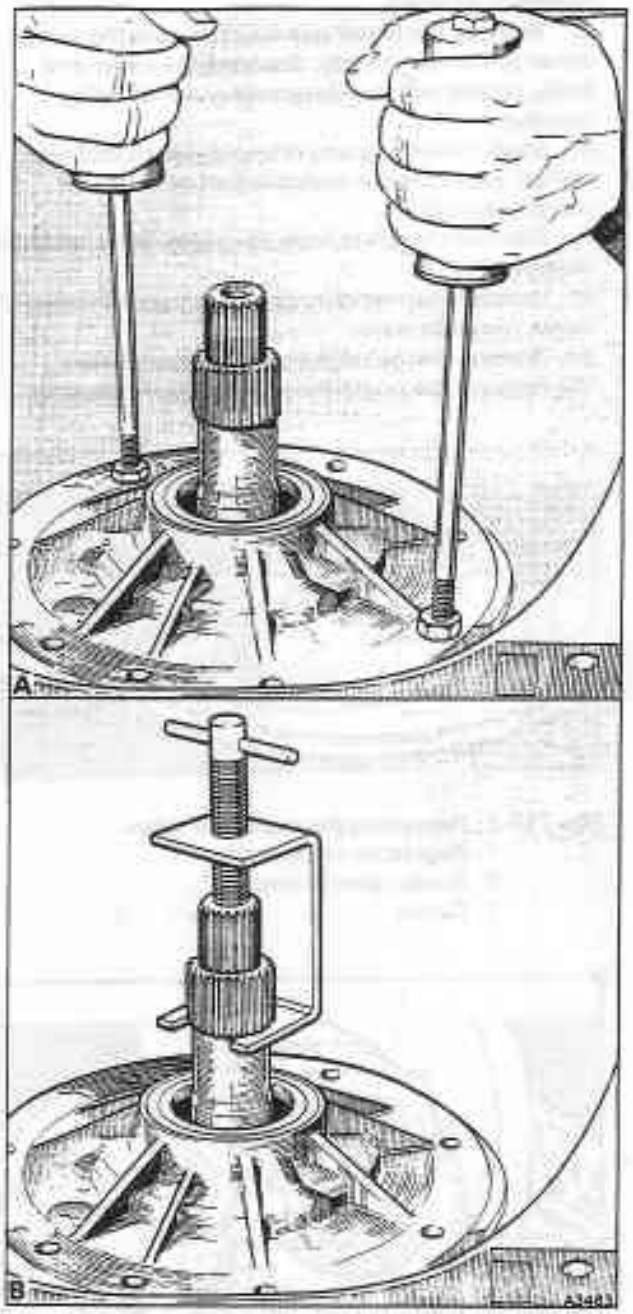


Fig. T17-1 Removing the oil pump
A Slide hammers J-7004
B Removal tool RH 12556

6. Remove and discard the pump to case sealing ring and gasket.

Oil pump – To dismantle

1. Holding the pump assembly firmly on a bench, push the regulator boost valve sleeve, against spring pressure, then remove the circlip (see fig. T17-2).

Note The pressure regulator spring is under pressure and care should be exercised when removing the boost valve and sleeve.

2. Remove the regulator boost valve and sleeve.
3. Remove the pressure regulator spring.
4. Remove the regulator valve, spring retainer, and spacer(s) (if fitted).
5. Remove the setscrews which secure the pump cover to the pump body. Separate the cover and body, noting that the setscrews are of differing lengths.
6. Mark the driving and driven gears to facilitate correct assembly (an indelible pen or pencil is recommended).
7. Remove the gears from the pump body as shown in figure T17-3.
8. Remove the retaining pin and plug from the end of the regulator bore.
9. Remove the oil rings from the pump cover.
10. Remove the pump to forward clutch housing

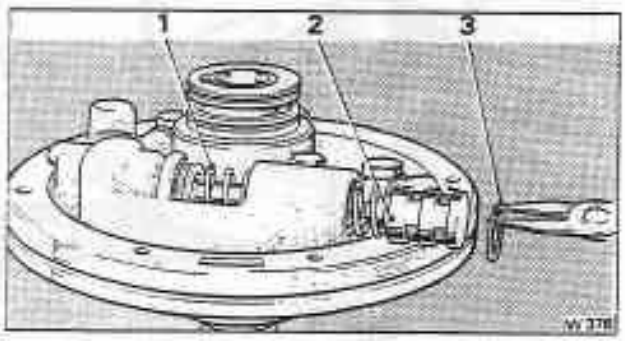


Fig. T17-2 Removing the regulator valve
1 Regulator valve spring
2 Boost valve sleeve
3 Circlip

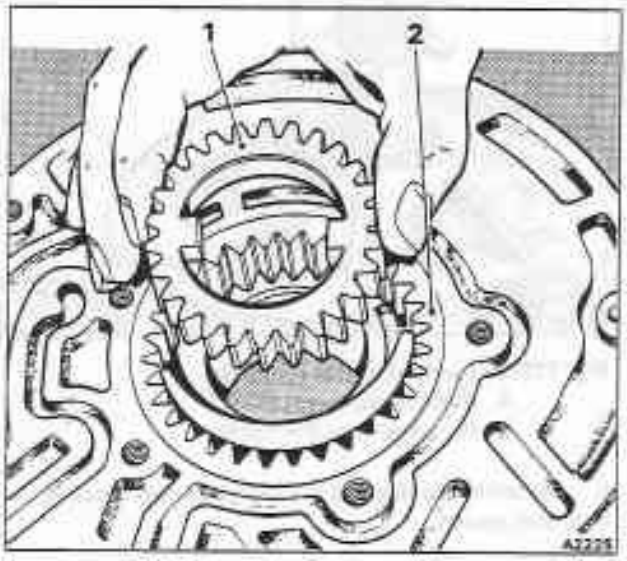


Fig. T17-3 Removing the pump gears
1 Driving gear (tangs uppermost)
2 Driven gear

selective washer, noting the thickness to facilitate fitting of a new washer on assembly.

Oil pump – To inspect

1. Wash all parts in clean paraffin, then dry with compressed air.
2. Examine the pump body gear pocket and the crescent for scoring or other damage.
3. Fit the gears into the pump body, then check the end clearance as shown in figure T17-4. The clearance should be between 0,02 mm and 0,09 mm (0.0008 in and 0.0035 in).
4. Examine the face of the pump body for scores and burrs.
5. Examine the oil passages for blockages and porosity.
6. Examine the threads into which the cover securing setscrews fit.
7. Check the pump cover and body faces for overall flatness.
8. Examine the pressure regulator valve bore for score marks.
9. Ensure that the pressure regulator valve and the boost valve will move freely in their respective bores.

Oil pump – To assemble

1. Fit the oil pump driving and driven gears into the pump body with the alignment marks (made with an indelible pen or pencil) uppermost.

Note If the pump driven gear has a rectangular or triangular identification mark on one tooth, the gear should be installed with the identification mark downwards.

Fit the drive gear with the drive tangs uppermost (see fig. T17-3).

2. Fit the pressure regulator spring retainer, spacer(s) (if fitted), and spring into the pressure regulator bore (see fig. T17-5).

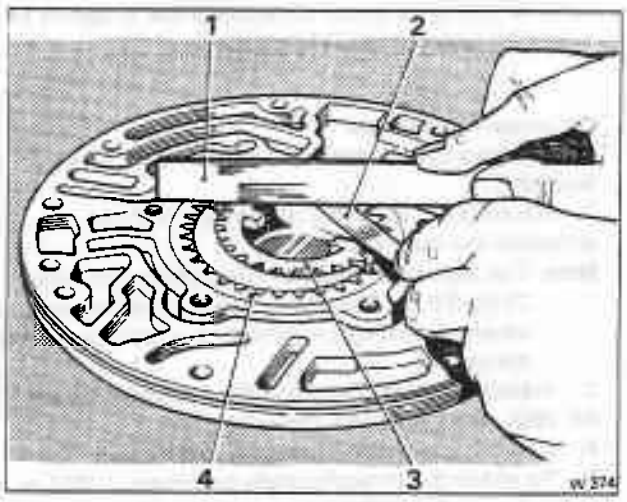


Fig. T17-4 Checking the gear end clearance
1 Straight edge
2 Feeler gauge
3 Inner (driving) gear
4 Outer (driven) gear

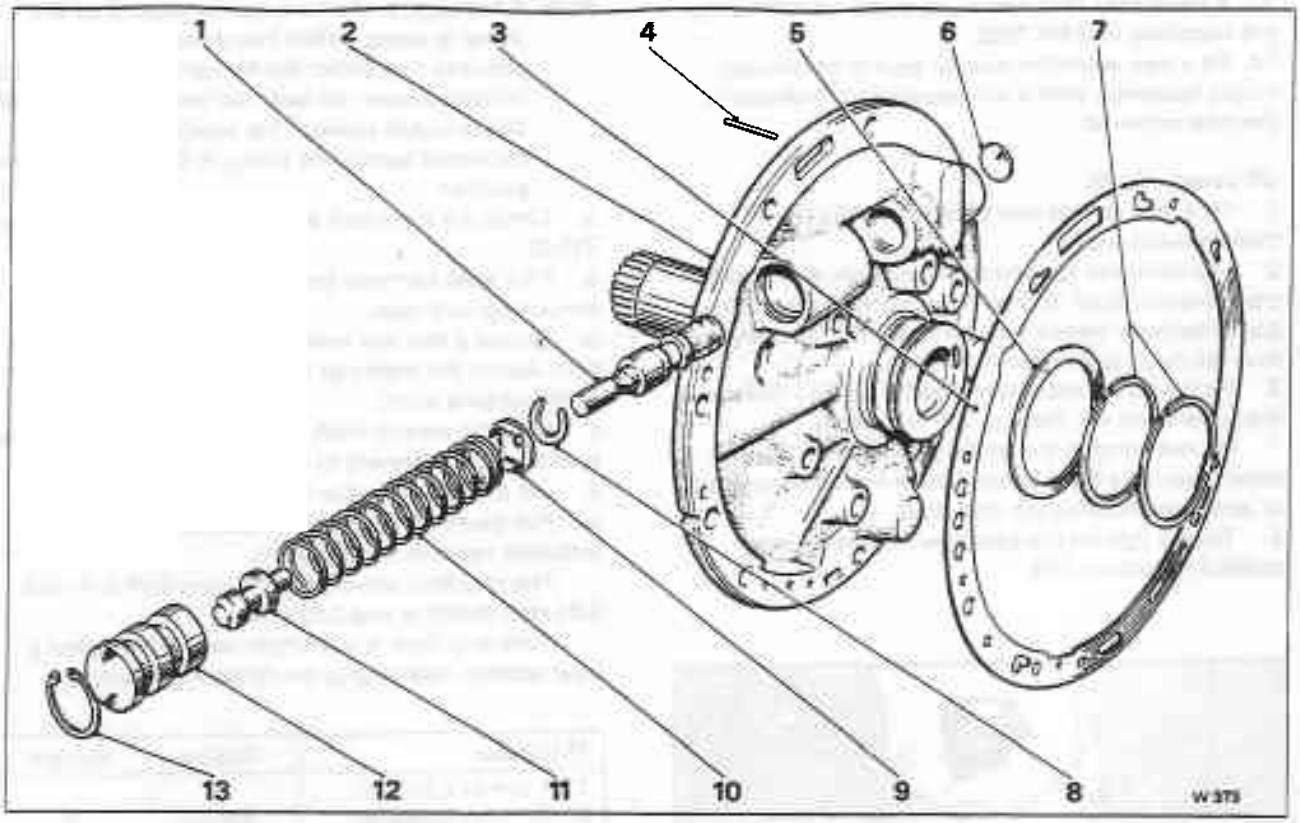


Fig. T17-5 Pump cover

1 Pressure regulator valve
2 Pump cover
3 Gasket
4 Retaining pin
5 Selective washer
6 Bore plug
7 Oil sealing rings
8 Spacer
9 Spring retainer
10 Pressure regulator spring
11 Boost valve
12 Sleeve
13 Circlip

3. Lightly lubricate the pressure regulator valve with clean transmission fluid, then fit the valve into the opposite end of the bore, stem end first.
4. Fit the pressure regulator valve end plug and retaining pin.
5. Lightly lubricate the boost valve and sleeve, then fit the valve into the sleeve (stem end out). Fit both parts into the bore in the pump cover by compressing the sleeve against the pressure regulator valve spring.
6. Retain the sleeve with the circlip.
7. Fit the two oil sealing rings to the pump cover.
8. Lubricate the pump gears with clean transmission fluid then fit the pump cover to the pump body.
9. Fit the cover securing setscrews into their original positions. Leave the setscrews finger tight.
10. Fit the pump body and cover alignment band J-21368 around the pump assembly. Tighten the band to align the cover with the body (see fig. T17-6).
11. With the band in position, tighten the pump body to cover securing setscrews to the figures quoted in Section T23. Remove the alignment band.
12. Fit a new pump to case 'O' ring.

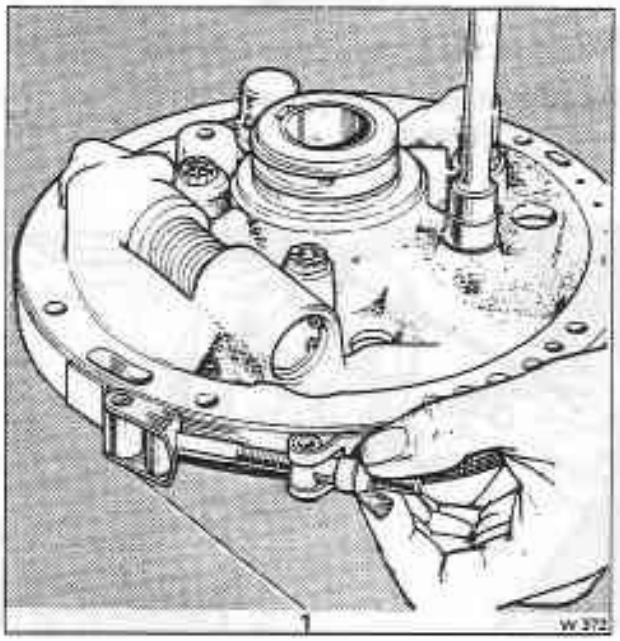


Fig. T17-6 Aligning pump cover with pump body

1 Alignment band

13. If necessary, fit a new front pump oil seal using the installing tool RH 7953.
14. Fit a new selective washer (pump to forward clutch housing), with a corresponding thickness to the one removed.

Oil pump – To fit

1. Fit a new gasket and guide pins into the transmission case.
2. Lubricate the turbine shaft journals with clean transmission fluid. Smear the sealing rings on the pump delivery sleeve with petroleum jelly, ensuring that the rings are correctly located.
3. Fit the pump assembly (see fig. T17-7). Ensure that new seals are fitted to the setscrews.

Do not remove the guide pins until all but two setscrews have been fitted. Leave one setscrew out to assist in checking the end-float.

4. Torque tighten the setscrews to the figures quoted in Section T23.

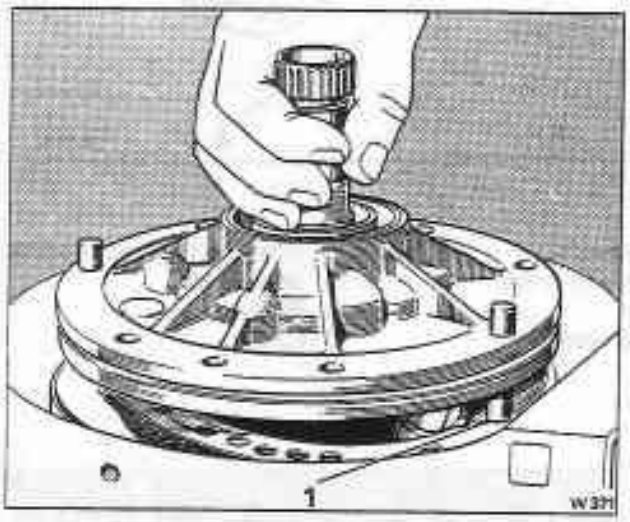


Fig. T17-7 Fitting the oil pump
1 Guide pin

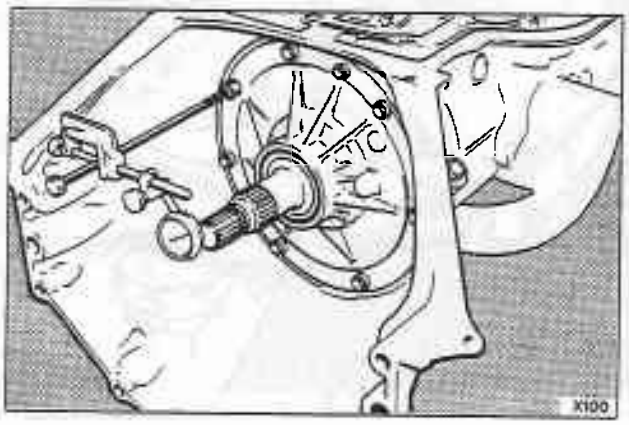


Fig. T17-8 Checking the front unit end-float

Note If the turbine shaft cannot be rotated as the pump is being pulled into position, it is possible that either the forward or direct clutch housings have not been correctly indexed with all the clutch plates. This condition must be corrected before the pump is finally pulled into position.

5. Check the front unit end-float as follows (see fig. T17-8).

a. Fit a slide hammer bolt J-7004 into the one remaining bolt hole.
b. Secure a dial test indicator on the slide hammer bolt. Adjust the indicator to register against the end of the turbine shaft.
c. Hold the output shaft forward whilst pushing the turbine shaft rearward to its stop.
d. Set the dial indicator to zero.
e. Pull the turbine shaft forward, noting the indicator reading (shaft travel).

The end-float should be between 0,08 mm and 0,61 mm (0.003 in and 0.024 in).

If the end-float is not within the limits, select a new washer, referring to the following chart.

Thickness	Colour	Number
1,52 mm to 1,63 mm (0.060 in to 0.064 in)	Yellow	0
1,80 mm to 1,90 mm (0.071 in to 0.075 in)	Blue	1
2,08 mm to 2,18 mm (0.082 in to 0.086 in)	Red	2
2,36 mm to 2,46 mm (0.093 in to 0.097 in)	Brown	3
2,64 mm to 2,74 mm (0.104 in to 0.108 in)	Green	4
2,92 mm to 3,02 mm (0.115 in to 0.119 in)	Black	5
3,20 mm to 3,30 mm (0.126 in to 0.130 in)	Purple	6

Note An oil soaked washer may tend to discolour. Therefore, if necessary, measure the washer to ascertain the thickness.

6. Remove the dial test indicator and slide hammer bolt.
7. Fit the final pump securing setscrew and seal. Torque tighten the setscrew to the figures quoted in Section T23.

Control rods, levers, and parking linkage

The control rods, levers, and parking linkage consist of an assembly of levers and rods which are operated by the electric gearchange actuator. The detent lever is connected to the manual control valve in the control valve unit and is retained in this position by a spring-loaded detent roller (see fig. T18-1).

The parking pawl actuating rod causes the parking pawl to engage the transmission whenever park is selected. This provides a mechanical lock which will hold the car.

When the gear range selector lever on the steering column is moved, with the ignition on, the electric actuator will move the gearchange operating lever to the required position via an adjustable rod. The gearchange operating lever is secured to the outer end of the manual shaft and the detent lever is secured to the inner end of the shaft. Therefore, the detent lever will move a corresponding distance, moving the manual control valve.

When the gear selector lever on the steering column is moved to park, the parking pawl actuating rod which is secured to the detent lever causes the parking pawl to engage with a gear ring on the rear unit planet carrier. The rear unit planet carrier is mechanically connected to the transmission output shaft, therefore, the shaft is prevented from rotating.

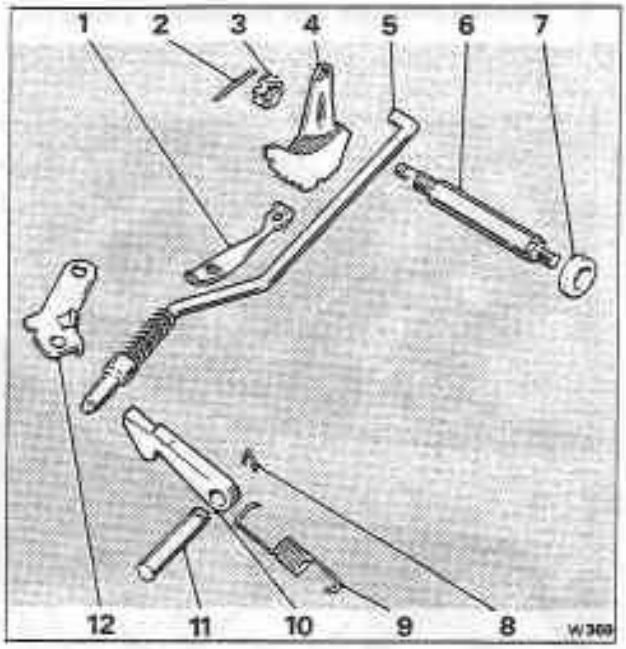


Fig. T18-1 Manual shaft and parking linkage

1 Detent roller and spring assembly
2 Retaining pin
3 Lock-nut
4 Detent lever
5 Parking pawl actuating rod
6 Manual shaft
7 Lip seal
8 Shaft retainer
9 Pawl return spring
10 Parking pawl
11 Pawl shaft
12 Parking lock bracket

Control rods, levers, and parking linkage – To remove

1. The units may be removed from the transmission whether or not the transmission has been removed from the car.
2. If the transmission has not been removed, drain and remove the sump as described in Section T12.
3. If the gearchange electric actuator has not been removed, disconnect the gearchange operating rod by removing the split pin and clevis pin.
4. Remove the split pin and clevis pin from the opposite end of the gearchange operating rod; remove the rod.
5. Remove the lock-nut which retains the gearchange operating lever to the manual shaft; remove the lever.
6. Remove the setscrew that secures the detent spring and roller assembly to the control valve unit; remove the detent spring assembly.
7. Remove the pin which secures the manual shaft to the case.
8. Slacken the lock-nut securing the detent lever to the manual shaft.
9. Remove the detent lever from the manual shaft. Then, remove the lock-nut completely.
10. Remove the parking pawl actuating rod, detent lever, and manual shaft from the case.

Note Do not remove the manual shaft seal unless replacement is required.

11. Remove the setscrews securing the parking lock bracket; remove the bracket.
12. Remove the parking pawl return spring.
13. Operations 14 and 15 are to be completed only if one or more of the parts involved requires replacement.
14. Remove the shaft retainer from the parking pawl shaft. Remove the parking pawl shaft cup plug by placing a screwdriver between the parking pawl shaft and the casing; levering outwards (see fig. T18-2).
15. Remove the parking pawl and the shaft.

Control rods, levers, and parking linkage – To inspect

1. Wash all parts in clean paraffin, then dry them with compressed air.
2. Examine the parking pawl actuator rod for cracks or broken spring retainer lugs.

3. Examine the actuator spring for distortion or damage. Ensure the actuator fits freely on the actuator rod.
4. Examine the parking pawl for cracks or wear.
5. Examine the manual shaft for damaged threads or shaft roughness (oil seal surface).
6. Examine the detent lever for cracks or a loose pin.

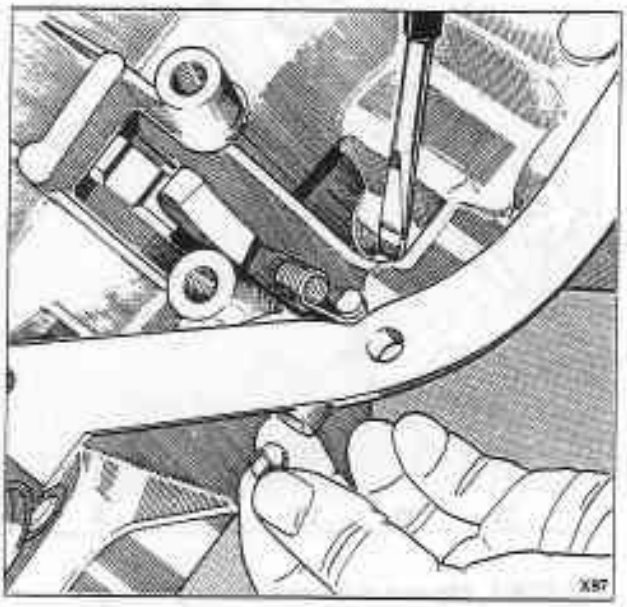


Fig. T18-2 Removing the cup plug

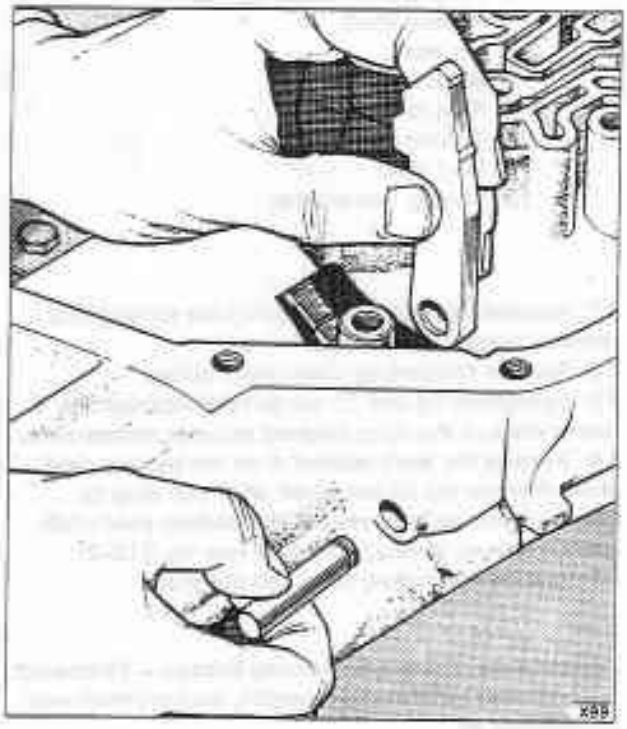


Fig. T18-3 Fitting the parking pawl and shaft

7. Examine the parking pawl shaft for damage to the retainer groove.
8. Examine the parking pawl return spring for distortion or damaged ends.
9. Examine the parking lock bracket for cracks or wear.
10. Examine the detent spring and roller assembly for cracks or damage.
11. Examine the gearchange operating rod for signs of bending.
12. Examine the jaws of the operating rod for cracks or damage.

Control rods, levers, and parking linkage – To fit

1. Fit the parking pawl with the tooth towards the centre of the transmission. Then, fit the parking pawl shaft and retainer (see fig. T18-3).
2. Fit the cup plug into the case, using a 9,52 mm (0.375 in) diameter steel rod, to drive the shaft and plug into the case until the shaft bottoms on the case rib.
3. Fit the parking pawl return spring with the squared end hooked around the pawl.
4. Fit the parking lock bracket with the guides over the parking pawl. Torque tighten the setscrews to the figures quoted in Section T23.
5. Fit the actuator rod plunger under the parking lock bracket and over the parking pawl.
6. Fit the opposite end of the actuator rod into the detent lever from the side opposite to the pin.
7. If necessary, fit a new manual shaft to case lip type seal into the case. Use a 19,05 mm (0.750 in) diameter steel rod to seat the seal.
8. Lubricate the manual shaft with Shell Retinax A grease. Fit the shaft into the case and through the detent lever (see fig. T18-4).
9. Fit the lock-nut onto the manual shaft. Torque tighten the nut to the figures quoted in Section T23.
10. Fit the retaining pin into the transmission casing, aligning it with the groove in the manual shaft (see fig. T18-5).
11. Fit the detent spring and roller assembly. Torque tighten the setscrew to the figures quoted in Section T23.
12. Fit the gearchange operating lever to the manual shaft. Fit the lock-nut and torque tighten to the figures quoted in Section T23.
13. Fit the gearchange operating rod using the clevis pins. Lubricate the clevis pins with Rocol MTS 1000 grease, then fit new split pins.
14. Fit the sump (see Section T12).

Control linkage – To check

1. Remove the split pin and clevis pin from the gearchange operating rod, at the actuator end.
2. Select park on the gearchange actuator. Push the lower end of the gearchange operating lever fully forward (park position).
3. Ensure that both jaws of the operating rod slide easily about the two levers and check the clevis pin will slide into the jaw and through the lever.
4. Select each of the gear positions in turn on the

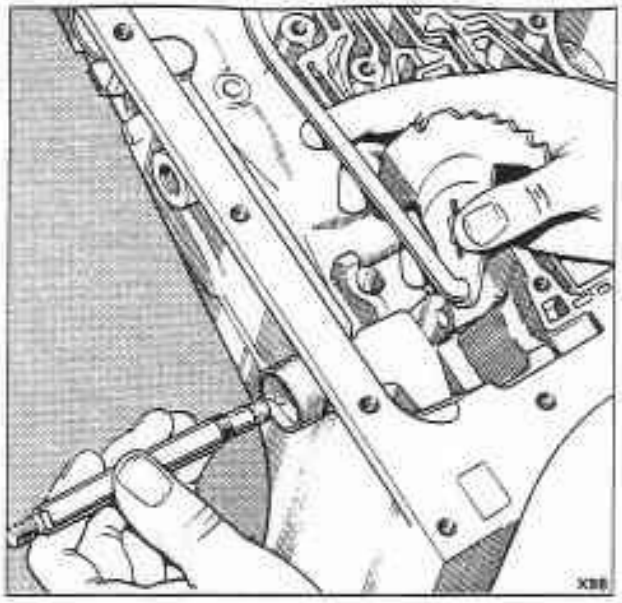


Fig. T18-4 Fitting the manual shaft

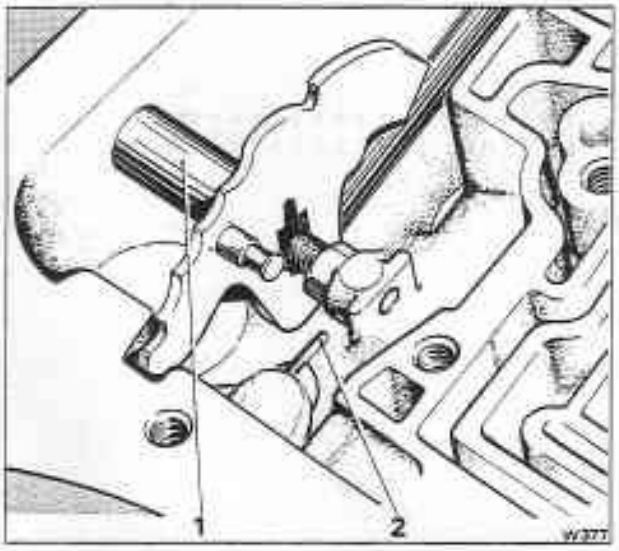


Fig. T18-5 Fitting the manual shaft retaining pin
1 Manual shaft
2 Retaining pin

actuator. At each position, ensure that the clevis pin will slide easily into the jaw and lever.

5. Check that the pin will slide easily into the jaw when low is selected after park, and conversely when park is selected after low.

6. If, in any position the pin will not pass through the jaw and lever, adjust the length of the rod.

7. Finally, lubricate the clevis pin with Rocol MTS 1000 grease. Fit the clevis pin and secure it with a new split pin.

Turbine shaft, forward and direct clutches, sun gear shaft, and front band

The turbine shaft is a splined shaft which connects the torque converter to the forward clutch.

The forward clutch comprises a housing, splined onto the turbine shaft; steel clutch driving plates, which are driven by the clutch housing; composition faced plates, which are splined onto a clutch hub; and a hydraulically operated clutch piston. The mainshaft is splined into the forward clutch hub.

The direct clutch is similar in construction to the forward clutch.

The composition plates are splined to a hub which is integral with the forward clutch back plate. The steel plates are splined to a housing which in turn is splined to the sun gear shaft. The clutch is applied hydraulically by a piston housed in the direct clutch housing.

The front band is a lined steel band which is anchored to the transmission case at one end and is servo operated at the other end. The band fits around the direct clutch housing and when moved by the servo, holds the housing stationary.

Whenever the forward clutch is applied, the drive transmitted by the turbine is connected to the transmission mainshaft. When the forward clutch is released the clutch return springs push back the hydraulic piston, the plates are then released and the connection between the converter and the mainshaft is broken. As a result, the transmission is in neutral.

Whenever the direct clutch is applied, drive from the forward clutch is divided and follows two different paths to the gear unit.

By following one path, the drive continues through the forward clutch to the mainshaft and the rear gear unit internal (annulus) gear. The other path is via the forward clutch back plate, through the direct clutch to the sun gear shaft.

As the direct clutch is applied, clockwise torque from the converter causes an intermediate inner sprag race to overrun the sprag clutch assembly.

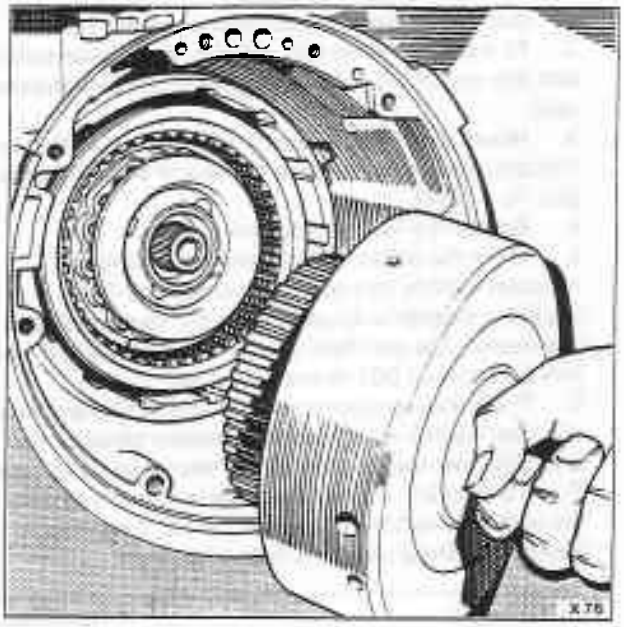


Fig. T19-1 Removing the forward clutch assembly

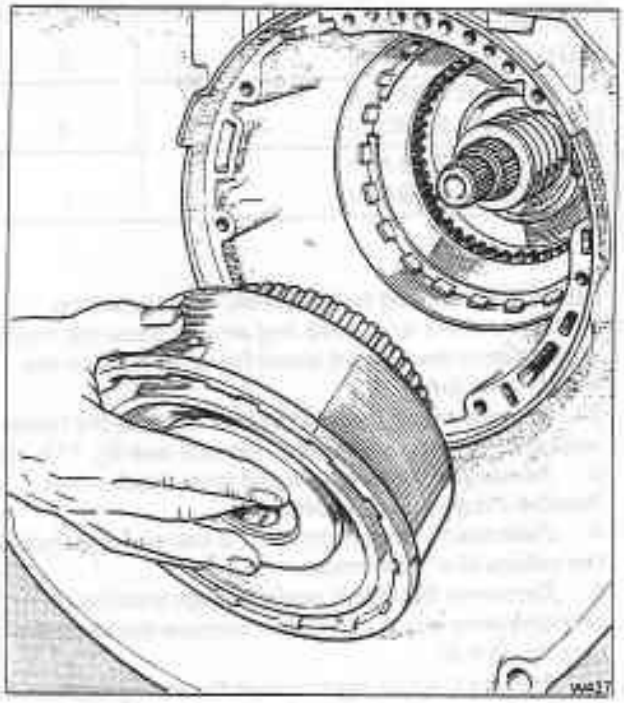


Fig. T19-2 Removing the direct clutch and intermediate sprag assembly

Turbine shaft, forward and direct clutches, sun gear shaft, and front band – To remove

1. Remove the transmission from the car; withdraw the converter assembly.
2. Remove the oil pump.
3. Withdraw the turbine shaft and the forward clutch from the transmission (see fig. T19-1).
4. Remove the thrust washer from between the forward clutch hub and the direct clutch housing. The washer may come out with the forward clutch.
5. Withdraw the direct clutch and intermediate sprag assembly (see fig. T19-2). The sun gear shaft may come out with the direct clutch assembly.

6. Remove the sun gear shaft if not previously removed.
7. Remove the front band.
8. Check the end-float of the rear unit.

Rear unit end-float – To check

1. Remove the transmission rear extension housing.
2. Fit a slide hammer bolt J-7004, or a similar suitable bolt into one of the holes in the end of the transmission case.
3. Mount a dial test indicator onto the bolt so that the indicator stem registers with the end of the output shaft (see fig. T19-3).
4. Set the dial indicator to zero.
5. Move the output shaft in and out, noting the indicator reading to enable the correct end-float adjusting washer to be used when the transmission is assembled. The end-float should be between 0,18 mm and 0,48 mm (0.007 in and 0.019 in).
6. The adjusting washer which controls this end-float is a steel washer with three tabs located between the thrust washer and the rear face of the transmission case.
7. If a different washer thickness is required to bring the end-float within the specified limits, it can be selected with the aid of the following chart.

Thickness	Number
0 mm to 0,41 mm (0 in to 0.016 in)	6
0,41 mm to 0,81 mm (0.016 in to 0.032 in)	5
0,81 mm to 1,22 mm (0.032 in to 0.048 in)	4
1,22 mm to 1,63 mm (0.048 in to 0.064 in)	3
1,63 mm to 2,03 mm (0.064 in to 0.080 in)	2
2,03 mm to 2,44 mm (0.080 in to 0.096 in)	1

Forward clutch and turbine shaft – To dismantle

1. Remove the large snap ring which retains the direct clutch hub to the forward clutch housing. Remove the direct clutch hub.
2. Remove the forward clutch hub. Remove the thrust washers, one from each side of the hub (see fig. T19-4).
3. Remove the composition and steel clutch plates. Remove the clutch apply ring.
4. Place the forward clutch on the bed of a press with the turbine shaft lowermost.
5. Compress the clutch return springs until the retaining snap ring is accessible. Remove the snap ring (see fig. T19-5).
6. Remove the tool, then remove the spring retainer and the sixteen clutch release springs. Keep these springs separate from the direct clutch release springs.
7. Remove the piston from the clutch housing (see fig. T19-6).

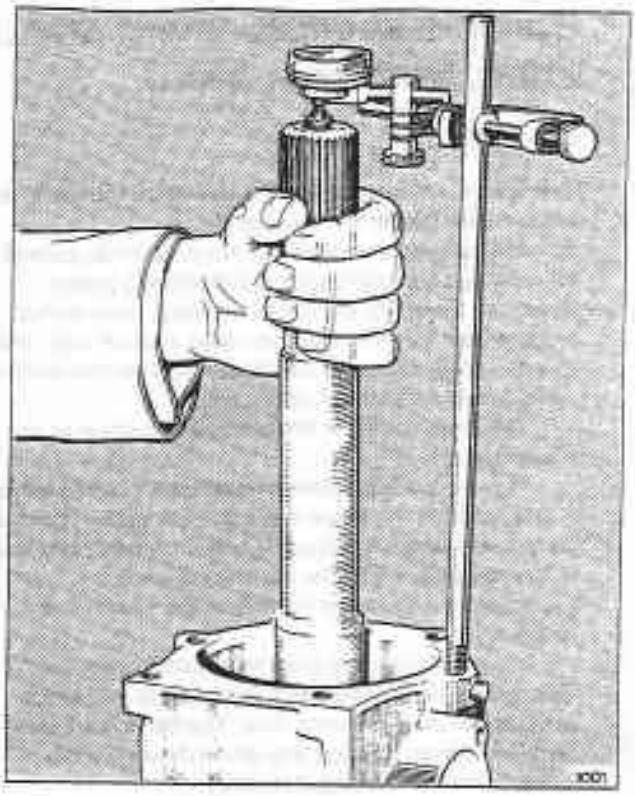


Fig. T19-3 Checking the rear unit end-float

Note The forward and direct clutch pistons are similar. Ensure that the forward clutch piston is identified during dismantling, so that it can be reassembled correctly into the forward clutch housing.

8. Remove and discard the inner and outer seals from the clutch piston.
9. Remove and discard the piston centre seal from the forward clutch housing.
10. It is not necessary to remove the turbine shaft from the forward clutch housing unless either the shaft or the housing is damaged and requires renewal. Therefore, if renewal is required, proceed as follows.
11. Place the forward clutch housing on the bed of a press with the turbine shaft lowermost.
12. Using a drive extension 9,53 mm (0.375 in) in diameter and approximately 76,20 mm (3 in) long, or similar tool as a drive, press the turbine shaft out of the forward clutch housing.

Forward clutch and turbine shaft – To inspect

1. Wash all parts **except** the composition faced clutch plates in clean paraffin. Dry with compressed air. The composition clutch plate surfaces should be examined for.

a. Pitting and flaking.
b. Wear.
c. Glazing.
d. Cracking.
e. Charring.
f. Metal particles embedded in the lining.

If a composition plate exhibits any of these symptoms, fit new plates.

2. The steel plates should be checked for heat discolouration. If the surface is smooth and an even colour is indicated, the plates can be used again. If severe heat spot discolouration or surface scuffing is indicated, fit new plates.

3. Examine the sixteen clutch release springs for collapsed coils or signs of distortion. If any springs show these symptoms, fit sixteen new springs.

Extreme heat or burning in the area of the clutch may have caused the springs to take a heat set. If this condition is found, fit sixteen new springs.

4. Examine the clutch hubs for worn splines. Ensure that the lubrication holes are clear and that the thrust faces are not scored or damaged.

5. Examine the piston for cracks.

6. Examine the clutch housing for wear, scoring, and open oil passages.

7. Ensure that the check ball in the clutch housing is free in its chamber.

8. Ensure that the lubrication holes in the turbine shaft are clear.

9. Examine the splines on the turbine shaft for damage and the shaft for cracks or distortion.

10. Examine the bush journals for damage.

Forward clutch and turbine shaft – To assemble

If the turbine shaft was removed from the forward clutch housing, proceed as follows.

1. Place the clutch housing on the bed of a press with the front face (flat side) uppermost.

2. Lightly lubricate the shorter splined end of the turbine shaft. Then, align the splines with the mating splines in the forward clutch housing. Using the press, carefully press the turbine shaft into the forward clutch housing until the shaft bottoms on the hub of the housing.

Note The shaft should be started in the housing, then the pressure on the press arbor relaxed to allow the shaft to straighten itself. Repeat this operation several times until it is evident that the shaft is squarely aligned with the housing. If the shaft is not started squarely, damage to the shaft or housing splines may occur.

3. Invert the forward clutch housing on the press so that the turbine shaft is downward.

4. Lubricate the new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in the piston with petroleum jelly. Then, fit the seals with the seal lip facing away from the return spring pockets.

5. Lubricate a new piston centre seal with clean transmission fluid. Lubricate the seal groove in the forward clutch housing with petroleum jelly. Then, fit the seal with the lip uppermost.

6. Fit the forward and direct clutch inner seal protector J-21362 over the forward clutch hub.

7. Fit the clutch piston inside the forward and direct clutch piston seal protector J-21409. Then, fit the

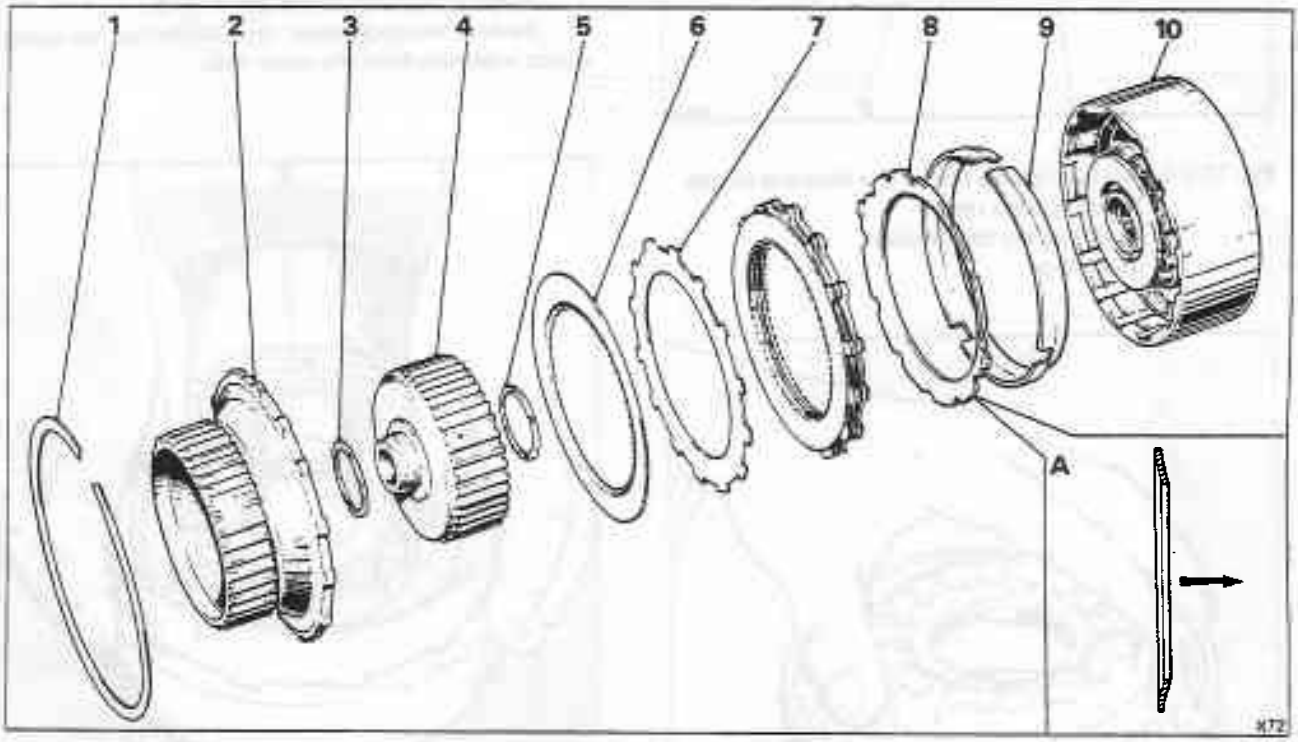


Fig. T19-4 Forward clutch assembly

1 Snap ring
2 Direct clutch hub
3 Thrust washer
4 Forward clutch hub
5 Thrust washer
6 Composition plate
7 Flat steel plate
8 Dished steel plate
9 Apply ring
10 Forward clutch assembly
A Direction of dished steel clutch plate into forward clutch housing

assembly into the forward clutch housing (see fig. T19-7).
8. Fit the clutch piston by rotating it clockwise until it is seated in the housing.
9. Fit the sixteen clutch release springs into the spring pockets in the clutch piston.
10. Place the clutch housing on the bed of a press with the turbine shaft lowermost.

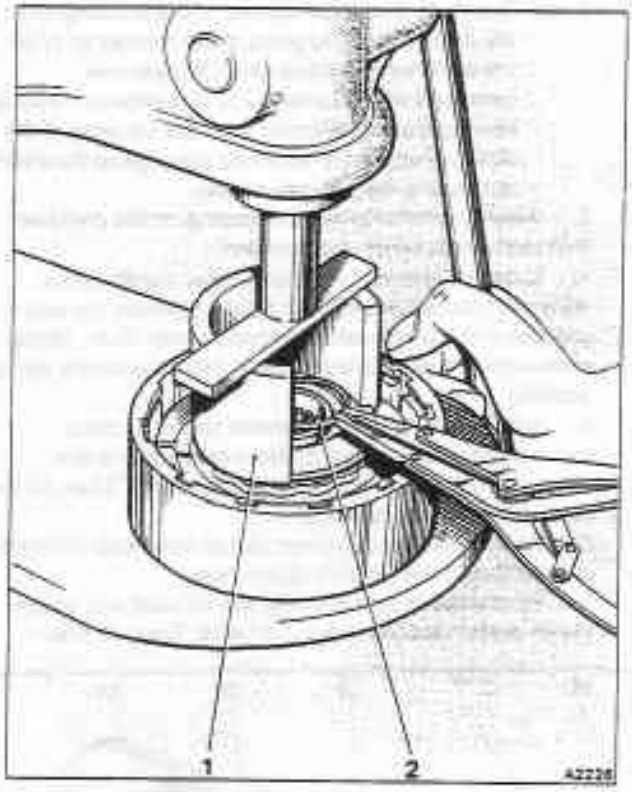


Fig. T19-5 Removing and fitting the forward clutch housing snap ring
1 Clutch spring compressor
2 Snap ring

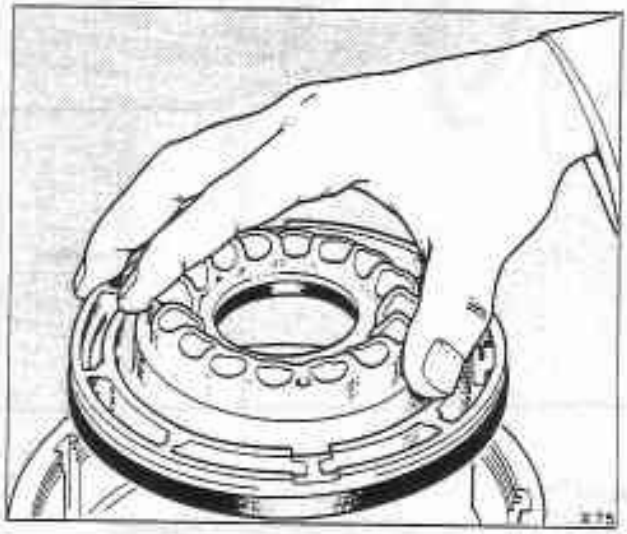


Fig. T19-6 Removing the forward clutch piston

11. Position the spring retainer on the springs.
12. Compress the springs ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring then release the tension on the springs.
Note Ensure that the release springs are not leaning. If necessary, push the springs into an upright position using a small screwdriver.
13. Fit the forward clutch apply ring into the clutch housing.
14. Fit the thrust washers on either side of the forward clutch hub. Retain the washers in position with petroleum jelly. Ensure the bronze washer is fitted to the side of the hub which faces the forward clutch housing.
15. Fit the forward clutch hub into the forward clutch housing.
16. Lubricate the five flat steel clutch plates, the five composition faced plates and the one dished steel clutch plate with clean transmission fluid.
17. Commence by fitting the dished steel plate with the concave side uppermost (away from the clutch piston), then alternate composition and flat steel plates (see fig. T19-4).
18. Fit the direct clutch hub into the forward clutch housing; fit the snap ring.

Direct clutch and intermediate sprag clutch assembly – To dismantle
1. Remove the snap ring which retains the sprag retainer.
2. Remove the retainer (see fig. T19-8).
3. Remove the sprag outer race. Withdraw the sprag clutch assembly from the outer race.

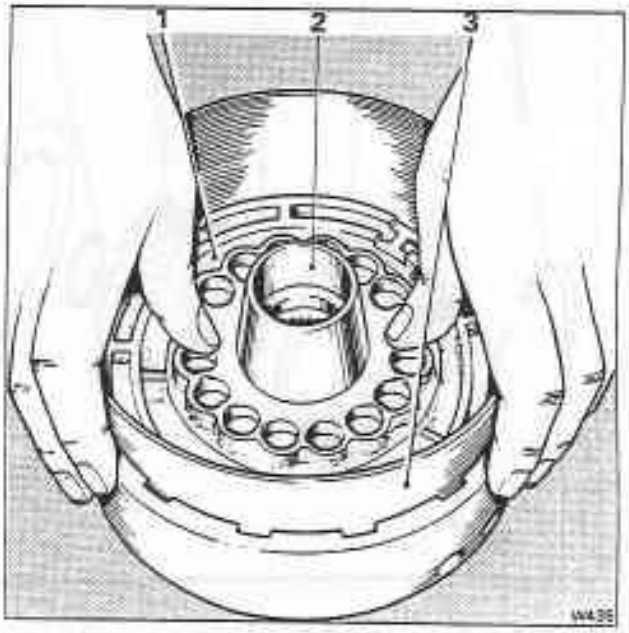


Fig. T19-7 Fitting the forward clutch piston
1 Forward clutch piston
2 Inner seal protector
3 Outer seal protector

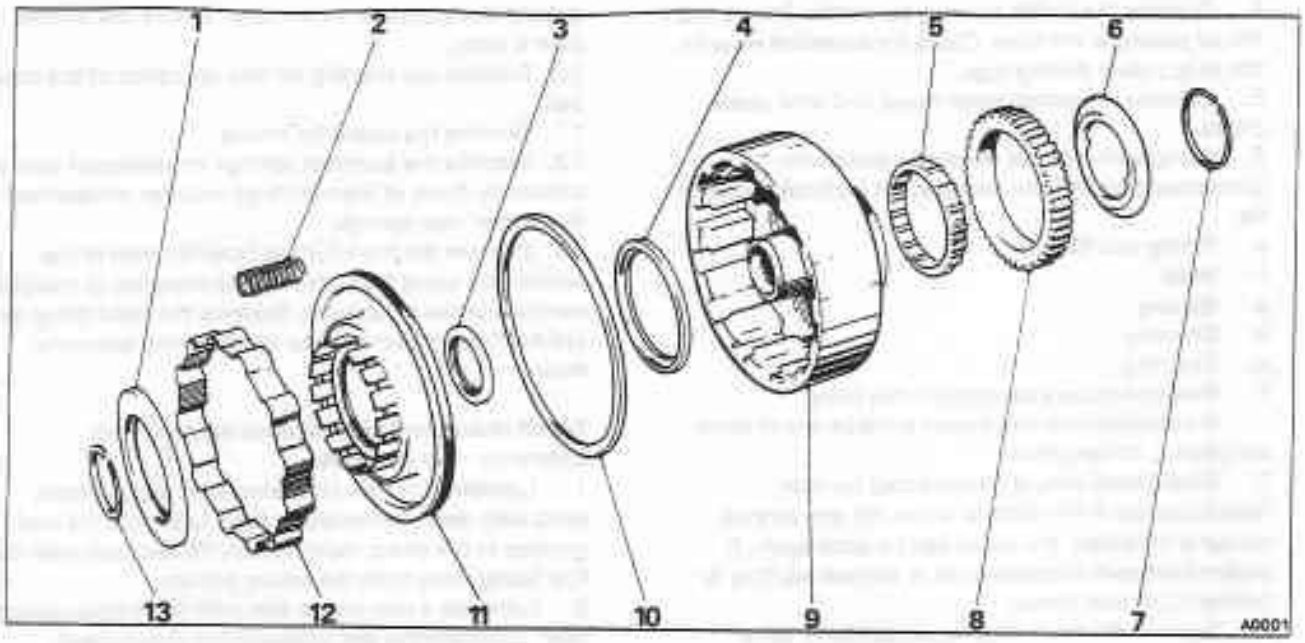


Fig. T19-8 Direct clutch and intermediate sprag assembly

1 Clutch spring retainer
2 Clutch release spring (14)
3 Piston inner seal
4 Piston centre seal
5 Sprag assembly
6 Sprag clutch retainer
7 Snap ring
8 Intermediate clutch outer race
9 Direct clutch housing
10 Piston outer seal
11 Direct clutch piston
12 Apply ring
13 Snap ring

4. Turn the unit over then remove the large snap ring which retains the direct clutch back plate in the clutch housing. Remove the back plate.
5. Remove the five composition plates, four steel plates, and one waved steel plate from the clutch housing. Remove the clutch apply ring.

On turbocharged cars, remove six composition plates, five flat steel plates, and one waved steel plate.

Note The direct clutch assembly on turbocharged cars is uprated from naturally aspirated cars, therefore it should be kept together as an assembly.

6. Using the clutch spring compressor J-2590, compress the clutch release springs and remove the snap ring (see fig. T19-9).
7. Remove the tool and lift off the spring retainer. Remove the fourteen clutch release springs. Keep these springs separate from the forward clutch release springs.
8. Withdraw the direct clutch piston from the clutch housing.

Note The forward and direct clutch pistons are similar. Ensure that the direct clutch piston is identified during dismantling so that it can be reassembled correctly into the direct clutch housing.

9. Remove and discard the piston inner and outer seals.
10. Remove and discard the piston centre seal from the direct clutch housing.

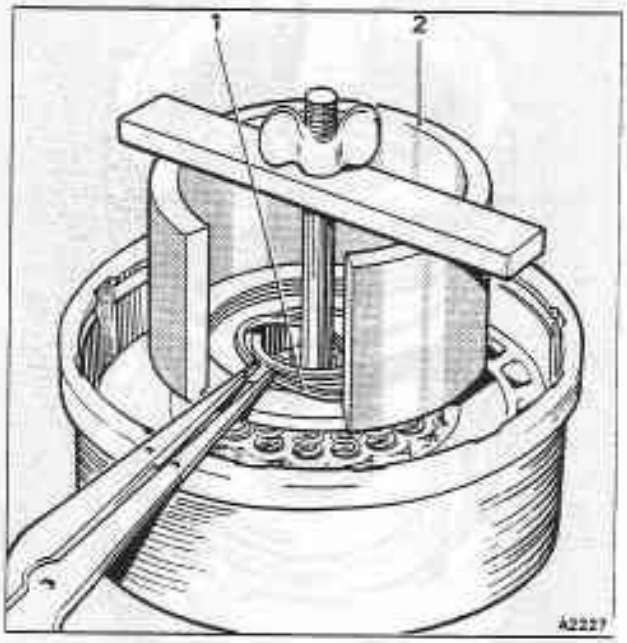


Fig. T19-9 Removing and fitting the direct clutch housing snap ring

1 Snap ring
2 Compressor adapter (seated on retainer)

Direct clutch, sun gear shaft, and intermediate sprag clutch assembly – To inspect

1. Wash all parts **except** the composition faced clutch plates in clean paraffin. Dry with compressed air.
2. Examine the sprag assembly.
3. Examine the inner cam and outer race for scratches or wear.

4. Examine the clutch housing for cracks. Ensure that the oil passages are clear. Check for excessive wear on the clutch plate driving lugs.
5. Examine the composition faced and steel clutch plates.
6. Composition plates should be dried with compressed air and the composition surfaces inspected for.
a. Pitting and flaking.
b. Wear.
c. Glazing.
d. Cracking.
e. Charring.
f. Metal particles embedded in the lining.

If a composition faced plate exhibits any of these symptoms, fit new plates.
7. Steel plates should be inspected for heat discolouration. If the surface is smooth and an even colour is indicated, the plates can be used again. If severe heat spot discolouration or surface scuffing is indicated, fit new plates.
8. Examine the back plate for scratches or other damage.
9. Examine the sun gear shaft for cracks. Examine the splines for damage, the bushes for scoring, and the ground bush journals for damage. Ensure the oil feed hole is clear.
10. Examine the housing for free operation of the check ball.
11. Examine the piston for cracks.
12. Examine the **fourteen** springs for collapsed coils or distortion. If any of these springs requires replacement, fit **sixteen** new springs.
13. Examine the front friction band for wear at the anchor and apply lugs, also for the presence of metallic particles in the band lining. Examine the band lining for cracks, flaking, burning, and for the lining becoming loose.

Direct clutch and intermediate sprag clutch assembly – To assemble

1. Lubricate the new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in the direct clutch piston. Fit the seals with the lips facing away from the spring pockets.
2. Lubricate a new centre seal with clean transmission fluid. Lubricate the seal groove in the direct clutch housing, then fit the seal with the lip uppermost.

Note Production built transmissions use a direct clutch housing with a check ball. If the housing requires replacement and the replacement housing does not contain a check ball, replace the direct clutch piston with the service piston which has a check ball. **Either the direct clutch housing and/or the piston must contain a check ball otherwise damage may occur to the direct clutch and related parts.**

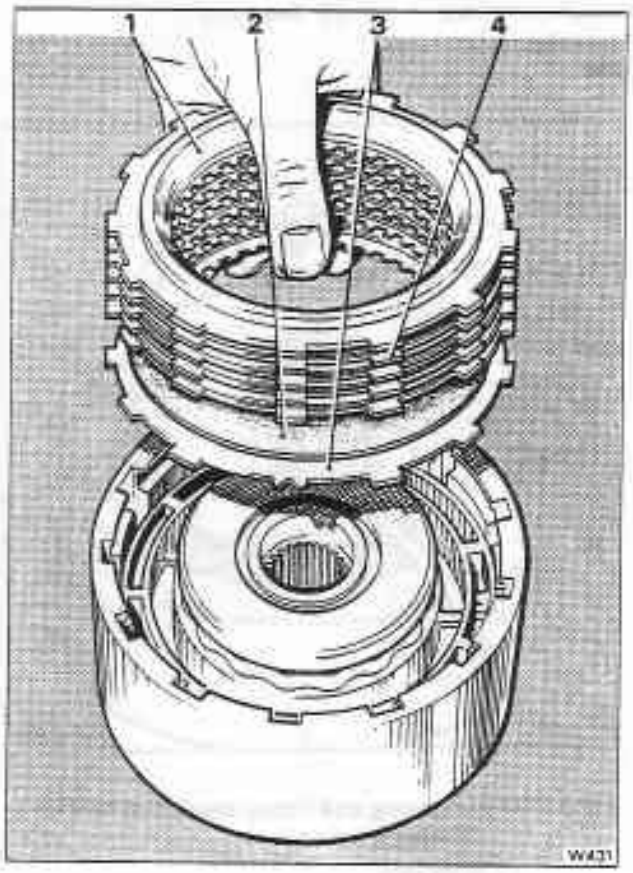


Fig. T19-10 Fitting the direct clutch plates
1 Backing plate
2 Composition plate
3 Waved steel plate
4 Flat steel plate

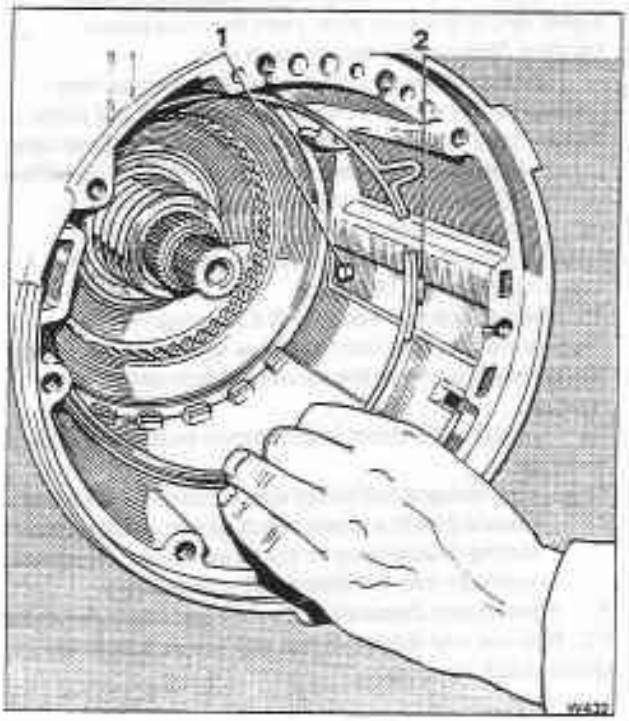


Fig. T19-11 Fitting the front band
1 Anchor pin
2 Front band location

3. Fit the inner seal protector J-21362 over the direct clutch hub.
4. Fit the outer seal protector J-21409 into the clutch housing and fit the piston, turning it clockwise as it is pushed down. Remove the tools.
5. Fit the **fourteen** clutch release springs into the spring pockets in the clutch piston, leaving two pockets directly opposite one another with no springs. If replacement springs are to be fitted, fit all **sixteen.**
6. Position the spring retainer over the springs.
7. Using the clutch spring compressor J-2590, compress the springs ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring, then remove the tool.

Note Ensure that the clutch release springs are not leaning. If necessary, push the springs into an upright position using a small screwdriver.

8. Fit the direct clutch apply ring into the clutch housing.
9. Lubricate the four flat steel clutch plates, five composition faced plates and one waved steel plate with clean transmission fluid. Then fit the plates into the clutch housing (see fig. T19-10). Commence with the waved steel plate and then alternate composition and steel plates.

On turbocharged cars, one waved steel plate, five flat steel plates, and six composition plates are fitted.

Note Do not use radially grooved composition plates at this point of the assembly.

10. Fit the direct clutch backing plate over the clutch plates and fit the large snap ring.
11. Turn the clutch unit over and fit the sprag clutch assembly onto the intermediate clutch inner cam.
12. Fit the intermediate sprag outer race with a clockwise turning motion.

Note When fitted, the outer race should not turn anti-clockwise.

13. Fit the sprag clutch retainer (cup side down) and fit the snap ring.

Turbine shaft, forward and direct clutches, sun gear shaft, and front band – To fit

1. Fit the front band so that the band anchor hole fits over the band anchor pin and the band apply lug faces the servo hole (see fig. T19-11).
2. Fit the sun gear shaft with the longer splined end innermost.
3. Fit the direct clutch housing and intermediate sprag assembly onto the centre support as follows.
4. Ensure that the ends of the oil sealing rings on the centre support are interlocked, and that the rings are lubricated.
5. Carefully slide the direct clutch housing onto the centre support sleeve. At the same time engage the housing internal splines with the splines on the sun gear shaft.
6. Ensure that the clutch housing hub bottoms on the sun gear shaft. Also ensure that the splines on the forward end of the sun gear shaft are flush with the splines in the direct clutch housing.

Note It will be necessary to rotate the clutch housing to allow the sprag outer race to line up with the intermediate clutch plates. If necessary, remove the direct clutch driving and driven plates to facilitate the handling of the housing.

7. Fit the bronze thrust washer onto the forward clutch hub; retain the washer in position with petroleum jelly.
8. Position the transmission horizontally in the transmission holding fixture. Fit the forward clutch assembly and the turbine shaft.
9. Ensure that the mainshaft bottoms on the end of the forward clutch hub.
10. It will be necessary to rotate the clutch housing to allow the direct clutch driving hub to line up with the clutch plates in the direct clutch.
11. When the forward clutch is correctly seated it should be approximately 31,75 mm (1.250 in) from the oil pump face in the transmission casing.

Note The missing internal splines in the forward clutch hub are lubrication passages and do not have to be aligned with any particular splines on the mainshaft.

12. Fit the oil pump.

Intermediate clutch, gear unit, centre support, and reaction carrier

The intermediate clutch comprises three steel plates (1 waved and 2 flat), three composition plates, and an apply piston.

The steel plates are slotted directly into the transmission casing. The composition plates engage in splines machined in the intermediate clutch outer race.

The compound planetary gear unit consists of an internal gear, which is splined onto the mainshaft; an output planet carrier and pinions; an output shaft, which is mechanically connected to the output carrier; and a sun gear, which is splined onto the sun gear shaft.

The centre support is keyed and bolted to the transmission casing and forms part of the reaction carrier roller assembly. The oil delivery sleeve, which supplies oil pressure to the direct clutch and the intermediate roller is an integral part of the centre support. The support also houses the piston that applies the intermediate clutch.

The reaction carrier comprises a housing, a set of planet pinions, and the outer race of the low roller.

When the mainshaft rotates, the splined internal gear is driven clockwise. This causes the rear planet pinions to idle clockwise and drive the sun gear anti-clockwise.

The front and rear sun gears are integral so they turn as one. As a result, the front planet pinions also idle clockwise and drive the front internal gear clockwise.

The front internal gear is an integral part of the output carrier and is thus connected to the output shaft. This reacts with a force on the front pinions which are trying to drive the front internal gear clockwise. This reaction tends to rotate the front carrier assembly anti-clockwise instead of allowing the force to turn the internal gear and output shaft against the weight of the car.

To make the gear set effective in driving the car, a roller assembly is used to hold the carrier against anti-clockwise rotation. This roller assembly is in effect a one-way clutch which allows a rotating part to turn one way only.

The roller assembly is fitted in such a manner that its elements will lock and prevent the reaction carrier from rotating anti-clockwise. This provides the required reaction and causes the front planet pinions to drive the front internal gear and output shaft in reduction at a ratio of approximately 2.5:1. This gear ratio, coupled with a maximum torque converter reduction of approximately 2.2:1 gives an overall ratio of almost 5.5:1 in first gear.

As the speed of the car increases, less torque multiplication is required so that the coupling will become more efficient. Therefore, it is desirable to move to a lower ratio. This is accomplished with the aid of the intermediate sprag assembly, intermediate clutch, and sun gear shaft.

A sprag assembly is a device having irregular shaped members wedged between inner and outer races, similar to a roller assembly. It permits a part to rotate in one direction only.

When the intermediate clutch is applied, the drive plates become locked to the reaction plates and by doing so they lock the intermediate sprag outer race to the transmission case.

This, in effect, holds the clutch housing, sun gear shaft, and sun gear against anti-clockwise rotation. When the sun gear is stationary, the power flow is as follows.

Converter output is transmitted clockwise through the forward clutch to the mainshaft and rear internal gear. As the rear internal gear turns clockwise, the rear pinions rotate clockwise on their pins and 'walk around' the stationary sun gear. This moves the output carrier and output shaft clockwise in reduction at a ratio of approximately 1.5:1 (or second gear).

The front gear unit is not required for second gear operation. However, because the output carrier is integral with the front internal gear, the front internal gear runs clockwise in reduction. This causes the front planet pinions to run clockwise around the stationary sun gear, turning the reaction carrier clockwise. This clockwise rotation of the reaction carrier causes the rear roller assembly to overrun or to become ineffective.

As the speed of the car increases further, a lower ratio is again required. The transmission is moved to third or direct gear. This is achieved by applying the direct clutch as well as the forward clutch so that both the rear internal gear and the sun gear rotate at the same speed.

In order to obtain reverse, a rear friction band is used. This band locks the reaction carrier against clockwise rotation which would cause the low or rear roller to overrun. Power flow through the transmission in reverse is as follows.

Turbine torque from the converter is transmitted to the forward clutch housing; the forward clutch is released, thus disconnecting the flow of power to the mainshaft and rear internal gear. Instead of power flowing through the forward clutch, it flows from the turbine shaft through the forward clutch housing and through the direct clutch hub to the direct clutch which is applied. This applies power to the sun gear shaft and sun gear, turning them clockwise. With the sun gear driving clockwise, the front pinions revolve anti-clockwise as idlers. This drives the front internal gear and output shaft anti-clockwise or in a reverse direction. The overall ratio in reverse with maximum converter ratio and gear reduction is approximately 4.4:1.

In intermediate range (second gear) with the accelerator pedal released, the car will slow down, using the engine as a brake. In this situation however, the rear wheels will drive the transmission through the output shaft and as a result, the intermediate sprag would attempt to overrun. To prevent this happening the front band is applied to the direct clutch housing, holding it stationary, thus keeping the transmission in second gear to provide effective engine braking.

For even greater engine braking, the transmission can be placed into low range. At speeds below approximately 64km/h (40 mile/h) the transmission will move to first gear. When the car is in first gear and the throttle is closed, the low roller tends to overrun. When the low/reverse band is applied, the reaction carrier is prevented from overrunning the roller and the transmission is retained in first gear.

Intermediate clutch, gear unit, centre support, and reaction carrier – To remove

Before the intermediate clutch, gear unit, and their associated parts can be removed, the transmission must be removed from the car.

Remove the following units.

1. Sump, strainer, and intake pipe assembly.
2. Control valve unit.

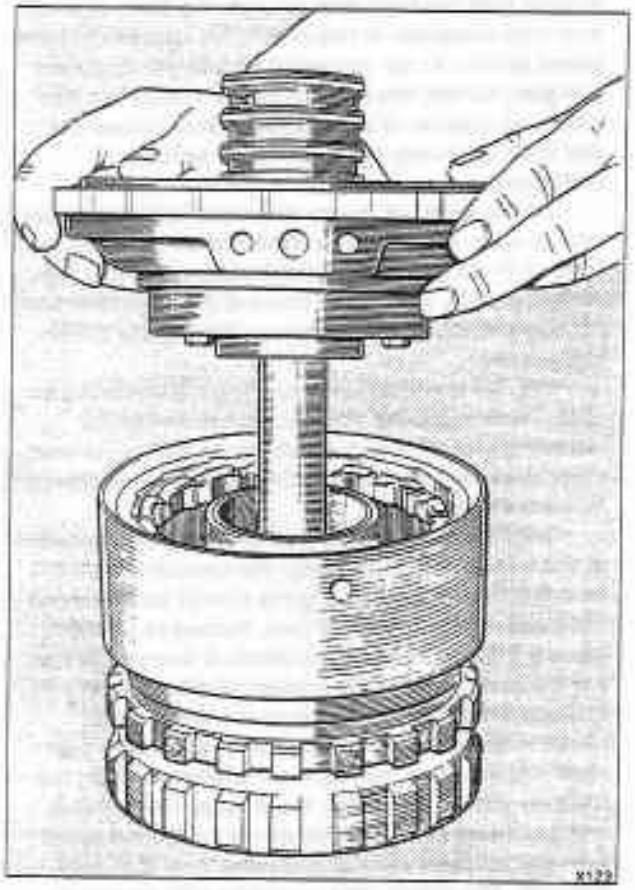


Fig. T20-1 Removing the centre support assembly

3. Rear servo.
4. Control valve spacer, check balls, and front servo.
5. Oil pump.
6. Turbine shaft, forward clutch, direct clutch, sun gear shaft, and front band.
7. Remove the centre support bolt from the transmission case. This is the socket-headed cap-screw located in the lower face of the transmission case at the rear of the control valve unit oil passages.
8. Remove the snap ring which secures the intermediate clutch back plate.
9. Remove the back plate then withdraw the three composition plates and the one waved and two flat steel plates.
10. Remove the snap ring which retains the centre support in the case.
11. Remove the complete gear unit assembly by lifting with the removal tool J-21795 and a slide hammer J-7004.
12. Remove the output shaft thrust washer from either the output shaft or the case.
13. Hold the gear unit assembly with the output shaft pointing down (i.e. through a suitable hole in the work bench).
14. Remove the rear unit selective washer from the transmission case.
15. Remove the support to case spacer.
16. Remove the rear band assembly. To facilitate removal, rotate the band lugs away from the pins and pull the band assembly out of the transmission case.
17. Remove the centre support assembly from the reaction carrier (see fig. T20-1).
18. Withdraw the centre support to reaction carrier thrust washer.

Note The thrust washer and the race may have adhered to the back of the centre support. If so, remove them from the centre support.

19. Remove the reaction carrier and roller clutch assembly from the output carrier (see fig. T20-2). Remove the roller clutch assembly and spacer ring from the reaction carrier.

Centre support and intermediate clutch piston – To dismantle

1. Remove and discard the four oil seal rings from the centre support (see fig. T20-3).
2. Remove the snap ring (see fig. T20-4).
3. Remove the spring retainer and the clutch release springs.
4. Remove the intermediate clutch piston from the centre support.
5. Remove and discard the inner and outer seals from the clutch piston.

Note **Do not** remove the three setscrews which secure the roller clutch inner race to the centre support.

Centre support and intermediate clutch piston – To inspect

1. Wash all parts in clean paraffin, then dry with compressed air.

2. Examine the roller clutch inner race for scratches and indentations. Ensure that the lubrication hole is clear.
3. Examine the bush for scoring or wear.

Note Ensure that the **rear** spiral oil groove (looking from the front of the centre support) is in a clockwise direction (see fig. T20-5).

If replacement is necessary proceed as follows.

a. With the aid of the fitting/removal tools J-21465-6 and J-8092, drive out the old bush.

b. **From the front of the centre support**, align the elongated slot in the bush with the drilled hole in the oil delivery sleeve (groove nearest to the intermediate piston).

c. Drive the bush squarely into the bore, until the bush is flush to 0,25 mm (0.010 in) below the top of the oil delivery sleeve.

4. Ensure that the oil ring grooves are clean and are not damaged.
5. Using compressed air check that the lubrication passages are clear and are not interconnected.
6. Examine the piston bore in the centre support for scratches or damage.
7. Examine the piston seal grooves for damage and ensure that they are clean.
8. Examine the piston for cracks or porosity.
9. Examine the springs for collapsed coils or signs of distortion. Check the spring length against that of a new spring before deciding whether to renew the complete set of springs.

Centre support and intermediate clutch piston – To assemble

1. Lubricate a new inner and a new outer seal with clean transmission fluid. Lubricate the seal grooves in the intermediate clutch piston and fit the seals with the lips facing away from the spring pockets.
2. Fit the intermediate clutch inner seal protector J-21363 over the centre support hub.
3. Fit the intermediate clutch piston (see fig. T20-6). Ensure that it seats fully in the centre support.
4. Fit the spring guide and the three clutch release springs into the pockets in the clutch piston.
5. Position the spring retainer centrally over the springs.
6. Compress the spring retainer, ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring.
7. Fit four new oil sealing rings onto the centre support.

Gear unit – To dismantle (see fig. T20-7)

1. Remove the centre support to sun gear races and thrust bearing. The outer race may have been removed with the centre support.
2. Remove the sun gear from the output carrier assembly.
3. Remove the reaction carrier to output carrier thrust washer and front internal gear ring.
4. Invert the gear unit on the bench so that the mainshaft is pointing downwards.

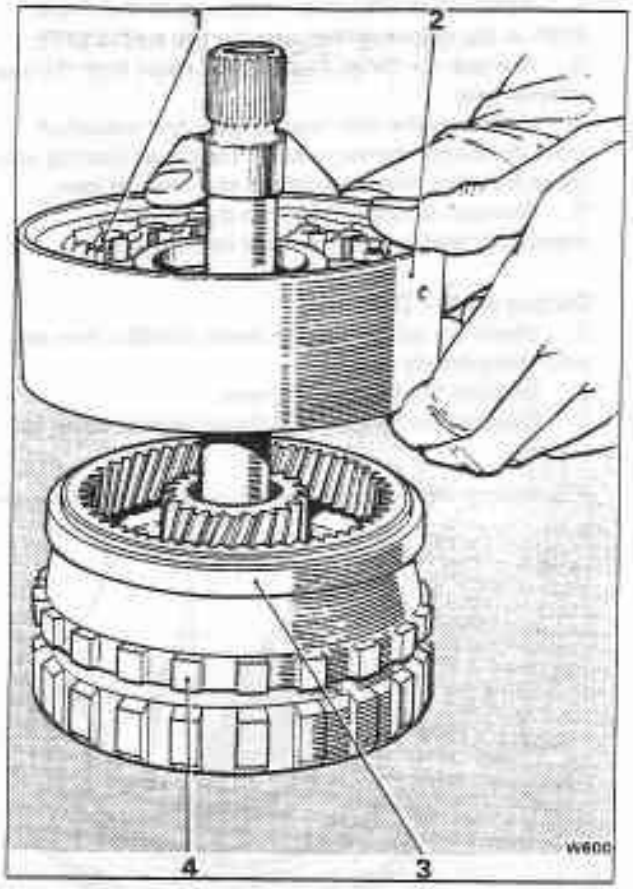


Fig. T20-2 Removing the reaction carrier assembly
1 Roller clutch assembly
2 Reaction carrier
3 Gear ring
4 Output carrier

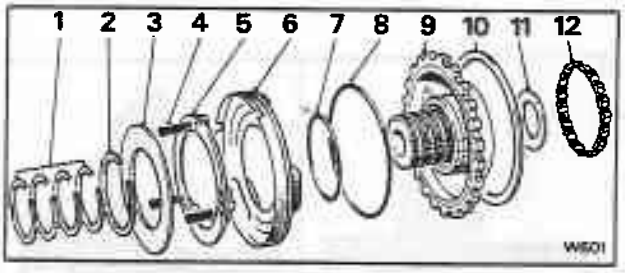


Fig. T20-3 Centre support assembly
1 Oil seal rings
2 Snap ring
3 Intermediate clutch spring retainer
4 Intermediate clutch release springs
5 Intermediate clutch spring guide
6 Intermediate clutch piston
7 Intermediate clutch inner seal
8 Intermediate clutch outer seal
9 Centre support assembly
10 Support to case spacer
11 Thrust washer
12 Roller clutch assembly

5. Remove the snap ring which retains the output shaft in the output carrier; remove the output shaft.
6. Remove the thrust bearing and races from the rear internal gear.
7. Withdraw the rear internal gear and mainshaft from the output carrier; remove the thrust bearing and races from the inner face of the rear internal gear.
8. Remove the snap ring from the end of the mainshaft, then remove the rear internal gear.

Output shaft – To inspect

1. Wash the output shaft in clean paraffin, then dry with compressed air.
2. Examine the bushing for wear.
3. Examine the bearing and thrust washer faces for damage.

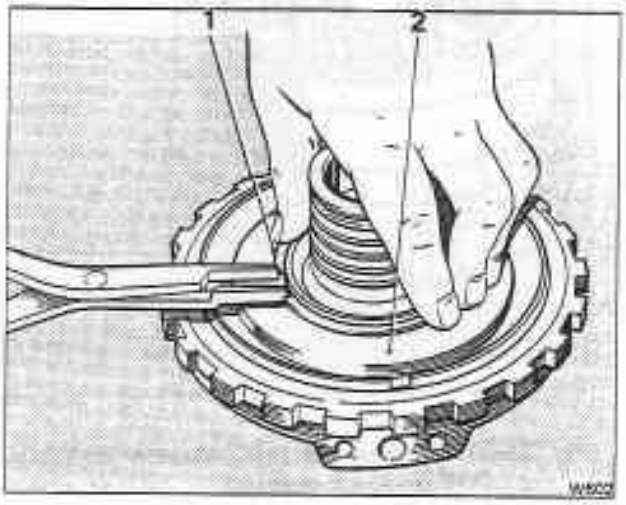


Fig. T20-4 Removing and fitting the intermediate clutch piston snap ring
1 Snap ring
2 Spring retainer

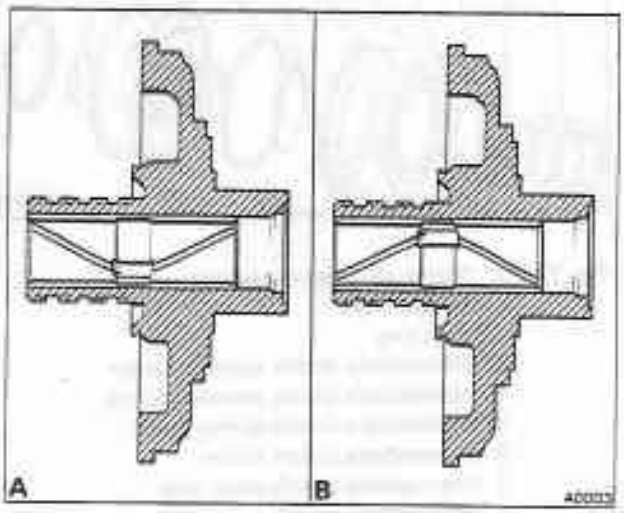


Fig. T20-5 Centre support bush
A Correctly fitted
B Incorrectly fitted

4. Examine the governor drive gear for rough or damaged teeth.
5. Examine the splines for damage.
6. Examine the drive lugs for damage.
7. Examine the speedometer drive gear for rough or damaged teeth. If a gear is badly worn or damaged, it can be renewed as follows.

Speedometer drive gear – To remove

It should be noted that a nylon speedometer drive gear is installed **only** at the factory. All replacement drive gears are manufactured from steel.

1. If a **nylon gear** is fitted to the shaft, depress the retaining clip and slide the gear off the output shaft (see fig. T20-8).
2. If a **steel gear** is fitted to the shaft, install the speedometer drive gear removal tools J-21427 and J-9578 (see fig. T20-9).

Tighten the bolt on the puller until the gear is free on the shaft.

Remove the tools and the gear from the shaft.

Speedometer drive gear – To fit

1. To a fit a **nylon gear,** align the slot in the speedometer drive gear with the hole in the output shaft, then install the retaining clip.
2. To fit **a steel gear,** lightly lubricate the bore of the gear, then fit the gear over the output shaft.

Press the gear down the shaft using a suitable length of tube and a press, until the distance from the rear face of the gear to the end of the output shaft measures 291,30 mm (11.469 in). Refer to figure T20-10.

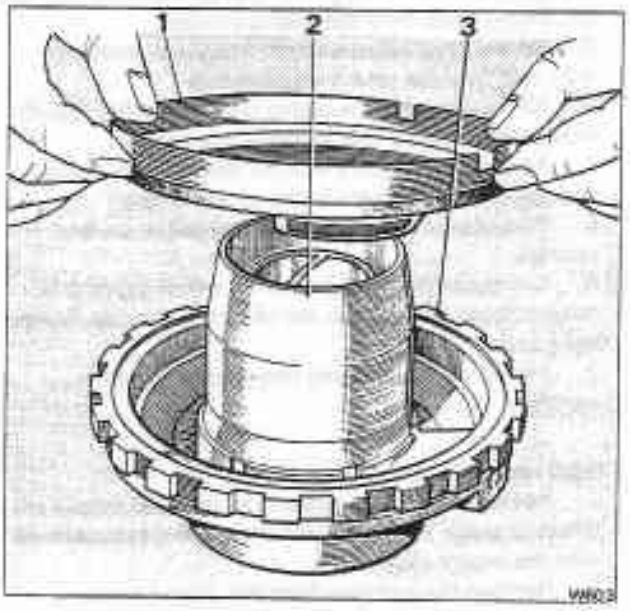


Fig. T20-6 Fitting the intermediate clutch piston
1 Intermediate clutch piston
2 Guide sleeve
3 Centre support

Mainshaft – To inspect

1. Wash the mainshaft in clean paraffin, then dry with compressed air.
2. Examine the shaft for cracks or distortion.
3. Examine the splines for damage.
4. Examine the ground journals for scratches or damage.
5. Examine the snap ring groove for damage.
6. Ensure the oil lubrication holes are clear.

Rear internal gear and sun gear – To inspect

1. Wash the rear internal gear and the sun gear in clean paraffin, then dry with compressed air.
2. Examine all the gear teeth for wear or damage.
3. Examine the splines for damage.
4. Examine the gears for cracks.

Output carrier assembly – To inspect

1. Wash the output carrier assembly in clean paraffin, then dry with compressed air.
2. Examine the front internal gear for damaged teeth.
3. Examine the pinion gears for damage, rough bearings, or excessive side movement.
4. Check the end-float of the pinions with the aid of a feeler gauge (see fig. T20-11). The end-float should be between 0,23 mm and 0,61 mm (0.009 in and 0.024 in).
5. Examine the parking pawl lugs for cracks or damage.
6. Examine the splines which drive the output shaft for damage.
7. Examine the front internal gear ring for flaking or cracks.

Reaction carrier assembly – To inspect

1. Examine the surface on which the rear band applies, for signs of burning or scoring.
2. Examine the roller outer race for scoring or wear.
3. Examine the thrust washer surfaces for signs of scoring or wear.
4. Examine the bush for damage. If the bush is damaged, the carrier must be renewed.

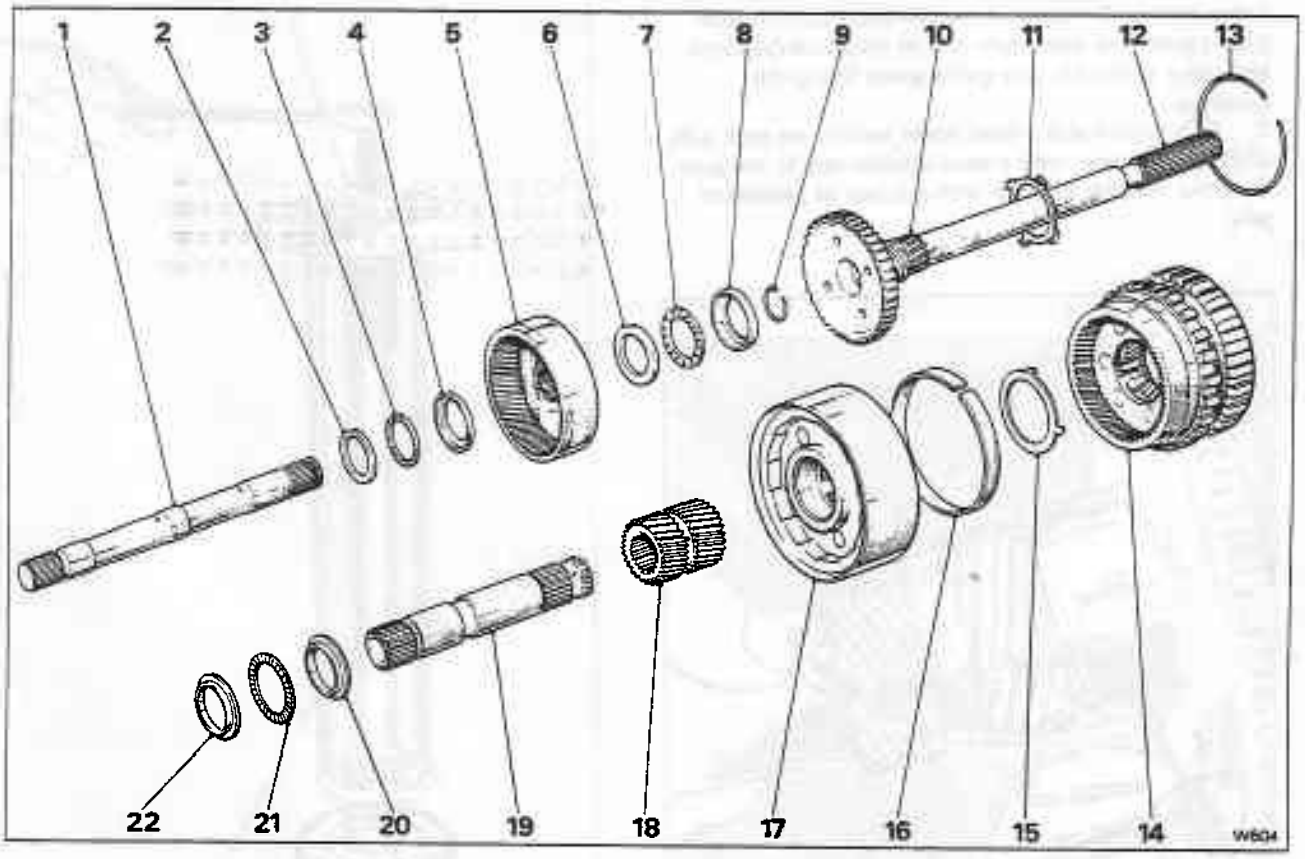


Fig. T20-7 Gear unit

1 Main shaft
2 I/D flanged race
3 Thrust bearing
4 O/D flanged race
5 Rear internal gear
6 I/D flanged race
7 Thrust bearing
8 O/D flanged race
9 Snap ring
10 Speedometer drive gear
11 Thrust washer
12 Output shaft
13 Snap ring
14 Output carrier assembly
15 Thrust washer
16 Front internal gear ring
17 Reaction carrier assembly
18 Sun gear
19 Sun gear shaft
20 I/D flanged race
21 Thrust bearing
22 I/D flanged race

5. Examine the pinion gears for damage, rough bearings, or excessive side movement.
6. Check the pinion end-float. This should be between 0,23 mm and 0,61 mm (0.009 in and 0.024 in).

Pinion gears – To renew

1. Support the carrier assembly on its **front** face.
2. Using a 12,70 mm (0.50 in) diameter drill, remove the stake marks from the end of the pinion pins. Ensure that the drill does not remove any metal from the carrier as this will weaken the component and could result in a cracked carrier.
3. Using a tapered punch, drive or press the pinions out of the carrier.
4. Remove the punch, gears, thrust washers, and needle roller bearings.
5. Examine the pinion thrust faces in the pinion gear pockets for burrs and stone off as necessary. Thoroughly wash the carrier in clean paraffin and dry with compressed air.
6. Ensure that the new gears are clean and free from burrs, then fit the eighteen needle bearings into each pinion gear. Use petroleum jelly to retain the bearings and use a pinion pin as a guide when fitting the bearings.
7. Fit a bronze and a steel thrust washer on each side of the pinion gear, with a steel washer next to the gear. Hold the washers in place with a smear of petroleum jelly.

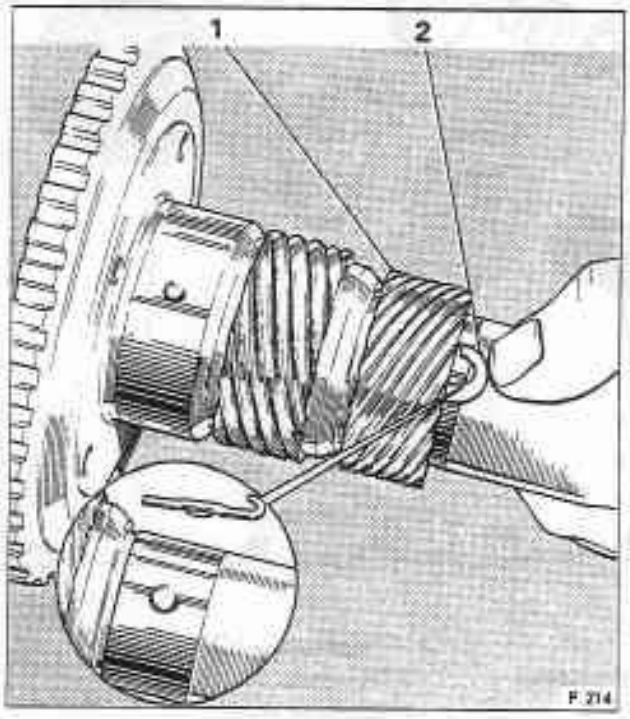


Fig. T20-8 Removing a nylon speedometer drive gear
1 Nylon gear
2 Retaining clip

On output carrier assemblies only, a steel and a bronze washer are always fitted on the thrust side, but two steel washers may be fitted on the non-thrust side. However, if the pinion end-float is outside the tolerance given, the washers should be replaced with a steel and a bronze on both sides (see fig. T20-12). **This is essential on RJA transmissions.**
8. Fit the pinion gear assembly into position in the carrier, then fit a pilot pin through the rear face of the assembly to centralize and hold the parts in position.
9. Drive a new pinion pin into position from the front, rotating the pinion whilst the pin is being driven in.
10. Ensure that the headed end of the pin is flush or below the face of the carrier.
11. Secure the punch to be used for staking the pins in a bench vice, so that it can be used as an anvil.
12. Support the carrier with the head of the pin resting on the punch. Then, using a chisel with a radiused end stake the opposite end of the pin in three places (see fig. T20-13).

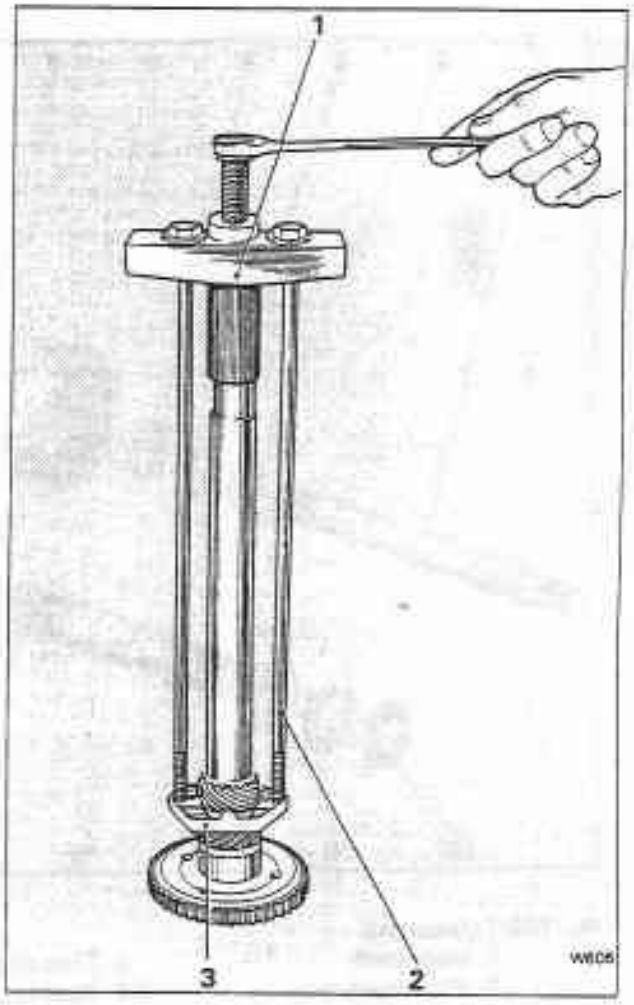


Fig. T20-9 Removing a steel speedometer drive gear
1 J-9578
2 Removal bolts
3 J-21427

Note Both ends of the pin must lie below the face of the carrier, otherwise a foul may occur between the pin and the adjacent component.

13. Repeat the procedure for the remaining pins.

Roller clutch – To inspect

1. Wash the assembly in clean paraffin, then dry with compressed air.
2. Examine the roller clutch for damaged rollers or springs.
3. Examine the roller cage for damage.

Intermediate clutch plates and rear band – To inspect

1. Examine the condition of the composition faced and steel plates. **Do not** diagnose a composition drive plate by colour.
2. Dry composition faced plates with compressed air and inspect the composition face for.

a. Pitting and flaking.
b. Wear.
c. Glazing.
d. Cracking.
e. Charring.
f. Metal particles embedded in the lining.

If any of the above conditions are evident, replacement is required.

3. Wipe the steel plates dry and check for heat discolouration. If the surface is smooth and an even colour is indicated, the plates should be used again. If severe heat spot discolouration or surface scuffing is indicated, the plates must be replaced.

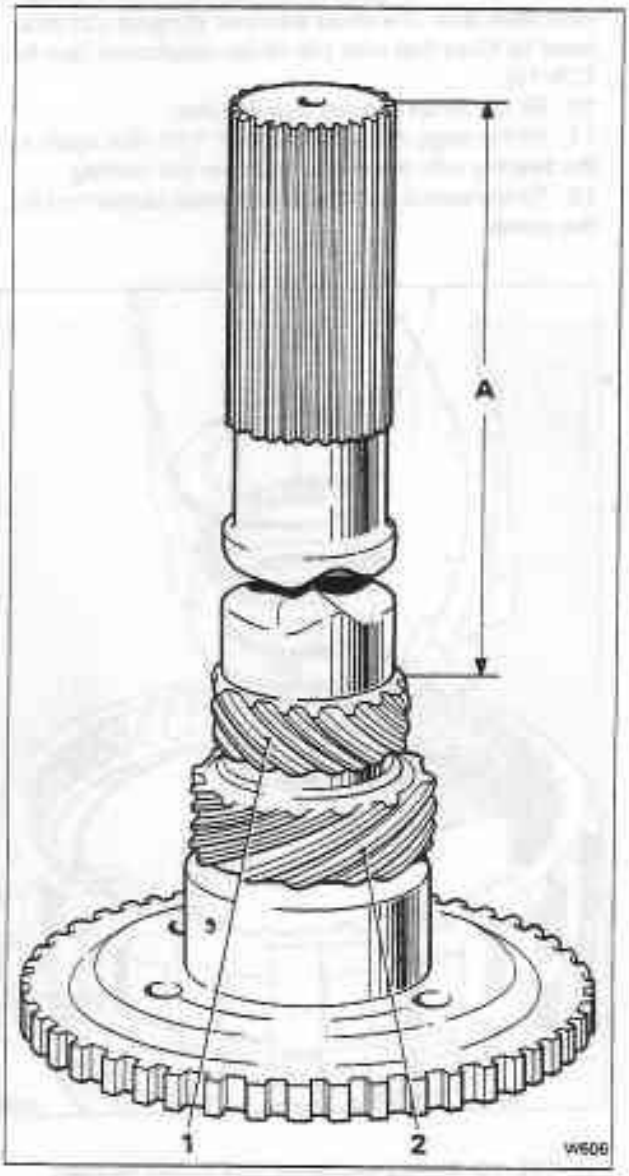


Fig. T20-10 Output shaft
1 Speedometer driving gear
2 Governor driving gear
A 291,30 mm (11.469 in)

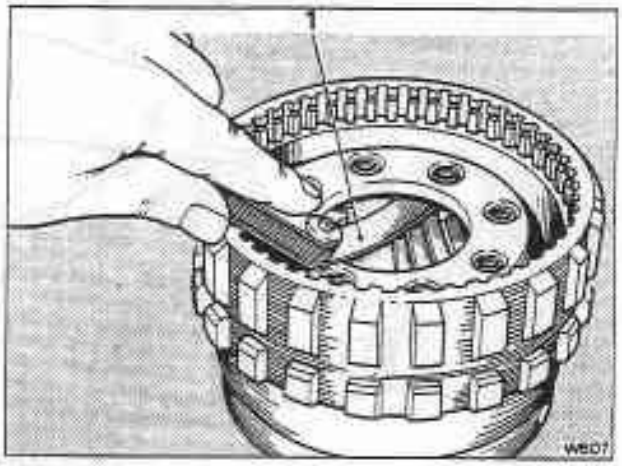


Fig. T20-11 Checking the output carrier pinion end-float
1 0,23 mm to 0,61 mm (0.009 in to 0.024 in)

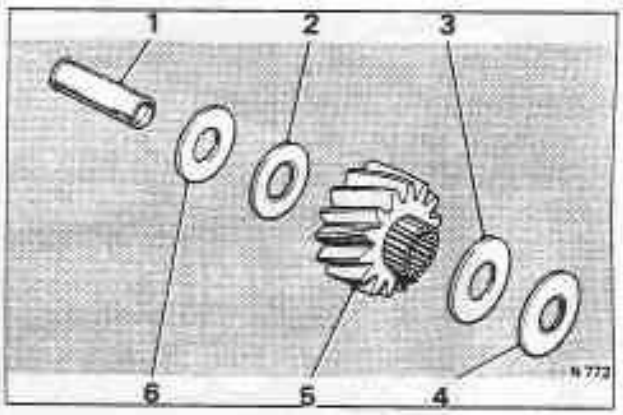


Fig. T20-12 Planet pinion gear
1 Pinion pin
2 Steel washer
3 Steel washer
4 Bronze washer
5 Planet pinion
6 Bronze washer

4. Examine the rear band for cracks or distortion.
5. Examine the ends of the band for damage at the anchor lugs and the apply lug.
6. Examine the lining for cracks, flaking, and burning.
7. Ensure that the lining is secured to the band.

Gear unit and centre support – To assemble

1. Ensure that all parts are clean. Lightly lubricate with clean transmission fluid all bushes, journals, gears, bearings, etc.
2. Fit the rear internal gear onto the mainshaft; fit the circlip.

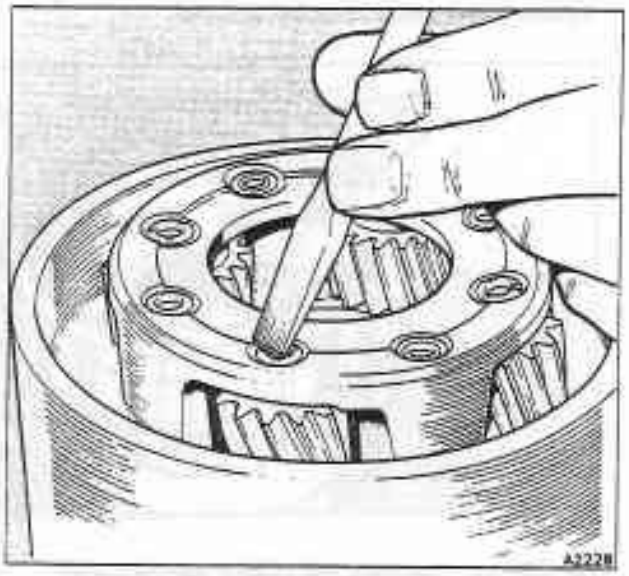


Fig. T20-13 Staking a pinion pin

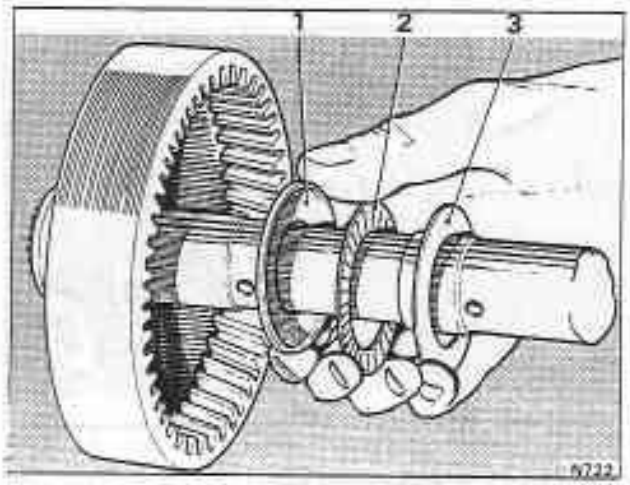


Fig. T20-14 Fitting the races and thrust bearing to the inner face of the rear internal gear
1 O/D flanged race
2 Thrust bearing
3 I/D flanged race

3. Fit the races and thrust bearing onto the inner face of the rear internal gear, retaining them with a smear of petroleum jelly (see fig. T20-14).
4. Fit the large diameter race first with the outer flange uppermost.
5. Fit the thrust bearing into the race.
6. Fit the smaller diameter race over the bearing with the inner flange towards the bearing.
7. Ensure that the pinion gears are adequately lubricated. Then, fit the output carrier onto the mainshaft so that the pinion gears mesh with the rear internal gear.
8. Position the assembly with the mainshaft pointing downwards through a hole in the bench. Take care not to damage the shaft.
9. Fit the races and thrust bearing onto the outer face of the rear internal gear, retaining them with a smear of petroleum jelly. The small diameter (flanged I/D) race must be fitted first with the flange uppermost (see fig. T20-15).
10. Fit the thrust bearing into the race.
11. Fit the large diameter (flanged O/D) race against the bearing with the flange cup over the bearing.
12. Fit the output shaft into the output carrier and fit the circlip.

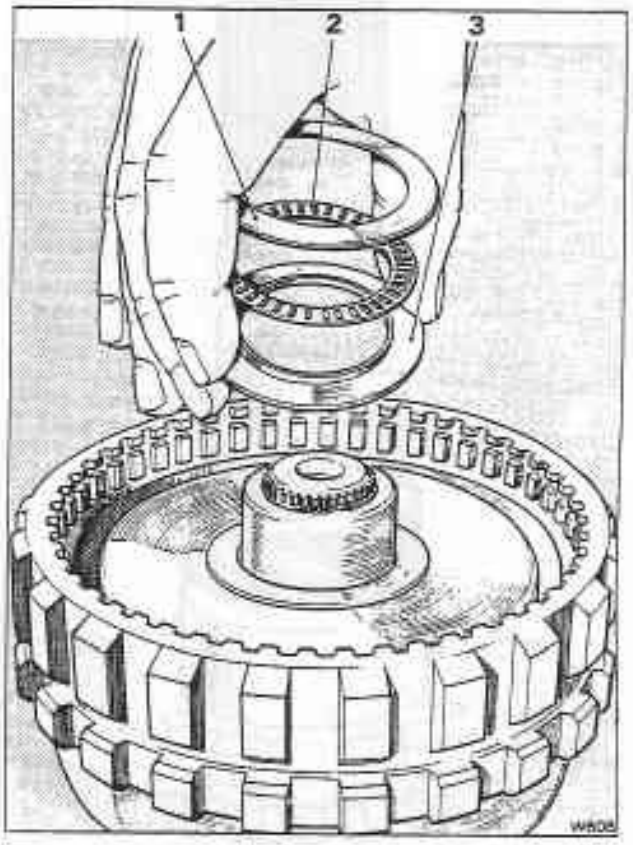


Fig. T20-15 Fitting the races and thrust bearing to the outer face of the rear internal gear
1 O/D flanged race
2 Thrust bearing
3 I/D flanged race

13. Smear the output shaft to case metal thrust washer with petroleum jelly, then fit the washer into position.
14. Turn the assembly over so that the output shaft points downwards.
15. Smear the reaction carrier to output carrier thrust washer with petroleum jelly. Then, fit the washer into the output carrier so that the bent tabs engage in the tab pockets.

Note The factory built transmissions use a non-metal washer, however, the service replacement thrust washer is metal.

16. Fit the sun gear; ensure that the end with the chamfered inside diameter faces downwards.
17. Fit the gear ring over the output carrier.
18. Fit the sun gear shaft with the longest splined end first.
19. Ensure that the reaction carrier pinion gears are adequately lubricated. Then, fit the reaction carrier onto the output carrier as shown in figure T20-16. Mesh the pinion gears with the front internal gear.

Note When a new output carrier and/or reaction carrier is being installed and the front internal gear ring prevents assembly of the carriers, replace the front internal gear ring with the service ring.

20. Smear the centre support to sun gear thrust races and bearing with petroleum jelly and fit as follows (see fig. T20-17).

a. The large outer diameter race, with the centre flange up, over the sun gear shaft.
b. The thrust bearing onto the large race.
c. The small diameter race, with the centre flange up.

21. Smear the centre support to reaction carrier thrust washer with petroleum jelly, then fit the washer into the recess in the centre support.

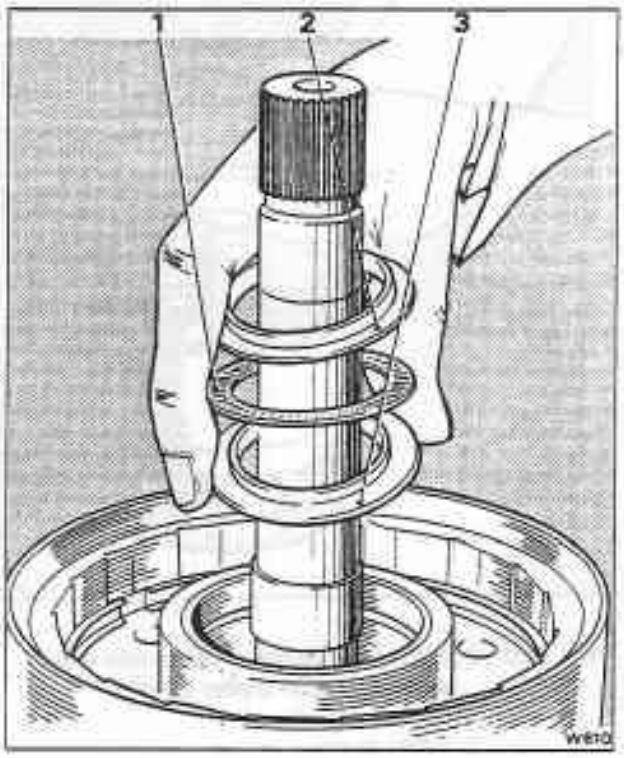


Fig. T20-17 Fitting the races and thrust bearing to the sun gear
1 Thrust bearing
2 I/D flanged race
3 I/D flanged race

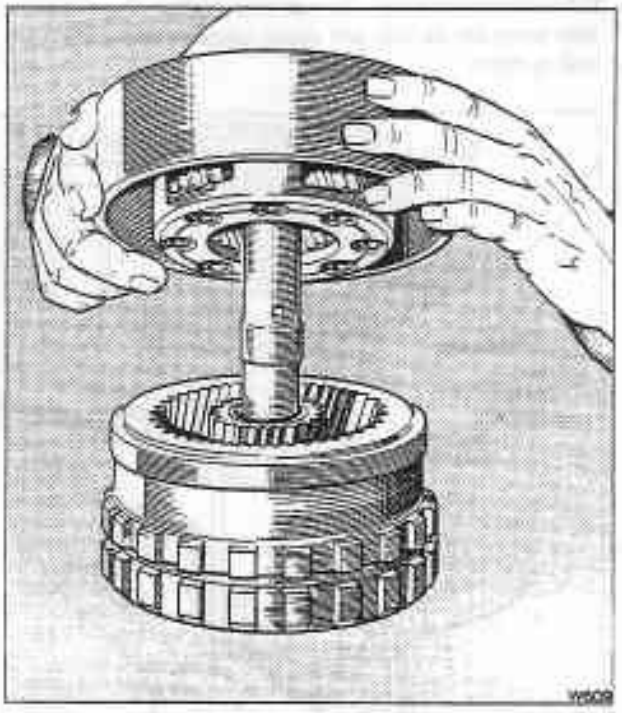


Fig. T20-16 Fitting the reaction carrier to the output carrier

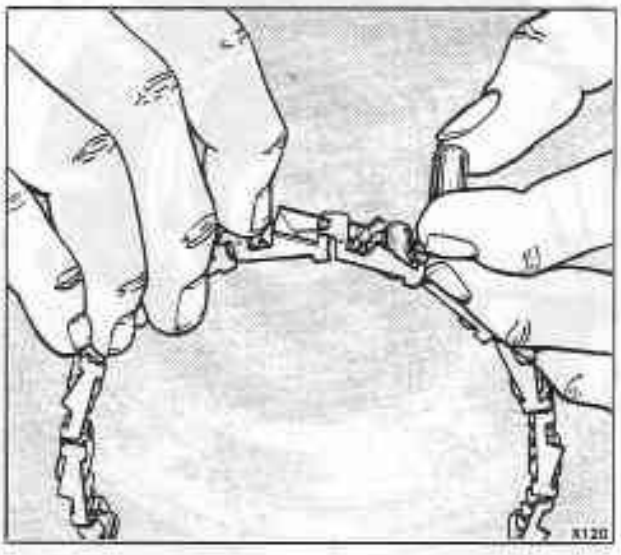


Fig. T20-18 Fitting a roller to the roller clutch cage

22. Fit the rollers that may have come out of the roller clutch cage, by compressing the energizing spring with the forefinger and inserting the roller from the outside (see fig. T20-18).

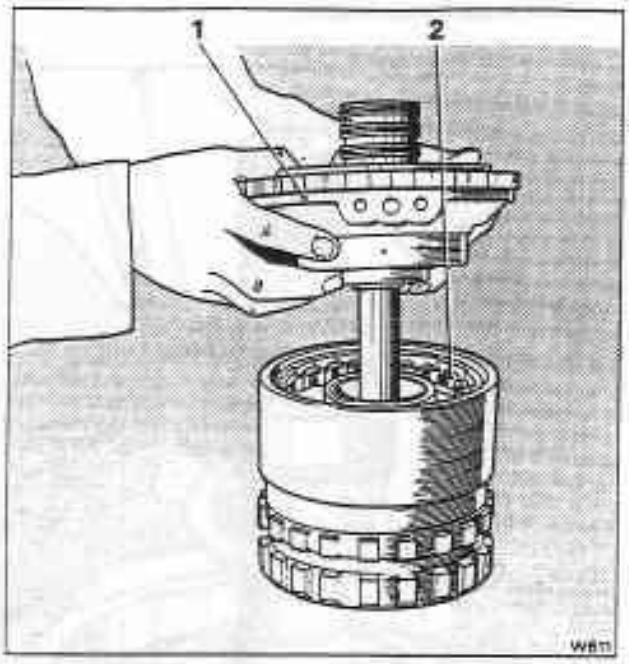


Fig. T20-19 Fitting the centre support into the reaction carrier (roller clutch)
1 Centre support
2 Roller clutch

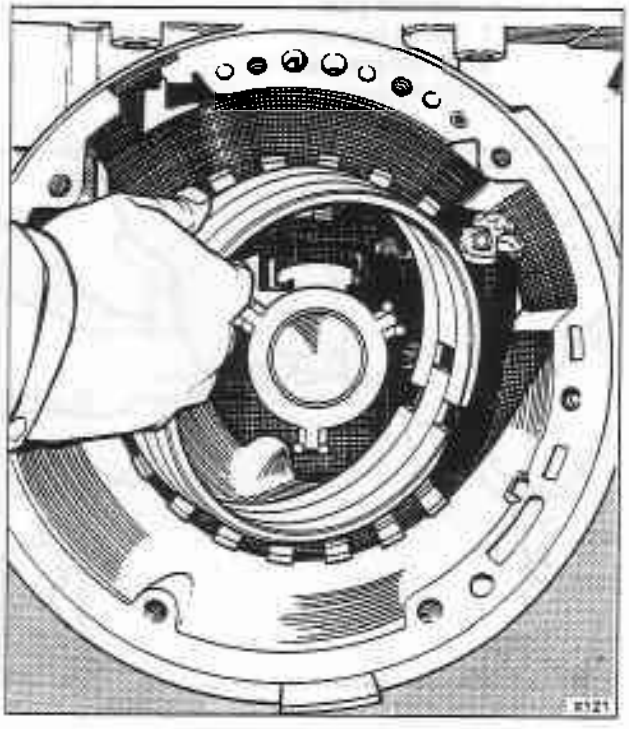


Fig. T20-20 Fitting the rear band

Note Ensure that the energizing springs are not distorted and that the curved end leaf of the springs are positioned against the rollers.

23. Fit the spacer ring and roller clutch assembly into the reaction carrier.

24. Fit the centre support assembly into the roller clutch (see fig. T20-19).

Note With the reaction carrier held, the centre support should turn **anti-clockwise only.**

Intermediate clutch, gear unit, centre support, and reaction carrier – To fit

1. Fit the rear band assembly into the transmission case so that the band lugs engage with the anchor pins (see fig. T20-20).

2. Inspect the support to case spacer for burrs or raised edges. If necessary, remove the burrs, etc., with a stone or fine emery cloth. Ensure that the spacer is clean.

3. Fit the support to case spacer against the shoulder at the bottom of the case splines and the gap adjacent to the band anchor pin.

Note Do not confuse this spacer [1,02 mm (0.040 in) thick and with boths sides flat] with either the centre support to case snap ring (one side bevelled) or the intermediate clutch backing plate to case snap ring [2,36 mm (0.093 in) thick with both sides flat].

4. Fit the previously selected rear unit adjusting washer (see Section T19) into the slots provided inside the rear of the transmission case. Retain the washer with a smear of petroleum jelly.

5. Fit the transmission case into the holding fixture (if it has been removed). Do not over-tighten the fixture side pivot pin as this will cause binding when the gear unit is fitted.

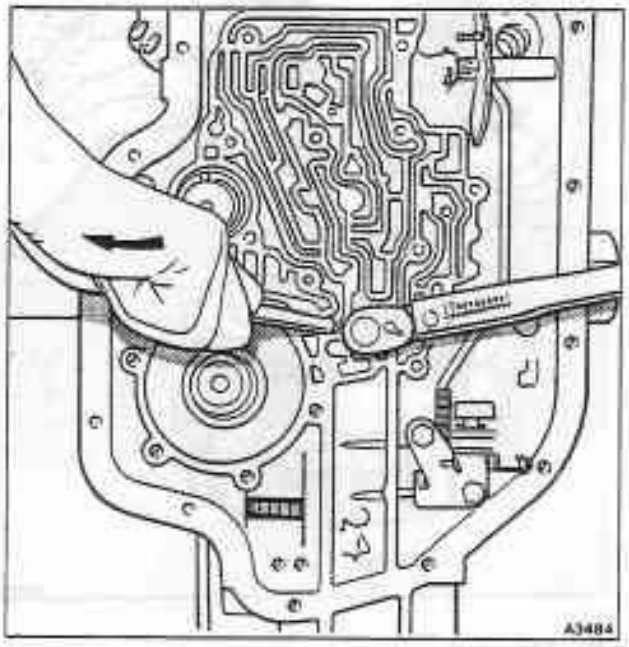


Fig. T20-21 Locating the centre support

6. Fit the gear unit assembly into the case. Align the slots. Then, carefully guide the assembly into the case, making certain that the centre support bolt hole is properly aligned with the hole in the case. Ensure that the tangs on the output shaft to case thrust washer are positioned in the pockets.
7. Lubricate the centre support retaining snap ring with clean transmission fluid. Fit the snap ring into the transmission case with the bevelled side uppermost and the flat side against the centre support. Position the location gap adjacent to the front band anchor pin.
8. With the transmission in a vertical position (see fig. T20-21), fit the case to centre support bolt by placing the centre support locating tool J-23093 into the case direct clutch passage. Ensure that the handle of the tool is pointing to the left as viewed from the valve body side and parallel to the bell housing mounting face.
9. Apply pressure to the tool handle as shown in figure T20-21, which will tend to rotate the centre support anti-clockwise as viewed from the bell housing end of the transmission.
10. While holding the centre support firmly anti-clockwise against the case splines, torque tighten the case to centre support bolt to the figures quoted in Section T23, using a $^{3}/_{8}$ in UNC 12 point thin wall, deep socket.

Note When using the locating tool, take care not to create burrs on the case valve body mounting face.

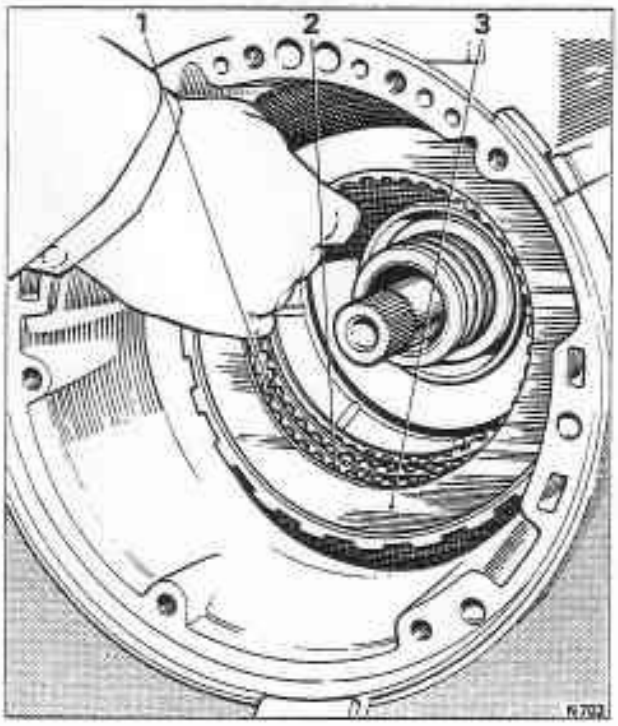


Fig. T20-22 Fitting the intermediate clutch plates
1 Steel plate
2 Composition plate
3 Back plate

11. Lubricate the one waved, two flat steel plates, and three composition intermediate clutch plates with clean transmission fluid, then fit the clutch plates. Commence with the waved steel plate, then fit alternate composition and flat steel plates (see fig. T20-22).
12. Fit the intermediate clutch backing plate with the ridge uppermost.
13. Fit the intermediate clutch backing plate to case snap ring, ensuring that the ring gap is opposite the band anchor pin. Both sides of this snap ring are flat and it is 2,36 mm (0.093 in) thick.
14. Check the rear unit end-float (see Section T19).

Transmission case

The transmission case is an alloy die casting which houses the main transmission components. It also forms the bell housing which encloses the torque converter.

The lower inner face of the case forms part of the hydraulic passages onto which the control valve unit is fitted. The oil pump is fitted to a machined face at the front of the case. This machined face contains oil passages which convey transmission fluid from the pump to various points in the case (see fig. T21-1).

The bore in the rear of the case contains a bush in which the ouput shaft rotates.

Transmission case – To inspect

1. When the transmission has been completely dismantled, the case should be thoroughly washed in clean paraffin, then dried with compressed air.
2. Ensure that all the oil passages are flushed out.
3. Take care not to create burrs on the ends of the passages.

Note If the case assembly requires replacement, ensure that the centre support to case spacer is removed from the old case and fitted in the new case.

4. Inspect the case assembly for cracks, internal porosity or cross channel leaks in the valve body face passages.
5. Check the retention of the band anchor pins.
6. Inspect all threaded holes for thread damage.

Note Stripped threads in bolt holes are repairable with Heli-coil inserts (see fig. T21-3 and Heli-coil chart).

7. Inspect the intermediate clutch plate lugs for damage.
8. Inspect the snap ring grooves for damage.
9. Inspect the bore of the governor assembly for scratches or scoring.
10. Inspect the modulator valve bore for scoring or damage.
11. Inspect the intermediate clutch cup plug for retention and sealing. If necessary, fit a new plug.

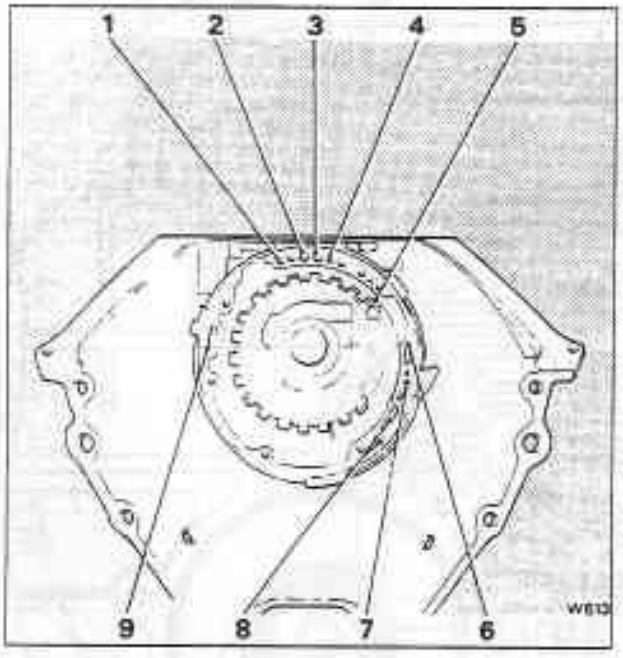


Fig. T21-1 Transmission case oil passages

1 Reverse
2 Line
3 Drive
4 Modulator
5 Intermediate clutch cup plug
6 To cooler
7 Cooler return
8 Vent
9 Pump intake

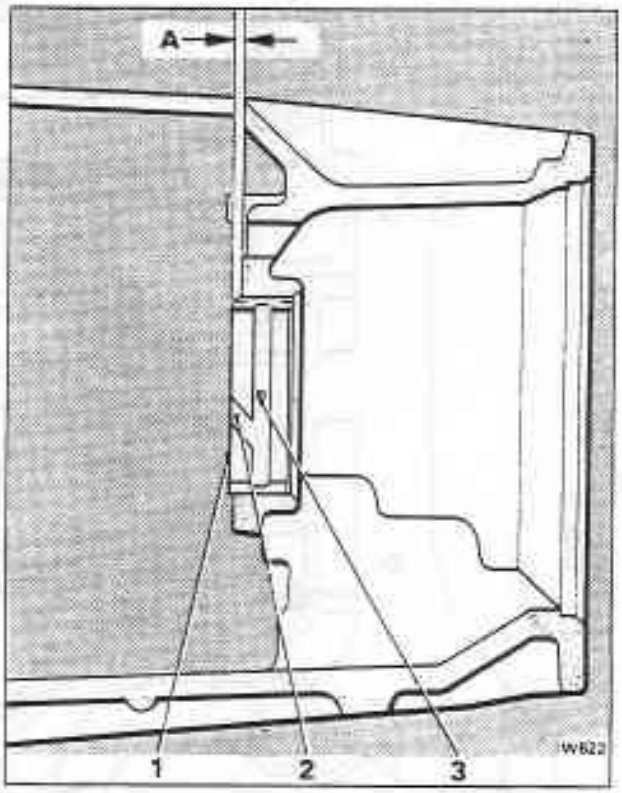


Fig. T21-2 Fitting a new case bush

1 Bush
2 Oil groove in direction shown
3 Stake mark
A 1,02 mm to 1,40 mm (0.040 in to 0.055 in)

External damage
External damage is usually caused by handling, road hazards, or the converter to flexplate setscrews becoming loose as a result of incorrect fitting. Therefore, when external damage is evident, fit a new case.

Internal damage
If internal damage is due to the incorrect installation of the spacer and/or the snap rings resulting in damage to the snap ring grooves, fit a new case and ensure that the snap rings are assembled correctly.

High oil pressure (faults usually located in the pressure regulator valve system) can also result in internal damage. If this is the cause, fit a new case and rectify the problem.

If the case bushing is found to be worn or scored, fit new bushing (see fig. T21-2).

Repair procedure for minor case porosity
1. Bring the transmission fluid up to the normal operating temperature approximately 77°C (170°F).
2. Locate the source of the oil leak.
3. Thoroughly clean the area to be repaired with cleaning solvent and a brush; dry the area with compressed air. A clean, dry soldering acid brush may be used to clean the area and also to apply the epoxy cement.
4. Following the manufacturer's instructions, mix a sufficient amount of epoxy cement 3M Scotch Weld 2216 or equivalent.

Note Observe the manufacturer's precautions regarding handling.

5. While the transmission is still at operating temperature, apply the epoxy cement to the area under repair. Ensure that the area is completely covered.
6. If 3M Scotch Weld 2216 has been used, allow 1 hour to pass before starting the engine. Equivalent epoxy cements may take longer to cure, therefore, always check the manufacturer's instructions.
7. Finally, bring the transmission fluid up to the normal operating temperature of approximately 77°C (170°F) and check the transmission for leaks.

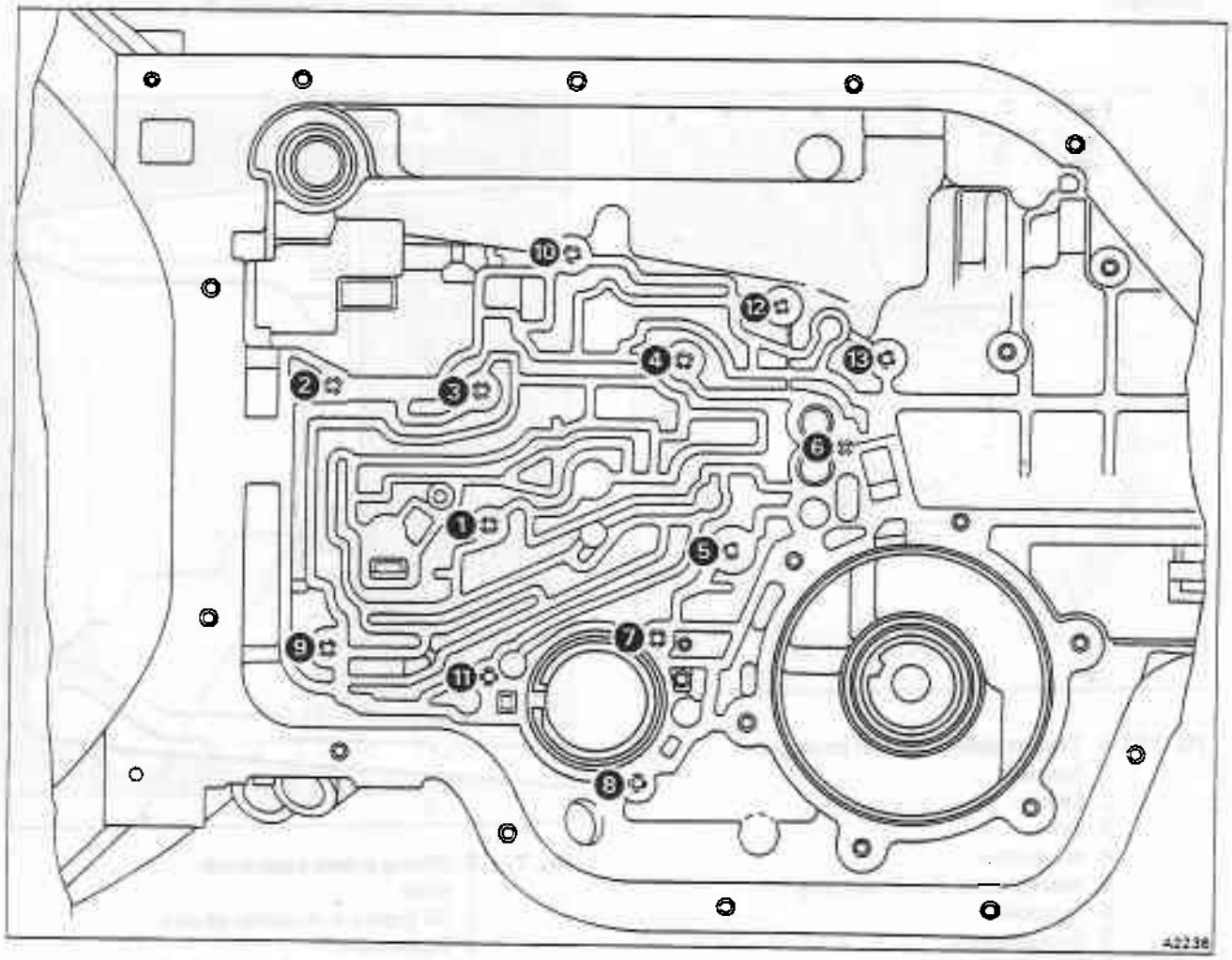


Fig. T21-3 Heli-coil identification – View of underside of transmission case

Intermediate clutch cup plug – To fit

1. Place the transmission case in the holding fixture RH 7955 and position it with the front end facing upwards.
2. Ensure that the intermediate clutch cup plug hole is thoroughly clean and enter the intermediate clutch cup plug into the hole, open end out. Drive the plug into the case until it is flush or slightly below the top of the hole using a 9,52 mm (0.375 in) diameter rod, approximately 254 mm (10 in) long.

Note Ensure that the diameter of the rod is large enough to locate on the lip edge of the plug and not the bottom of the plug.

3. Stake the plug securely in the case.

Heli-coil information

Transmission out of car and partially or completely dismantled

Location	Hole number	Drill size	Tap size	Heli-coil size
Pump to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	1 to 4 (see fig. T21-3)	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	5 and 6 (see fig. T21-3)	6,76 mm (0.266 in)	1/4-20 UNC-2B	1/4 - 20 STI-NC
Converter to flexplate	All	10,30 mm (0.406 in)	M10-1.5	M10-1.5 x 1½D

Transmission in car and partially dismantled

Location	Hole number	Drill size	Tap size	Heli-coil size
Rear extension to case	All	9,93 mm (0.391 in)	3/8-16 UNC-2B	3/8 - 16 STI-NC
Governor cover to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Modulator retainer to case	–	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Speedometer driven gear assembly to case	–	6,20 mm (0.244 in)	M6-1.0	M6-1.0 x 2D
Oil sump to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Rear servo cover to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Parking lock bracket to case	All	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	7 to 10 (see fig. T21-3)	8,33 mm (0.328 in)	5/16-18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	11 (see fig. T21-3)	6,76 mm (0.266 in)	1/4-20 UNC-2B	1/4 - 20 STI-NC
Solenoid to case	12 and 13 (see fig. T21-3)	6,76 mm (0.266 in)	1/4-20 UNC-2B	1/4 - 20 STI-NC

Case bushing – To remove

1. Support the case in the holding fixture and thread the extension handle J-21465-13, into the bushing removal tool J-21465-8. Then, using drive handle J-8092, remove the bush.

Case bushing – To fit

1. Obtain the following tools.
   Removal/fitting tool J-21465-8.
   Adapter J-21465-9.
   Drive handle J-8092.
   Extension J-21465-13.
2. Support the transmission case.
3. Assemble the tools. Then, using the adapter, press the bush into the case until it is between 1,02 mm and 1,40 mm (0.040 in and 0.055 in) **above** the selective thrust washer face as shown in figure T21-2.

Note Ensure that the bush is fitted with the lubrication passage facing the front of the transmission case.

4. Stake the bush in the oil groove using tool J-21465-10.

Heli-coils

Refer to figure T21-3 and the Heli-coil information chart, for the correct drill and tap sizes, before commencing any repair work.

1. Blank off the area around the hole to be heli-coiled (if possible), to contain any small particles of metal.
2. Drill out the old threads and clean any particles from the hole.

Note Drill out only to the depth of the original hole. When drilling hole No. 4 (see fig. T21-3), the drill may go through to the inside of the case. Located just behind this hole are the intermediate clutch splines. Therefore, the burrs **must** be removed from the clutch splines.

3. Tap the hole with the Heli-coil tap.
4. Fit the standard insert (STI) Heli-coil.
5. Break off the tang from the bottom of the Heli-coil.
6. Remove any blanks, etc., as described in Operation 1 and **ensure that all particles of metal, etc., are removed.**

Fault diagnosis

Accurate diagnosis of transmission problems begins with a thorough understanding of normal transmission operation. In particular it is essential to know which units are involved in the various gears and speeds, so that the specific unit or fluid flow can be isolated and investigated further.

The following sequence of tests may help to simplify the diagnosis of defects and should be performed first.

1. Check the fluid level.
2. Warm-up the engine and transmission to obtain normal operating temperature, approximately 77°C (170°F).
3. Check the control linkage.
4. Check the throttle position switch.
5. Check the vacuum lines and fittings.
6. Fit a pressure gauge and road test the car.

Note If possible, test the car with the customer as a passenger. It is possible that the condition which the customer requires correcting is a normal function of the transmission, thus, unnecessary work can be avoided.

Symptom	Possible cause	Action
1. No drive in drive range	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3). Check for external leaks or the vacuum modulator diaphragm leaking.
	2. Control linkage.	2. Check and adjust the control linkage (see Section T18).
	3. Low oil pressure.	3. (a) Check the vacuum modulator. (b) Check for a restricted intake strainer, a leak at the intake pipe, grommet, or the 'O' ring damaged or missing. (c) Check that the oil pump assembly pressure regulator is not sticking. Also check the pump drive gear tang has not been damaged by the converter. (d) Check the case for porosity around the intake bore. (e) Check the items listed on page T22-13.
	4. Control valve assembly.	4. Check for the manual valve being disconnected from the detent lever.
	5. Forward clutch.	5. (a) Check the forward clutch apply piston for cracks, the seals damaged or missing, or the clutch plates burnt (see page T22-14). (b) Check the oil seal rings (missing or broken) on the pump cover. (c) Check for a leak in the feed circuit or the pump to case gasket mis-positioned or damaged. (d) Check the clutch housing check ball is not sticking or missing.
	6. Roller clutch assembly.	6. Check the clutch assembly for broken springs or damaged cage.

Symptom	Possible cause	Action
1. No drive in drive range (continued)	7. Actuator inoperative.	7. (a) Check the gearchange fuse (fuse A6 on fuse panel F2). (b) Check the charge condition of the battery. (c) Check the operation of the actuator (see Section T6).
2. (a) No drive in reverse range. (b) Slips in reverse range	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Actuator inoperative.	2. (a) Check the gearchange fuse (fuse A6 on fuse panel F2). (b) Check the charge condition of the battery. (c) Check the operation of the actuator (see Section T6).
	3. Control linkage.	3. Check and adjust the control linkage (see Section T18).
	4. Oil pressure.	4. Check the items listed on page T22-13.
	5. Control valve assembly.	5. (a) Check that the valve body/spacer plate gaskets are not damaged or incorrectly fitted. (b) Check that the 2-3 valve train is not sticking open (this would also cause a 1-3 up-change in drive range). (c) Low/reverse check ball missing from the case (this will also cause no overrun braking in low range).
	6. Rear servo and accumulator.	6. (a) Check for a damaged rear piston seal. (b) Check for a short band apply pin (this may also cause no overrun braking or slipping in overrun braking – low range).
	7. Forward clutch.	7. Check that the clutch unit will release (if it does not release this will also cause drive in neutral).
	8. Direct clutch.	8. (a) Check the outer seal for damage. (b) Check the clutch plates (if burnt, it may be caused by the check ball sticking in the piston). (c) Check the items listed on page T22-15.
	9. Rear band.	9. Check the band for burnt or loose linings, apply pin or anchor pins not engaged, or the band broken.
3. Drive in neutral	1. Control linkage.	1. Check and adjust the control linkage (see Section T18).
	2. Forward clutch.	2. (a) Check that the clutch is releasing, if the clutch does not release it

Symptom	Possible cause	Action
3. Drive in neutral (continued)		will also cause no reverse. (b) Check the items listed on page T22-14.
	3. Pump assembly.	3. Transmission fluid pressure leaking into the forward clutch apply passage.
4. Will not hold in park	1. Control linkage.	1. Check and adjust the control linkage (see Section T18).
	2. Internal parking linkage.	2. (a) Check the parking brake lever and actuator assembly. (b) Check the chamfer on the actuator rod sleeve. (c) Check the parking pawl (broken or inoperative). (d) Check that the parking pawl return spring is not broken, missing, or incorrectly hooked.
5. No engine braking in intermediate range – 1st gear	1. Control valve assembly.	1. Check the low-reverse check ball (missing from case).
	2. Rear servo.	2. (a) Check for a damaged oil seal ring, bore, or piston. (b) Rear band apply pin short or improperly assembled.
	3. Rear band.	3. (a) Rear band broken or burnt (check for cause). (b) Check the rear band assembly engages correctly on the anchor pins and/or servo pin.
6. No engine braking in intermediate range – 2nd gear	1. Front servo and accumulator.	1. (a) Check for leaking or broken oil sealing rings. (b) Check for scored bores. (c) Check for a sticking servo piston.
	2. Front band.	2. (a) Check to ensure that the front band is not burnt or broken. (b) Check to ensure that the front band is engaged correctly on the anchor pin and/or servo pin.
7. No detent down-changes **Note** Position the car on a ramp. Switch on ignition, but do not start the engine.	1. Transmission case electrical plug.	1. (a) Disconnect the electrical connections. (b) Connect a test lamp to the detent solenoid terminal of the disconnected wiring loom. (c) Depress the accelerator fully, from the normal driving position. (d) Light off. Incorrectly adjusted or faulty throttle position switch. Faulty electrical circuit. (e) Light on. Check the operation of the detent solenoid. If the solenoid cannot be heard to operate this may be due to.

Symptom	Possible cause	Action
7. No detent down-changes (continued)		(i) Faulty electrical connection. (ii) Sticking detent valve train. (iii) Restricted oil passage.
	2. Control valve assembly.	2. (a) 3-2 valve sticking, spring missing, or broken. (b) Detent valve train sticking.
8. Transmission noisy	1. Noise in park, neutral, and all drive ranges.	1. (a) Check for pump cavitation. (i) Transmission fluid level low or high, top-up etc. as necessary (see Section T3). (ii) Restricted or incorrect strainer assembly. (iii) Intake 'O' ring damaged or intake pipe split. (iv) Porosity at pump face intake port. (v) Pump to transmission case gasket incorrectly fitted. (vi) Coolant in the transmission fluid. (b) Check pump assembly for. (i) Defective or damaged gears. (ii) Drive gear incorrectly assembled. (iii) Crescent interference. (iv) Seal rings damaged or worn. (c) Check converter for. (i) Damage. (ii) Loose bolts, converter to flywheel. (iii) Cracked or broken flexplate.
	2. Noise in first, second, and/or reverse.	2. (a) Check that the transmission does not contact the body. (b) Check planetary gear train for. (i) Gears or thrust bearings damaged. Thoroughly clean thrust bearings and thrust races. Closely inspect needles and surfaces for pitting and roughness. (ii) Front internal gear ring damaged.
	3. Noise during acceleration in any gear.	3. (a) Check that the transmission fluid lines to and from the cooler are not fouling. (b) Check that the engine mounts are not loose or broken.
	4. Squeak at low vehicle speeds.	4. Check the speedometer driven gear shaft seal (lubricate or replace).
	5. Slight creaking noise, when accelerating gently from the stationary position.	5. Check for the converter pilot spigot fretting in the crankshaft tail bore (lubricate the spigot liberally with Retinax A grease or equivalent).

Symptom	Possible cause	Action
8. Transmission noisy (continued)	6. Clutch noise, during application. (a) Neutral to drive and/or park to drive. (b) 1-2 up-change in intermediate and drive ranges. (c) 2-3 up-change in drive range, neutral to reverse, and park to reverse.	6. (a) Check the condition of the forward clutch plates. (b) Check the condition of the intermediate clutch plates. (c) Check the condition of the direct clutch plates.
	7. Converter noise in reverse, drive, intermediate, and low ranges. The noise level is generally lower in park and neutral.	7. Check for damaged needle bearings in the converter.
9. 1st and 2nd ranges only (no 2-3 up-change)	1. Incorrect vacuum.	1. Check the items listed on page T22-14, Incorrect vacuum at modulator.
	2. Governor system.	2. Check line pressure.
	3. Control valve assembly.	3. (a) Check for the 2-3 shift valve train sticking (valves should fall under their own weight). (b) Check for damaged, leaking, or incorrectly fitted gaskets between the control valve unit, oil spacer plate, and case.
	4. Direct clutch burnt.	4. (a) Check the modulator bellows. (b) Check the centre support for the oil seal rings missing or broken. (c) Check that the direct clutch piston seals are not missing, cut, or incorrectly assembled. (d) Check that the piston check ball is not sticking or missing.
	5. Throttle position switch.	5. Check that the throttle position switch is not faulty, causing the solenoid to be activated all the time.
	6. Detent solenoid.	6. Check that the solenoid is not sticking open.
10. (a) No 1-2 up-change. (b) Delayed up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Throttle position switch.	2. Check that the throttle position switch is not faulty, causing the solenoid to be activated all the time.
	3. Detent solenoid.	3. Check that the solenoid is not sticking open.

Symptom	Possible cause	Action
10. (a) No 1-2 up-change. (b) Delayed up-change (continued)	4. Governor assembly.	4. (a) Check for the governor valve sticking. (b) Check that the driven gear is not loose, damaged, or worn (also check the output shaft drive gear, if the driven gear shows damage). (c) Check that the driven gear securing pin is not loose, broken, or missing.
	5. Control valve assembly.	5. (a) Check that the 1-2 shift valve train is not sticking in the closed position. (b) Check that the governor feed channels are not blocked, leaking, or the pipes out of position. (c) Check that the valve body spacer plate gaskets are not leaking, damaged, or incorrectly fitted.
	6. Case.	6. (a) Check for the intermediate clutch plug leaking or blown out. (b) Check for porosity between channels. (c) Check that the governor feed channel is not blocked, the governor bore scored or worn allowing a cross pressure leak.
	7. Intermediate clutch.	7. (a) Check that the clutch piston seals are not cut, improperly fitted, or missing. (b) Check that the centre support oil rings are not missing or broken. (c) Check that the orifice cup plug is fitted.
11. Rough 1-2 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Vacuum modulator.	2. (a) Check for loose fittings, restrictions in line, or the modulator assembly inoperative. (b) Check that the modulator valve is not sticking.
	3. Oil pressure.	3. (a) Check that the oil pump regulator or boost valve has not jammed. (b) Check for the pump to case gasket being incorrectly fitted or damaged.
	4. Check condition of engine.	4. Tune the engine.
	5. Control valve assembly.	5. (a) Check that the 1-2 accumulator valve train is not sticking. (b) Check that the valve body to case bolts are not loose. (c) Check that the valve body spacer plate gaskets are not damaged, incorrectly fitted, or the wrong gasket fitted.

Symptom	Possible cause	Action
11. Rough 1-2 up-change (continued)	6. Case.	6. (a) Check the intermediate clutch ball (missing or not sealing). (b) Check for porosity between channels.
	7. Rear servo accumulator assembly.	7. (a) Check the oil seal rings for damage. (b) Check that the piston has not jammed. (c) Check that the spring is not broken or missing. (d) Check that the servo bore is not damaged.
	8. Intermediate clutch.	8. (a) Check that only one waved plate has been fitted. (b) Check that the clutch plates are not burnt.
12. Slipping 1-2 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Control linkage.	2. Check and/or adjust.
	3. Check condition of engine.	3. Tune the engine.
	4. Vacuum line and components.	4. Check the vacuum system for response at the modulator.
	5. Line pressure.	5. (a) Check the oil pressure (it should vary and respond rapidly to quick changes in throttle openings). (b) Check the vacuum modulator for possible failure. (c) Check that the modulator valve is not sticking.
	6. Control valve assembly.	6. (a) Check for the 1-2 accumulator valve train sticking. (b) Check for porosity in the valve body or case. (c) Check the valve body attaching bolts for tightness.
	7. Front accumulator.	7. Check the oil seal ring (damaged or missing).
	8. Rear accumulator.	8. Check the oil seal ring (damaged or missing) or the case bore damaged.
	9. Oil pump.	9. (a) Check that the pump to case gasket is not misaligned or damaged. (b) Check that the pressure regulator valve is not sticking.
	10. Case.	10. (a) Check that the intermediate clutch plug is not leaking excessively. (b) Check for porosity between channels.
	11. Intermediate clutch.	11. (a) Check the piston seals (damaged or missing). Also check for burnt clutch plates.

Symptom	Possible cause	Action
12. Slipping 1-2 up-change (continued)		(b) Check the centre support for leaks in the feed circuit (oil rings or grooves damaged). Also, for an excessive leak between the tower and the bush, or the orifice bleed hole blocked. (c) Check that the centre support bolt has seated properly in the case. (d) Check that only one waved plate has been fitted.
13. Rough 2-3 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Check condition of engine.	2. Tune the engine.
	3. Oil pressure – High.	3. (a) Check the vacuum modulator assembly. (b) Check that the modulator valve is not sticking. (c) Check that the oil pump regulator valve and boost valve are operating correctly.
	4. Front servo accumulator or assembly.	4. (a) Check that the accumulator spring is not missing or broken. (b) Check that the accumulator piston is not sticking.
	5. Direct clutch.	5. (a) Check that only one waved clutch plate has been fitted. (b) Check the direct clutch for leakage to the outer area of the clutch piston. (c) Check the centre support for damage.
14. Slipping 2-3 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Control linkage.	2. Check and/or adjust.
	3. Check condition of engine.	3. Tune the engine.
	4. Oil pressure – Low.	4. (a) Check the vacuum modulator assembly. (b) Check the modulator valve. (c) Check the oil pump pressure regulator valve and/or the boost valve for operation. (d) Check the oil pump to case gasket for damage or incorrect location.
	5. Control valve assembly.	5. (a) Check the front accumulator piston pin for a leak at the swaged end. (b) Check for sticking valves. (c) Check for damage or leaking oil passages. (d) Check the spacer plate for damage, blocked direct clutch feed orifice, or misaligned gasket.

Symptom	Possible cause	Action
14. Slipping 2-3 up-change (continued)	6. Case.	6. Check the case for porosity cross leaks.
	7. Direct clutch.	7. (a) Check the piston seals and check ball for leaks. (b) Check the centre support oil seal rings for damage and for an excessive leak between the tower and bush. (c) Check that only one waved plate has been fitted.
	8. Front servo.	8. (a) Check for a broken or missing front servo spring. (b) Check for a leak at the servo pin.
15. (a) Delayed up-changes. (b) No up-changes	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Control linkage.	2. Check and/or adjust.
	3. Throttle position switch.	3. Disconnect the white/green wire from the connector on the side of the transmission case. Test the up-changes. (a) If the up-changes occur, the problem is in the throttle position switch or wiring. (b) If the fault persists continue to Operation 4.
	4. Incorrect modulator vacuum.	4. Connect a gauge to the lower end of the modulator vacuum pipe and check for normal vacuum. (a) If the vacuum is low or not present, check for leaks and restrictions. (b) If the fault persists continue to Operation 5.
	5. Incorrect line pressure.	5. Connect a gauge to the transmission adapter and check the line pressure in drive range with an engine speed of 1000 rev/min. Normal pressure is between 4,5 bar and 5,2 bar (65 lbf/in^2 and 75 lbf/in^2). **Note** Normal line pressure in drive range with the car stationary should vary from approximately 4,5 bar (65 lbf/in^2) at idle speed to 10,3 bar (150 lbf/in^2) at full throttle. The pressure increases as the engine vacuum decreases.
	6. Line pressure between 6,6 bar and 7,6 bar (95 lbf/in^2 and 110 lbf/in^2).	6. Check the complete detent system.
	7. Line pressure between 9,3 bar and 10,3 bar (135 lbf/in^2 and 150 lbf/in^2).	7. With the correct vacuum at the modulator, check. (a) Modulator valve. (b) Pressure regulator components.

Symptom	Possible cause	Action
15. (a) Delayed up-changes. (b) No up-changes (continued)	8. Normal line pressure between 4,5 bar and 5,2 bar (65 lbf/in^2 and 75 lbf/in^2).	8. Remove the governor assembly; check for freedom of operation and presence of dirt, etc. Clean if necessary.
	9. Detent system.	9. (a) Check that the detent solenoid is not loose or defective. (b) Check that the solenoid feed orifice is not blocked.
16. 1-2 up-change – Full throttle only	1. Throttle position switch.	1. Check that the throttle position switch is not sticking.
	2. Detent solenoid.	2. (a) Check that the solenoid securing bolts are torque tightened. (b) Check that the solenoid is not sticking open.
	3. Control valve assembly.	3. (a) Check the valve body spacer plate gasket for. (i) Leaks. (ii) Damage. (iii) Incorrectly fitted. (b) Check that the detent valve train has not jammed. (c) Check that the 3-2 valve has not jammed.
	4. Case.	4. Check the case for porosity.
17. Slips in all ranges	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T3).
	2. Control linkage.	2. Check and/or adjust.
	3. Oil pressure.	3. (a) Check that the vacuum modulator valve is not sticking. (b) Check that the oil strainer assembly is not blocked or leaking, or the grommet or 'O' ring missing or damaged. (c) Check the oil pump assembly for the regulator or boost valve sticking, or for a cross leak. (d) Check that the oil pump to case gasket is not damaged or incorrectly fitted.
	4. Case.	4. Check the case for cross leaks or porosity.
	5. Forward and direct clutches slipping.	5. (a) If the clutches appear burnt, look for the cause in 'Burnt clutch plates' on page T22-14. (b) Check the oil pump sealing rings on the pump cover for wear or damage.
18. No part throttle down-changes	1. Oil pressure.	1. Check the vacuum modulator assembly, modulator valve, and pressure

Symptom	Possible cause	Action
18. No part throttle down-changes (continued)		regulator valve, etc., for leaks, sticking valves, and restrictions.
	2. Control valve assembly.	2. Check that the 3-2 valve is not sticking, or the spring missing or broken.
19. Low or high up-changes	1. Oil pressure.	1. (a) Check the engine vacuum at the transmission end of the modulator pipe. (b) Check for loose vacuum connections at the engine and transmission. Also, check the modulator valve, pressure regulator valve train, etc., for leaks, sticking valves, and restrictions.
	2. Governor.	2. (a) Check that the governor valve is not sticking. (b) Check the feed holes, lines, etc., for leaks or restrictions, or the pipes damaged or misaligned.
	3. Detent solenoid.	3. Check that the solenoid is not sticking open, or become loose, etc., as this will cause late up-changes.
	4. Control valve assembly.	4. (a) Check the detent valve train for free movement or restrictions. (b) Check the 3-2 valve train. (c) Check the 1-2 valve train, if the 1-2 regulator valve is sticking this would cause a constant 1-2 shift point, regardless of throttle opening. (d) Check that the valve body spacer plate gaskets are not misaligned, or the spacer plate holes missing or blocked.
	5. Case.	5. Check the case for porosity, intermediate plug leaking or missing.
20. Torque converter leaks	1. Converter welding.	1. Check the converter welding and if at all suspect, fit a new converter.
	2. Damaged or worn converter hub.	2. Inspect the converter hub for wear, also, scoring that can damage the seal.
21. Torque converter vibrations	1. Converter/flex-plate out of balance, or cracked.	1. (a) Isolate the cause of the vibration. (b) Alter the position of the converter on the flexplate 60° at a time until the out of balance condition is corrected. (c) Replace the converter/flexplate.
	2. Converter balance weight.	2. Check the converter for the loss of balance weight(s), change the converter if a balance weight is lost.
	3. Crankshaft pilot.	3. (a) Check to ensure that the converter

Symptom	Possible cause	Action
21. Torque converter vibrations (continued)		to crankshaft pilot is not broken. (b) Change the converter if the pilot is broken.
22. Torque converter slipping or noisy. (Most converter noise occurs under light throttle in drive range with the brakes applied)	1. Loose flexplate to converter setscrews.	1. (a) Check the flexplate and converter for damage. (b) If **no damage** is apparent, tighten the bolts. (c) **If damage** is apparent replace the components.
	2. Cracked flexplate.	2. (a) Check for a cracked flexplate (engine to case dowel pins missing can result in a cracked flexplate). (b) Replace the damaged components.
	3. Items listed under Operation 21 – Torque converter vibrations.	3. See items listed under Operation 21 – Torque converter vibrations.
	4. Fretting of the converter pilot spigot in the crankshaft tail bore.	4. Apply a liberal coating of Shell Retinax A grease or its equivalent, over the spigot.
	5. Converter balance weights lifting (spot welds breaking and one end lifting up and catching on the case).	5. (a) Check for welds breaking on the balance weights. (b) Change the converter if the balance weights have broken away.
	6. Internal damage to converter.	6. (a) Check the thrust roller bearing, thrust races, and roller clutch for damage. Fit a new converter if damage is apparent.
	7. Converter fluid.	7. (a) Check the colour of the fluid, if it has the appearance of aluminium paint, the converter is damaged internally. (b) Check that anti-freeze has not contaminated the converter fluid. (c) Fit a new converter.
	Note It is not necessary to change the converter if a failure in some other part of the transmission has resulted in the converter containing dark discoloured fluid. The full flow strainer used in the transmission will remove all harmful residue from	

Symptom	Possible cause	Action
22. Torque converter slipping or noisy (continued)	failures (other than converter to pump failures) before the oil is pumped into the converter.	Correct the transmission problem, then change the intake stainer and fluid.

High line pressure

If either the idle or full throttle pressure check is high, the cause may be as follows.

1. **Vacuum leak**
a. Full leak (vacuum line disconnected).
b. Partial leak in the line from the engine to the modulator.
c. Incorrect engine vacuum.
d. Leak in vacuum operated accessories.

2. **Damaged modulator**
a. Sticking valve.
b. Water in modulator.
c. Incorrect operation of modulator.

3. **Detent system**
a. Throttle position switch incorrectly adjusted or shorted.
b. Detent wiring shorted.
c. Detent solenoid sticking open.
d. Detent feed orifice in spacer plate blocked.
e. Detent solenoid loose.

4. **Pump**
a. Pressure regulator and/or boost valve sticking.
b. Incorrect pressure regulator spring.
c. Excessive number of pressure regulator valve spacers.
d. Faulty pump casting.
e. Pressure boost valve installed incorrectly or otherwise defective.
f. Aluminium bore plug defective.
g. Pressure boost bush defective.

5. **Control valve assembly**
a. Spacer plate-to-case gasket incorrectly fitted.
b. Incorrect plate-to-case gasket.

Low line pressure

If either the idle or full throttle pressure checks are low, the cause may be as follows.

1. **Transmission oil level low**

2. **Modulator assembly**

3. **Intake strainer**
a. Blocked or restricted.
b. 'O' ring on intake pipe omitted or damaged.
c. Incorrect strainer fitted.

Note When checking the intake strainer, it should be noted that there is no approved method for either checking or cleaning the strainer. If the performance of the strainer is suspect, **a new strainer must be fitted.**

4. **Split or leaking intake pipe**

5. **Pump**
a. Pressure regulator or boost valve sticking.
b. Gear clearance, damaged or worn (pump will become damaged if the drive gear is installed the wrong way or if the converter pilot does not enter the crankshaft freely).
c. Pressure regulator spring weak.
d. Insufficient spacers in pressure regulator.
e. Pump to case gasket incorrectly positioned.
f. Defective pump body and/or cover.

6. **Leaks in the internal circuit**
a. Forward clutch leak (pressure normal in neutral and reverse – pressure low in drive).
(i) Check pump rings.
(ii) Check forward clutch seals.
b. Direct clutch leak (pressure normal in neutral, low, intermediate, and drive – pressure low in reverse).
(i) Check centre support oil seal rings.
(ii) Check direct clutch outer seal for damage.
(iii) Check rear servo and front accumulator pistons and rings for damage or missing.

7. **Case assembly**
a. Porosity in intake bore area.
b. Check case for intermediate clutch plug; leak or blown out.
c. Low – reverse check ball incorrectly positioned or missing (this condition will cause no reverse and no overrun braking in low range).

Incorrect vacuum at modulator

1. **Engine**

a. Requires tune-up.
b. Loose vacuum fittings.
c. Vacuum operated accessory leak.

2. **Vacuum line to modulator**

a. Leak.
b. Loose fitting.
c. Restricted orifice, or incorrect orifice size.
d. Carbon build-up at modulator vacuum fitting.
e. Pinched line.
f. Grease or varnish material in pipe (no or delayed up-change – cold).

Oil leaks

1. **Transmission oil sump leaks**

a. Securing bolts not correctly torque tightened.
b. Improperly installed or damaged sump gasket.
c. Oil sump gasket mounting face not flat.

2. **Case extension leak**

a. Securing bolts not correctly torque tightened.
b. Rear seal assembly damaged or incorrectly installed.
c. Gasket (extension to case) damaged or incorrectly installed.
d. Porous casting.

3. **Case leak**

a. Modulator assembly 'O' ring damaged or incorrectly installed.
b. Electrical connector 'O' ring damaged or incorrectly installed.
c. Governor cover, gasket, and bolts damaged or loose; case face leak.
d. Damage or porosity. Leak at speedometer driven gear housing or seal.
e. Manual shaft seal damaged or incorrectly installed.
f. Line pressure tap plug stripped.
g. Vent pipe (refer to item 5).
h. Porous case or crack at pressure plug boss.

4. **Front end leak**

a. Front seal damaged (check converter neck for score marks, etc., also for pump bushing moved forward), garter spring missing.
b. Pump securing bolts and seals damaged; bolts missing or loose.
c. Converter (leak in weld).
d. Pump 'O' ring seal damaged. Also check pump oil ring groove and case bore.
e. Porous casting (pump or case).
f. Pump drain back hole not open.

5. **Oil comes out of vent pipe**

a. Transmission overfilled.
b. Water in oil.
c. Strainer 'O' ring damaged or incorrectly assembled causing oil to foam.
d. Foreign material between pump and case or between pump cover and body.
e. Case porous, pump face incorrectly machined.
f. Pump porous.
g. Pump to case gasket misaligned.
h. Pump breather hole blocked or missing.
i. Hole in intake pipe.
j. Check ball in forward clutch missing or sticking.

6. **Modulator assembly**

a. Diaphragm defective.

Control valve assembly – Governor line pressure check

1. Install a line pressure gauge.
2. Install a tachometer in accordance with the manufacturer's instructions.
3. Disconnect the vacuum line to the modulator.
4. With the car on a ramp (rear wheels off the ground), footbrake off, in drive, check line pressure at 1000 rev/min.
5. Slowly increase the engine revolutions to 3000 rev/min and determine if a line drop occurs of 0,7 bar (10 lbf/in^2) or more.
6. If a pressure drop of 0,7 bar (10 lbf/in^2) or more occurs, dismantle, clean, and inspect the control valve assembly.
7. If the pressure drop is less than 0,7 bar (10 lbf/in^2).

a. Inspect the governor.
   (i) Sticking valve.
   (ii) Weight freeness.
   (iii) Restricted orifice in governor valve.
b. Governor feed system.
   (i) Check screen in governor feed pipe hole in case assembly.
   (ii) Check for restrictions in governor pipe.

Burnt clutch plates

Burnt clutch plates can be caused by incorrect usage of clutch plates. Also, anti-freeze in transmission fluid can cause severe damage, such as large pieces of composition clutch plate material peeling off.

1. **Forward clutch**

a. Check the ball in the clutch housing for damage, sticking, or missing.
b. Clutch piston cracked, seals damaged, or missing.
c. Low line pressure.
d. Manual valve misaligned.
e. Restricted oil feed to forward clutch. (Clutch housing to inner and outer areas not drilled, restricted or porosity in pump).
f. Pump cover oil seal rings missing, broken, or undersize; ring groove oversize.
g. Case valve body face not flat or porosity between channels.
h. Manual valve bent and centre land not ground properly.

2. **Intermediate clutch**

a. Rear accumulator piston oil ring, damaged, or missing.
b. 1-2 accumulator valve sticking in control valve assembly.
c. Intermediate clutch piston seals damaged or missing.
d. Centre support bolt loose.
e. Low line pressure.
f. Intermediate clutch plug in case missing.
g. Case valve body face not flat or porosity between channels.
h. Manual valve bent and centre land not ground properly.

3. **Direct clutch**

a. Restricted orifice in vacuum line to modulator (poor vacuum response).
b. Check ball in direct clutch piston damaged, sticking, or missing.
c. Defective modulator bellows.
d. Centre support bolt loose (bolt may be tight in support but not holding support tight to case).
e. Centre support oil rings or grooves damaged or missing.
f. Clutch piston seals damaged or missing.
g. Front and rear servo pistons and seals damaged.
h. Manual valve bent and centre land not cleaned up.
i. Case valve body face not flat or porosity between channels.
j. Intermediate sprag clutch installed backwards.
k. 3-2 valve, 3-2 springs, or 3-2 spacer pin installed in wrong location in 3-2 valve bore.

Note If direct clutch plates and front band are burnt, check manual linkage.

Vacuum modulator assembly

The following procedure is recommended for checking modulator assemblies in service before replacement is undertaken.

1. **Vacuum diaphragm leak check**

Check with a vacuum pump or insert a pipe cleaner into the vacuum connector pipe as far as possible and check for the presence of transmission oil. If oil is found, replace the modulator.

Note Petrol or water vapour may settle in the vacuum side of the modulator. If this is found **without** the presence of oil, the modulator should **not** be changed.

2. **Atmospheric leak check**

Apply a liberal coating of soap bubble solution to the vacuum connector pipe seam and the crimped upper to lower housing seam. Using a short piece of rubber tubing, apply air pressure to the vacuum pipe by blowing into the tube and observe for leak bubbles. If bubbles appear, replace the modulator.

Note Do not use any method other than human lung power to apply air pressure, as pressures over 0,4 bar (6 lbf/in^2) may damage the modulator.

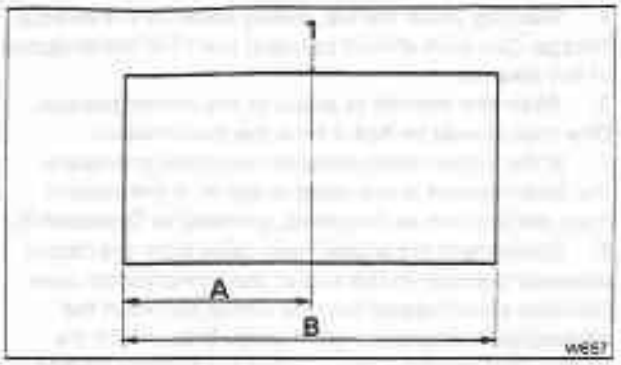


Fig. T22-1 Comparison gauge
1 Scribed centre line
A 12,70 mm (0.50 in)
B 25,40 mm (1.0 in)
Note Round bar between 9,52 mm and 10,32 mm (0.375 in and 0.406 in) diameter. Ends to be square within 0,39 mm (0.015 in)

3. **Bellows comparison check**

Make a comparison gauge (see fig. T22-1), and compare the load of a known good modulator with the assembly in question.

a. Install the modulator that is known to be acceptable on either end of the gauge.
b. Install the modulator in question on the opposite end of the gauge.
c. Holding the modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the centre of the gauge. The gap between the opposite modulator sleeve end and the gauge line should not be greater than 1,59 mm (0.062 in). If the distance is greater than this amount the modulator in question should be replaced.

4. **Sleeve alignment check**

Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity to the body. If the sleeve is concentric and the plunger is free, the modulator is acceptable. Once the modulator assembly passes all of the above tests, it is an acceptable part and should be fitted again.

Detent (down-change) solenoid circuit - To check

Before checking the detent solenoid circuit, make certain that the throttle position switch is properly adjusted as described in the Engine Management Systems Manual - TSD 4737, Chapter K, and the battery is in a fully charged condition.

Naturally aspirated cars

1. With the transmission gear range selector lever in park, turn the ignition switch to the RUN position but do **not start the engine.** The ignition switch has to be in the RUN position throughout the checking procedure. However, switch off the ignition when removing cables from switches, etc.

2. Working under the car, slowly advance the throttle linkage. One click should be heard from the transmission of full throttle.
3. Allow the throttle to return to the closed position. One click should be heard from the transmission.
4. If the system performed as described previously, the detent circuit is operating properly. If the system does not perform as described, proceed to Operation 5.
5. Disconnect the white/green cable from the detent solenoid terminal on the side of the transmission case. Connect a multi-meter into the circuit between the white/green cable and a good earth. Ensure that the multi-meter registers 12V+ when the throttle linkage is in the full throttle position, operated from the normal driving position. The reading should fall to zero when the thottle is released.
a. If the system operates as described previously, but did not perform properly during Operations 1 to 3 inclusive, replace the solenoid after first checking to see that the internal wiring is operational.
b. If the multi-meter fails to register 12V+ with the throttle in the wide open position, the circuit is open, proceed to Operation 6.
c. If the multi-meter registers 12V+, with the throttle closed, the circuit is closed. Replace the throttle position switch and recheck the system.
6. Remove the yellow/purple cable from the throttle position switch plug and socket. Connect a multi-meter between the cable removed and a good earth. At full throttle ensure that the multi-meter registers 12V+.
a. If the multi-meter registers 12V+, reconnect the yellow/purple cable to the switch plug and socket. Recheck the system.
b. If the multi-meter fails to register a voltage, proceed to Operation 7.
7. Remove the white feed cable from the throttle position switch plug and socket. Connect a multi-meter between the cable removed and a good earth.
a. If the multi-meter registers 12V+, replace the throttle position switch. Recheck the system.
b. If the multi-meter fails to register a voltage, proceed to Operation 8.
8. Check fuse B3 on fuse panel F1 on the main fuseboard.
a. If the fuse is intact, it will be necessary to locate the fault in the wiring. Test for circuit continuity from the white feed cable at the throttle position switch plug and socket, to fuse B3 on fuse panel F1 on the main fuseboard.

Turbocharged cars prior to 1989 model year
1. Carry out Operations 1 to 4 inclusive as described for Naturally aspriated cars.
2. Disconnect the white/green cable from the detent solenoid terminal on the side of the transmission case. Connect a multi-meter into the circuit between the white/green cable and a good earth. Ensure that the multi-meter registers 12V+ when the throttle linkage is in the full throttle position, operated from the normal driving position. The reading should fall to zero when the throttle is released.
a. If the system operates as described previously, but did not perform properly during Operation 1, replace the solenoid after first checking to see that the internal wiring is operational.
b. If the multi-meter fails to register 12V+ with the throttle in the wide open position, check for continuity of the white/green cable from the detent solenoid terminal to the kick-down relay.
3. Check fuse B3 on fuse panel F1 on the main fuseboard. If the fuse is intact, proceed as follows.
a. Ensure that the multi-meter registers 12V+ on both white cables at the kick-down relay.
b. If the multi-meter fails to register 12V+ on both cables, check for continuity of the white cables from the kick-down relay to fuse B3 on fuse panel F1.
4. If the multi-meter registers 12V+ on the white cables, proceed as follows.
a. Disconnect the throttle position switch plug and socket. Then, ensure that there is continuity of the yellow/purple cable from the throttle position switch plug to the kick-down relay. Alternatively, remove the yellow/purple cable from the plug and apply an intermittent earth to this cable. The contacts of the kick-down relay should be heard 'making' and 'breaking' during this operation. Connect the yellow/purple cable, if removed from the plug.
5. With the throttle closed and the throttle position switch plug and socket disconnected, check the throttle position switch and its loom as follows.
a. Connect a multi-meter between the blue/purple and black cables. Ensure that a continuity reading is obtained.
b. With the throttle in the wide open position, connect a multi-meter between the yellow/purple and black cables. Ensure that a continuity reading is obtained.
If continuity readings are not obtained, the throttle position switch or its loom is faulty.
c. Connect a multi-meter between the black cable in the throttle position switch socket on the engine loom and a good earth. Ensure that a continuity reading is obtained.

1989 model year turbocharged cars
1. Carry out Operations 1 to 4 inclusive as described for Naturally aspirated cars.
2. Disconnect the white/green cable from the detent solenoid terminal on the side of the transmission case. Connect a multi-meter into the circuit between the white/green cable and a good earth. Ensure that the multi-meter registers 12V+ when the throttle linkage is in the full throttle position, operated from the normal driving position. The reading should fall to zero when the throttle is released.
a. If the system operates as described previously, but did not perform properly during Operation 1, replace the solenoid after first checking to see that the internal wiring is operational.
b. If the multi-meter fails to register 12V+ with the throttle in the wide open position, check for continuity of the white/green cable from the detent solenoid terminal to the kick-down relay.
3. Check fuse A4 on fuse panel F1 on the main fuseboard. If the fuse is intact, proceed as follows.

a. Ensure that the multi-meter registers 12V+ on both white/slate cables at the kick-down relay.
b. If the multi-meter fails to register 12V+ on both cables, check for continuity of the white/slate cables from the kick-down relay to fuse A4 on fuse panel F1.
4. If the multi-meter registers 12V+ on the white/slate cables, proceed as follows.
a. Disconnect the throttle position switch plug and socket and ensure that there is continuity of the yellow/purple cable from the throttle position switch plug to the kick-down relay. Alternatively, remove the yellow/purple cable from the plug and apply an intermittent earth to this cable. The contacts of the kick-down relay should be heard 'making' and 'breaking' during this operation. Connect the yellow/purple cable, if removed from the plug.
5. With the throttle **closed** and the throttle position switch plug and socket disconnected, check the throttle position switch and its loom as follows.
a. Connect a multi-meter between the blue/purple and black cables. Ensure that a continuity reading is obtained.
b. With the throttle in the wide open position, connect a multi-meter between the yellow/purple and black cables. Ensure that a continuity reading is obtained.

If continuity readings are not obtained, the throttle position switch or its loom is faulty.

c. Connect a multi-meter between the black/pink cable in the throttle position switch socket on the engine loom and a good earth. Ensure that a continuity reading is obtained.

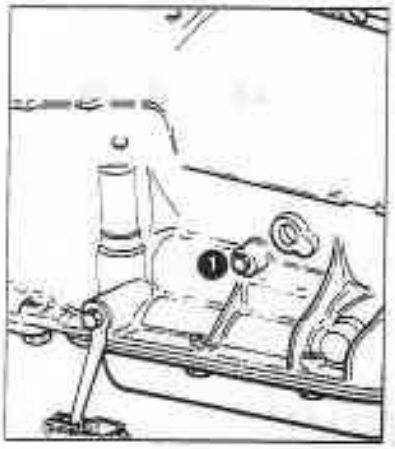
Special torque tightening figures

Introduction
This section contains the special torque tightening figures applicable to Chapter T.

For standard torque tightening figures refer to Chapter P.

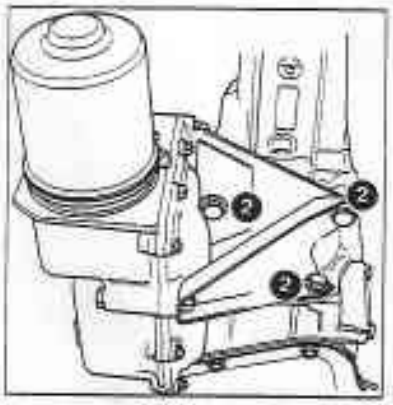
Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Section T4



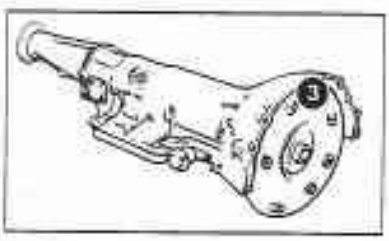
Ref.	Component	Nm	kgf m	lbf ft
1	Line pressure plug	20	2,0	15

Section T6

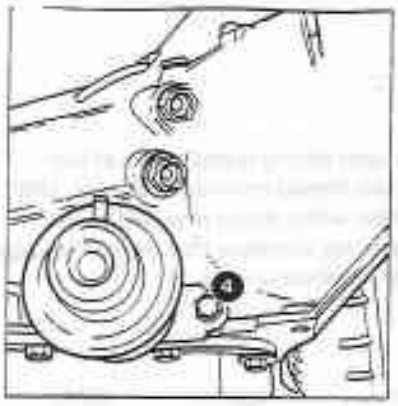
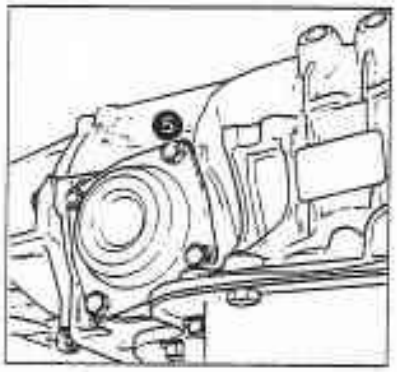
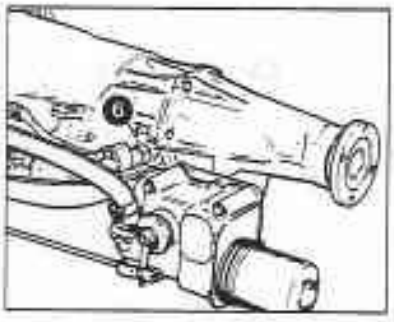
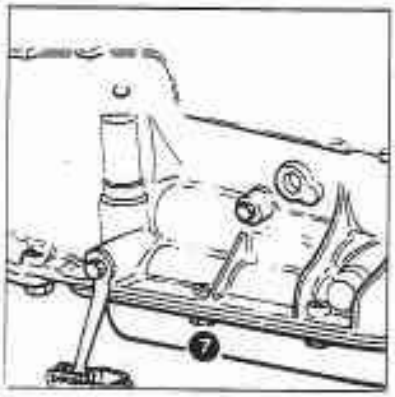


Ref.	Component	Nm	kgf m	lbf ft
2	Setscrew – Actuator mounting bracket to rear extension	52	5,3	38

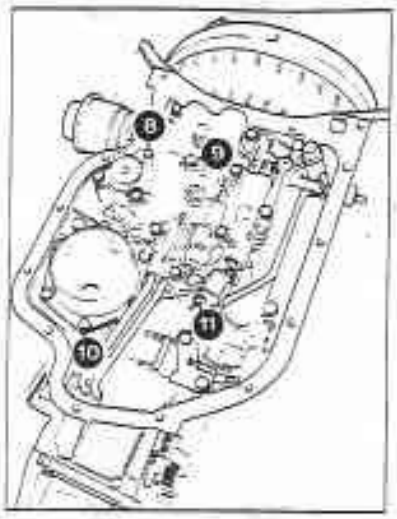
Section T7



Ref.	Component	Nm	kgf m	lbf ft
3	Setscrew – Engine flexplate to torque converter	41	4,1	30

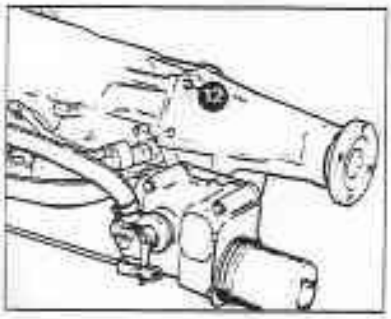
Section	Ref.	Component	Nm	kgf m	lbf ft
Section T9					
	4	Setscrew – Vacuum modulator retainer to case	25	2,5	18
Section T10					
	5	Setscrew – Governor to case	25	2,5	18
Section T11					
	6	Setscrew – Speedometer drive to case retainer	17	1,7	13
Section T12					
	7	Setscrew – Sump to case	8-14	0,9-1,4	6-10

Sections T13, T14, and T15



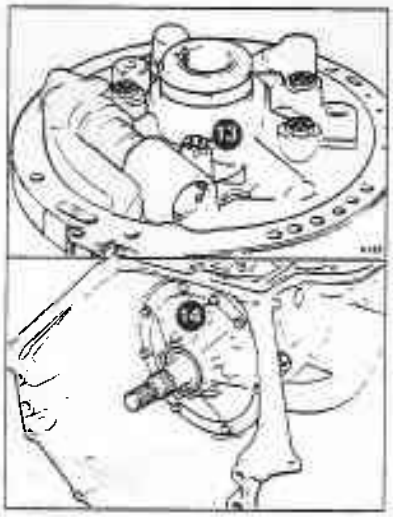
Ref.	Component	Nm	kgf m	lbf ft
8	Setscrew (¼ UNC) – Control valve unit to case	11	1,1	8
9	Setscrew (5/16 UNC) – Control valve unit to case	11	1,1	8
10	Setscrew – Rear servo cover to case	25	2,5	18
11	Setscrew – Solenoid to case	11	1,1	8

Section T16



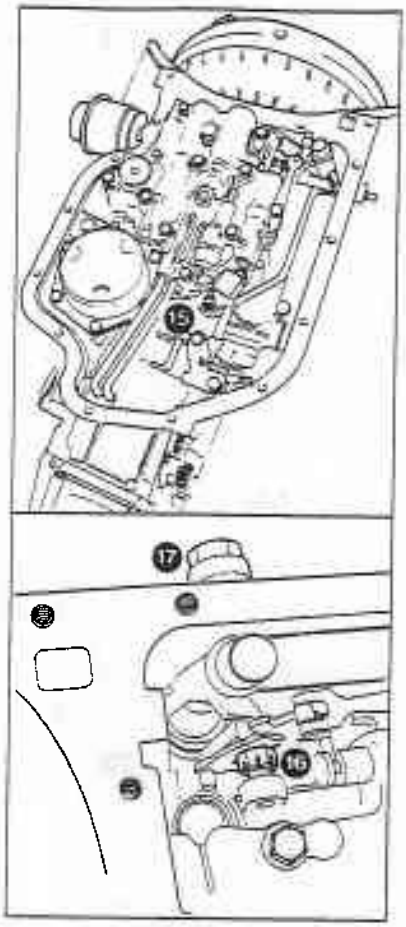
Ref.	Component	Nm	kgf m	lbf ft
12	Setscrew –Rear extension to case	32	3,2	23

Section T17



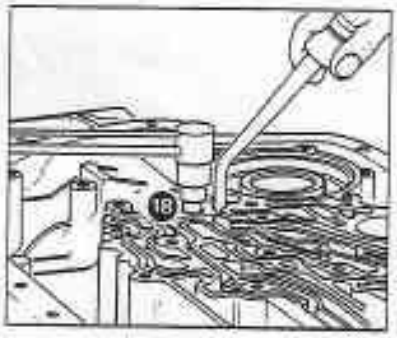
Ref.	Component	Nm	kgf m	lbf ft
13	Setscrew – Pump body to cover	25	2,5	18
14	Setscrew – Pump to case	25	2,5	18

Section T18



Ref.	Component	Nm	kgf m	lbf ft
15	Setscrew – Parking lock bracket to case	25	2,5	18
16	Nut – Manual shaft to detent lever	25	2,5	18
17	Nut – Gearchange lever to manual shaft	28	2,8	20

Section T20



Ref.	Component	Nm	kgf m	lbf ft
18	Setscrew – Case to centre support	30	3,0	22

Workshop tools

Workshop tools with either R or RH prefix letters are obtainable from the Parts Distribution Centre at Crewe. However, certain other tools prefixed with the letter 'J' may be obtained from the Kent-Moore or General Motors Organization.

R 5244	Oil pressure gauge
R 5280	Adapter – air checking
RH 7674	Circlip and snap ring pliers
RH 7794	Universal handle – case bush
RH 7914	Adapter – oil pressure tapping
RH 7952	Retaining clamp – converter
RH 7953	Insertion tool – oil pump and rear extension housing oil seals
RH 7955	Holding fixture – transmission
RH 7956	Base – holding fixture (used with RH 7955)
RH 12556	Extractor – oil pump
J-2590	Spring compressor – forward and direct clutches
J-7004	Slide hammers
J-9578	Removal tool – steel speedometer gear (used with J-21427)
J-21362	Inner seal protector – forward and direct clutches
J-21363	Inner seal protector – intermediate clutch
J-21368	Alignment band – oil pump body and cover
J-21370-5	Selector pin – rear servo (used with J-21370-6)
J-21370-6	Band apply pin selector gauge – rear servo (used with J-21370-5)
J-21409	Outer seal protector – forward and direct clutches
J-21427	Removal tool – steel speedometer gear (used with J-9578)
J-21465-8	Removal tool – case bush (used with J-21465-13 and RH 7794)
J-21465-9	Adapter – fitting case bush (used with J-21465-8 and J-21465-13)
J-21465-10	Staking tool – case bushing
J-21465-13	Extension – case bushing
J-21795	Removal tool – gear unit assembly
J-21885	Fitting and removal tool – control valve accumulator piston
J-23093	Locating tool – centre support to case

Transmission

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Introduction

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Transmission

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Introduction

The torque converter transmission is a fully automatic unit, consisting primarily of a three-element hydraulic torque converter and a compound planetary gear train. Three multiple-disc clutches, one roller clutch, one sprag clutch, and two friction bands, provide the elements which are required to obtain the desired functions of the gear train.

A name plate is fitted to the right-hand side of the transmission, toward the centre of the case. The serial number is prefixed by either the letters RR, RR-A, RC, or RT and the year in numerals.

The torque converter, clutches and rollers connect the engine to the planetary gears with the aid of pressurized transmission fluid. Three forward gears and reverse are provided. When necessary, the torque converter will supplement the gears by multiplying engine torque.

The torque converter is of welded steel construction and connot be dismantled. The unit is made up of two vaned sections which face each other across a fluid filled housing. The pump half of the converter is connected to the engine and the turbine half is connected to the transmission.

When the engine is running the converter pump rotates and throws fluid against the turbine, causing the turbine to rotate. The fluid then returns to the pump in a circular flow and continues this cycle as long as the engine is running.

The converter also has a smaller vaned section, called a stator, which directs the fluid back to the pump through smaller openings at greater speed. The speeded-up fluid imparts additional force to the engine driven converter pump, thus multiplying engine torque.

A hydraulic system pressurized by an internal/external gear type of pump provides the working pressure required to operate the friction elements and automatic controls.

External control connections

The external control connections to the transmission are.

1. An electric gear change actuator, connecting rod, and levers. The actuator responds to an electrical signal from a switch on the steering column, then moves the gear change lever on the transmission to the required position.
2. Engine vacuum which operates a vacuum modulator unit.
3. 12 volt electrical signals to operate an electrical detent solenoid.

Gear and torque ratios

The gear or torque ratios of the transmission are.

First	–	2.5:1
Second	–	1.5:1
Third	–	1.0:1
Reverse	–	2.0:1

Each gear ratio can be multiplied by as much as 2.2, depending upon the slip speed of the converter pump and turbine.

Vacuum modulator

A vacuum modulator is used to automatically sense engine torque input to the transmission. The modulator transmits this signal to the pressure regulator which controls main line pressure, so that all the torque requirements of the transmission are met and the correct gear change spacing is obtained at all throttle openings.

Detent solenoid

The detent solenoid is activated by a micro-switch assembly which is mounted to the toeboard, beneath the accelerator pedal. When the pedal is in the kick-down position, the micro-switch is closed; the solenoid in the transmission is then activated and a down-change will occur at speeds below 113 km/h (70 mile/h). At lower speeds a down-change will occur at smaller throttle openings without the aid of the micro-switch assembly, or the solenoid.

Heat exchanger

The heat exchanger for the transmission fluid is situated in the bottom of the radiator matrix (see fig. T1-1).

Selector positions

The transmission quadrant has six selector positions which enable the driver to control the operation of the transmission under varying driving conditions. The six selector positions appear in the following sequence, from left to right; P – Park, R – Reverse, N – Neutral, D – Drive, I – Intermediate and L – Low. The engine can only be started in the Park and Neutral positions.

P – Park position positively locks the output shaft to the transmission case by means of a locking pawl and prevents the car from rolling either backward or forward when parked on a steep incline.

R – Reverse enables the car to operate in a reverse direction.

N – Neutral enables the engine to be started and run without the car moving.

D – Drive is used for all normal driving conditions and maximum economy. Drive range has three gear ratios, from starting to direct drive. Forced down-

changes are available for safe and rapid overtaking, by fully depressing the accelerator pedal.

I – Intermediate adds new performance for congested traffic conditions or hilly terrain. This range has the same starting ratio as D, but prevents the transmission from changing above second gear; acceleration is retained when extra performance is required.

The engine can be used to assist braking in this Range.

L – Low range permits operation at a lower gear ratio and should be used when maximum torque multiplication is required or, when descending a steep gradient. When the selector lever is moved from Drive to Low at normal road speeds, the transmission will change to second gear and remain in second gear until the speed of the car is reduced to the normal 2-1 down-change speed. The transmission will then change down to first gear and remain in first gear regardless of car speed or engine revolutions, until the selector lever is moved into either the Drive or the Intermediate position.

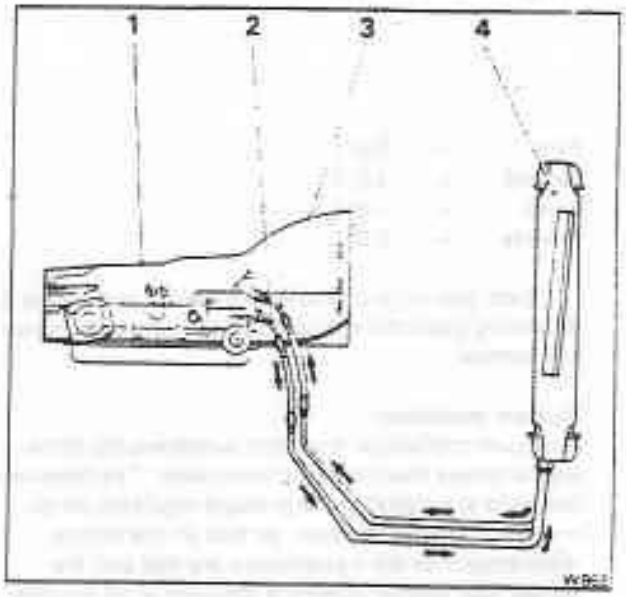

Fig. T1-1 Heat exchanger system
1 Transmission
2 Transmission fluid to heat exchanger
3 Transmission fluid from heat exchanger
4 Coolant radiator with heat exchanger in bottom tank

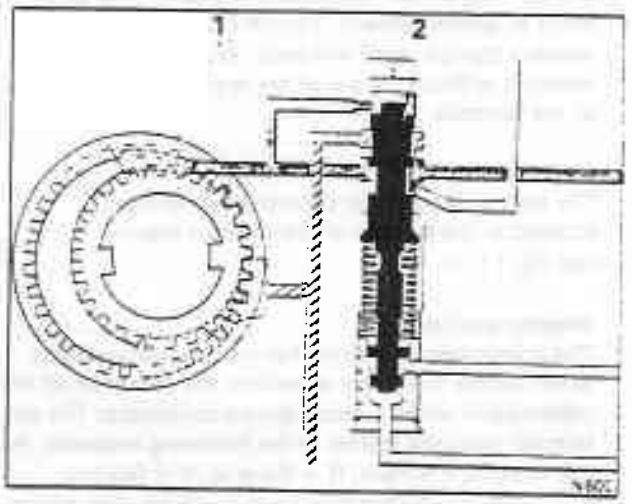

Fig. T1-2 Pressure control
1 Transmission oil pump
2 Pressure regulator valve train

Main line pressure

Intake pressure

Converter pressure

Modulator pressure

Hydraulic system

Pressure control

The transmission is controlled automatically by a hydraulic system (see fig. T1-2). Hydraulic pressure is supplied by the transmission oil pump, which is engine driven.

Main line oil pressure is controlled by a pressure regulator valve train which is located in the pump and by the vacuum modulator which is connected to engine vacuum.

The pressure regulator controls main line oil pressure automatically, in response to a pressure signal from a modulator valve. This is done in such a manner, that the torque requirements of the transmission clutches are met and correct gearchange spacing is obtained at all throttle openings.

To control line pressure, a modulator pressure is used. This pressure varies in the same manner as torque input to the transmission. Since the torque input to the clutches is the product of engine torque and converter ratio, modulator pressure must compensate for changes in either or both of these.

To meet these requirements, modulator pressure is regulated by engine vacuum, which is an indicator of engine torque and throttle opening. It will decrease as the car speed increases to compensate for the changing converter torque ratio.

Vacuum modulator assembly

The engine vacuum signal is received by the vacuum modulator (see fig. T1-3), which comprises an evacuated metal bellows, a diaphragm and two springs. The assembly is so arranged that the bellows and external spring apply a force that acts on the modulator valve so that it increases modulator pressure. To control modulator pressure, engine vacuum and an internal spring oppose the bellows and external spring.

To reduce the effect of altitude on change points, the effective area of the diaphragm is different than that of the bellows. Atmospheric pressure acts on the resulting differential area to reduce modulator pressure.

Governor assembly

The speed of the car is signalled to the transmission

by a governor which is driven by the transmission output shaft. The governor is comprised basically of a valve body, a regulator valve, and flyweights.

Centrifugal force causes the flyweights to act on the regulator valve. The valve then regulates a pressure signal which increases with road speed.

Governor pressure acts on the modulator valve to cause modulator pressure to decrease as the speed of the car increases.

Operation of valves and hydraulic control units

Pressures and speeds quoted are only a guide, actual values will vary, dependent on transmission model.

Line pressure regulator
The line pressure regulator valve regulates line pressure according to pump speed and engine torque.

Manual valve
The manual valve establishes the range in which the transmission is to operate as selected by the driver through the selector switch anc the gear change actuator.

Governor assembly
The governor assembly generates an oil pressure that is sensitive to the speed of the car and which increases as the car speed increases.

Governor pressure is used to control the change points and to regulate modulator pressure.

Vacuum modulator valve
The vacuum modulator valve provides modulator pressure which senses engine torque and car speed. It is used to vary the change points, according to throttle opening, by opposing governor oil on the shift valves and also to raise line pressure proportional to engine torque.

1-2 shift valve
This valve controls the speeds at which the 1-2 and 2-1 changes occur.

1-2 regulator valve
The 1-2 regulator valve regulates modulator pressure to a proportional pressure and tends to hold the 1-2 shift valve in the down-change position.

1-2 detent valve
The 1-2 detent valve senses regulated modulator pressure which tends to hold the 1-2 shift valve in the down-changed position and provides an area for detent pressure for 2-1 detent changes.

2-3 shift valve
This valve controls the speeds at which the 2-3 and 3-2 changes occur.

2-3 modulator valve
The 2-3 modulator valve is sensitive to modulator pressure and applies a variable force on the 2-3 shift valve which tends to hold the 2-3 shift valve in the down-changed position.

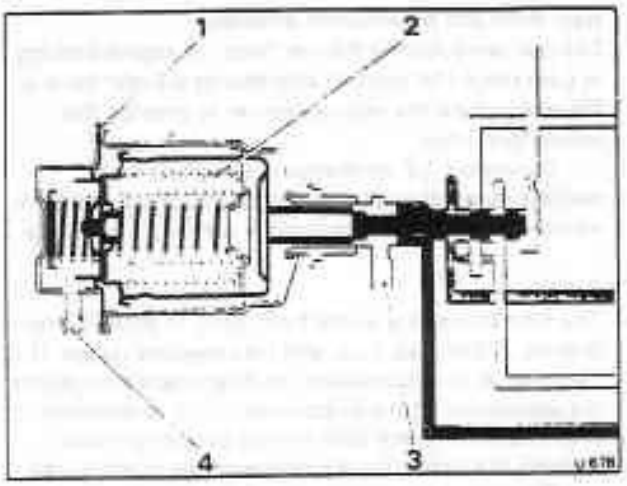

Fig. T1-3 **Vacuum modulator assembly**
1 Diaphragm
2 Aneroid bellows
3 Exhaust
4 Engine vacuum

Main line pressure

Governor pressure

Modulator pressure

3-2 valve
The 3-2 valve prevents modulator pressure from acting on the shift valves after the direct clutch has been applied. This allows fairly heavy throttle operation in third gear without effecting a down-change. In third gear, detent pressure or modulator pressure above 6,0 bar (87 lbf/in^2) can be directed to the shift valves to provide the necessary force to effect the down-change.

1-2 accumulator valve
The 1-2 accumulator valve is sensitive to modulator oil and regulates drive oil to a proportionally smaller value. The pressure increases as modulator pressure increases and is used to control the engagement of the intermediate clutch.

Detent valve
The detent valve moves when line oil is exhausted from the end of the valve when the detent solenoid is energised. As a result, detent oil is directed to the 1-2 and 2-3 modulator valves and allows the detent regulator valve to regulate.

Detent regulator valve
When the detent valve moves, the detent regulator is freed and allows drive oil to enter the detent passage at a regulated pressure of 4,8 bar (70 lbf/in^2). Detent oil will also flow into the modulator passages which lead to the shift valves. Low oil moves the detent regulator to accept drive oil, allowing drive oil to enter the modulator and detent passages.

Rear servo and accumulator assembly
The rear servo applies the rear band for engine braking in Low range (1st gear). It also applies the rear band in Reverse to hold the reaction carrier to provide the reverse gear ratio.

During the 1-2 up-change in Drive and Intermediate ranges the servo acts as an accumulator for the intermediate clutch oil to provide a smooth up-change.

Front servo
The front servo applies the front band to provide engine braking in 2nd gear, Low, and Intermediate ranges. It is used also as an accumulator for direct clutch oil during the application of the direct clutch. This in conjunction with a series of check balls (which control orifices), controls the timing for the release of the direct clutch.

To prevent the application of the front band in Neutral, Drive, or Reverse ranges, oil is directed from the manual valve to the release side of the servo piston.

In D range, the servo release oil from the manual valve is used to charge the servo in preparation for the application of the direct clutch.

Direct clutch oil is directed to the front servo accumulator piston where spring force plus direct clutch pressure, stroke the piston up against the force of the servo release oil. This lowers the clutch apply pressure for a smooth engagement.

The release of the direct clutch and the exhausting of the front servo accumulator is slowed down by three check balls and three orifices. This permits a smooth return of the drive load to the intermediate sprag clutch and also allows the engine rev min to increase during a detent 3-2 down-change in preparation for the lower gear ratio. This results in a smooth change and better acceleration.

The position of the shift valves in each range and gear, and the various oil passages which are used are shown in figures T1-4 to T1-12. The operation of the valves when each gear is selected is described in the following paragraphs.

Drive and Intermediate — First gear

Power flow
Forward clutch — applied. Direct clutch — released. Intermediate clutch — released. Roller clutch — effective. Front band — released. Intermediate sprag clutch — ineffective. Rear band — released.

With the selector lever in either Drive or Intermediate range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear clockwise. (Converter torque ratio is approximately 2.2:1 at stall).

Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear anti-clockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier, and output shaft clockwise in a reduction ratio of approximately 2.5:1. Reaction of the front pinions against the front internal gear is taken by the reaction carrier and roller clutch assembly to the transmission case. (Approximate stall ratio 5.5:1).

Oil flow
When the selector lever is moved to either Drive or Intermediate position, the manual valve is repositioned to allow line pressure to enter the drive circuit. Drive oil then flows to the following (see fig. T1-4).

Forward clutch
1-2 shift valve
Governor assembly
1-2 accumulator valve
Detent regulator valve

Basic control
Drive oil is directed to the forward clutch where it acts on two areas of the clutch piston to apply the forward clutch. The first, or inner area, is fed through an unrestricted passage. The outer area is fed through an orifice to ensure a smooth change into Drive.

Drive oil at the governor assembly is regulated to a variable pressure. This pressure increases with car speed and acts against the ends of the 1-2 and 2-3 shift valves and an area on the modulator valve.

Drive oil is regulated also to another variable pressure at the 1-2 accumulator valve. This pressure is controlled by modulator oil and is directed to the rear servo. 1-2 accumulator oil at the rear servo acts on the accumulator piston.

In addition, to maintain the lower pressure in the 1-2 accumulator passage, the 1-2 accumulator valve intermittently uncovers the Low oil passage. Oil is then exhausted at the manual valve.

Summary
The converter is filled. The forward clutch is applied. The transmission is in first gear.

Drive — Second gear

Power flow
Forward clutch — applied. Direct clutch — released. Intermediate clutch — applied. Roller clutch — ineffective. Front band — released. Intermediate sprag clutch — effective. Rear band — released.

In second gear the intermediate clutch is applied to allow the intermediate sprag clutch to hold the sun gear against anti-clockwise rotation. Turbine torque through the forward clutch is then applied clockwise through the mainshaft to the rear internal gear.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.5:1.

Note
Further reduction is possible at low speeds, due to the torque multiplication provided by the converter.

Oil flow
As the speed of the car and the governor pressure increases, the force of governor oil acting on the 1-2 shift valve will overcome the force of regulated modulator oil pressure. This allows the 1-2 shift valve to open, permitting drive oil to enter the intermediate clutch passage.

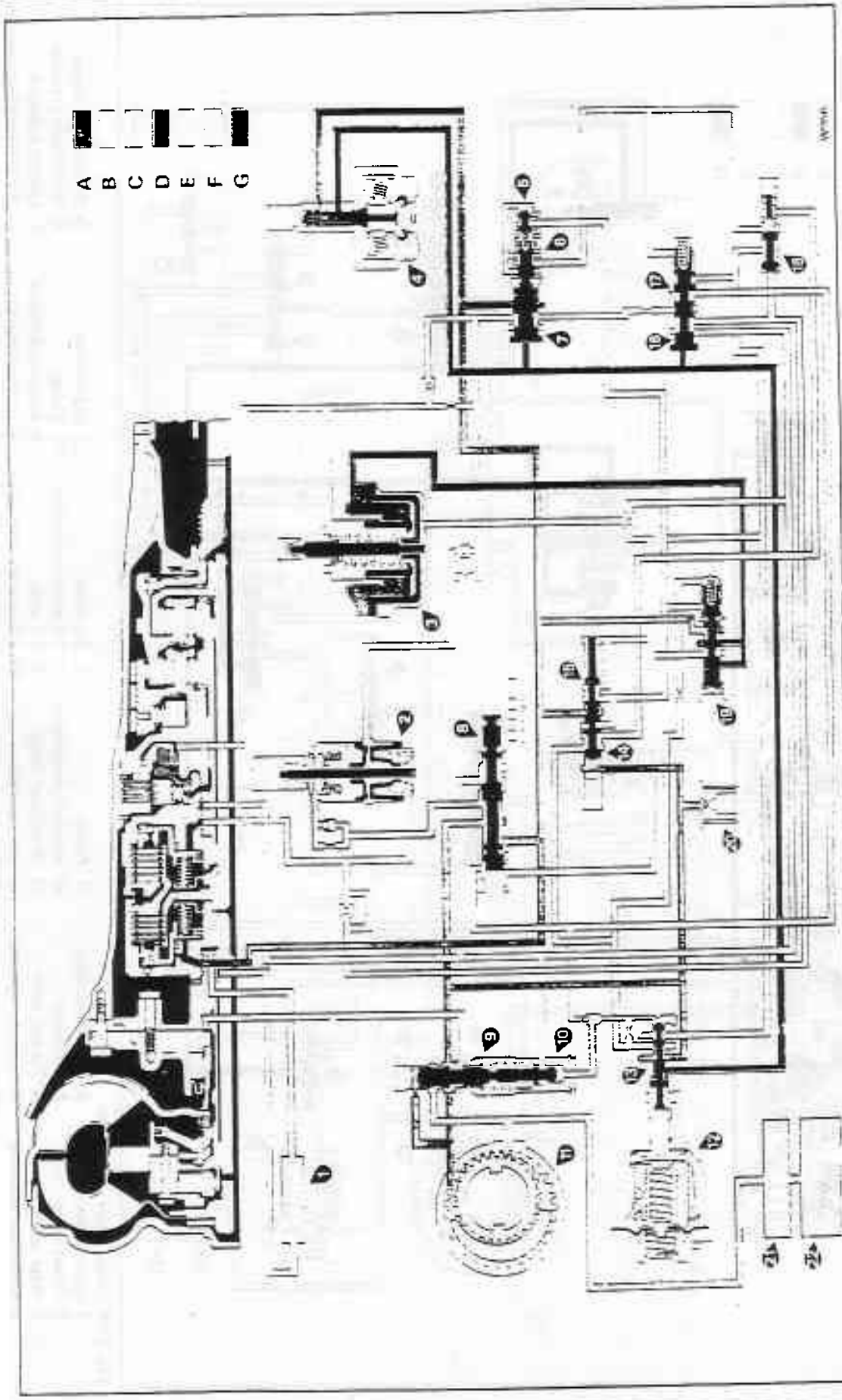

Fig. T1-4 Drive range — 1st gear

1 Heat exchanger
2 Front servo
3 Rear servo
4 Governor assembly
5 Regulator plug
6 1-2 detent valve
7 1-2 valve
8 Manual valve
9 Pressure regulator
10 Boost valve
11 Pump
12 Vacuum modulator
13 Modulator valve
14 Detent valve
15 Regulator valve
16 2-3 valve
17 2-3 modulator valve
18 3-2 valve
19 1-2 accumulator valve
20 Detent solenoid
21 Oil strainer
22 Sump
A Mainline pressure
B Intake pressure
C Converter pressure
D Governor pressure
E Modulator pressure
F Detent pressure
G 1-2 accumulator pressure

TSD 4400

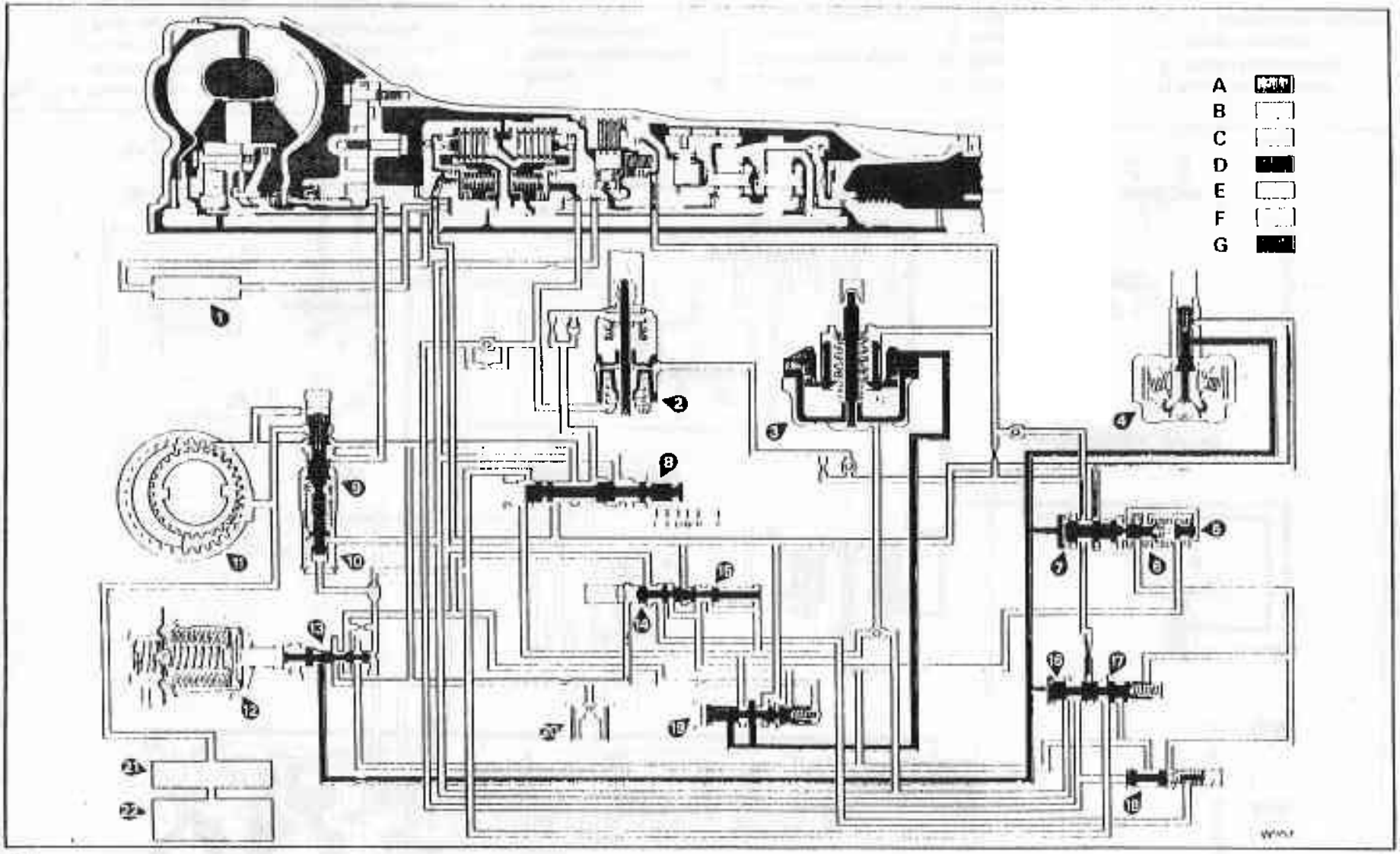

Fig. T1-5 Drive range – 2nd gear

1 Heat exchanger
2 Front servo
3 Rear servo
4 Governor assembly
5 Regulator plug
6 1-2 detent valve
7 1-2 valve
8 Manual valve
9 Pressure regulator
10 Boost valve
11 Pump
12 Vacuum modulator
13 Modulator valve
14 Detent valve
15 Regulator valve
16 2-3 valve
17 2-3 modulator valve
18 3-2 valve
19 1-2 accumulator valve
20 Detent solenoid
21 Oil strainer
22 Sump
A Mainline pressure
B Intake pressure
C Converter pressure
D Governor pressure
E Modulator pressure
F Detent pressure
G 1-2 accumulator pressure

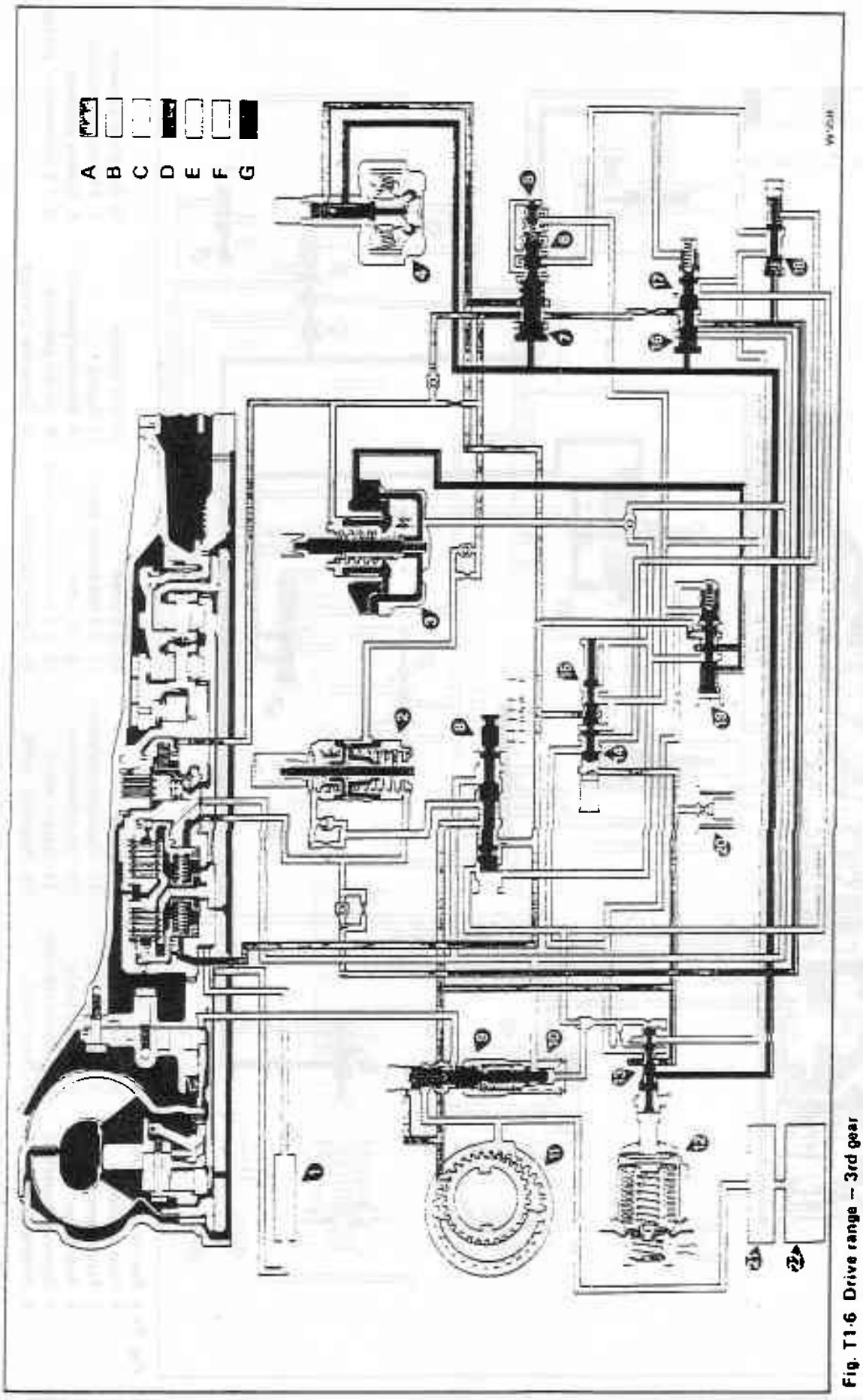

Fig. T1-6 Drive range – 3rd gear

1 Heat exchanger
2 Front servo
3 Rear servo
4 Governor assembly
5 Regulator plug
6 1-2 detent valve
7 1-2 valve
8 Manual valve
9 Pressure regulator
10 Boost valve
11 Pump
12 Vacuum modulator
13 Modulator valve
14 Detent valve
15 Regulator valve
16 2-3 valve
17 2-3 modulator valve
18 3-2 valve
19 1-2 accumulator valve
20 Detent solenoid
21 Oil strainer
22 Sump
A Mainline pressure
B Intake pressure
C Converter pressure
D Governor pressure
E Modulator pressure
F Detent pressure
G 1-2 accumulator pressure

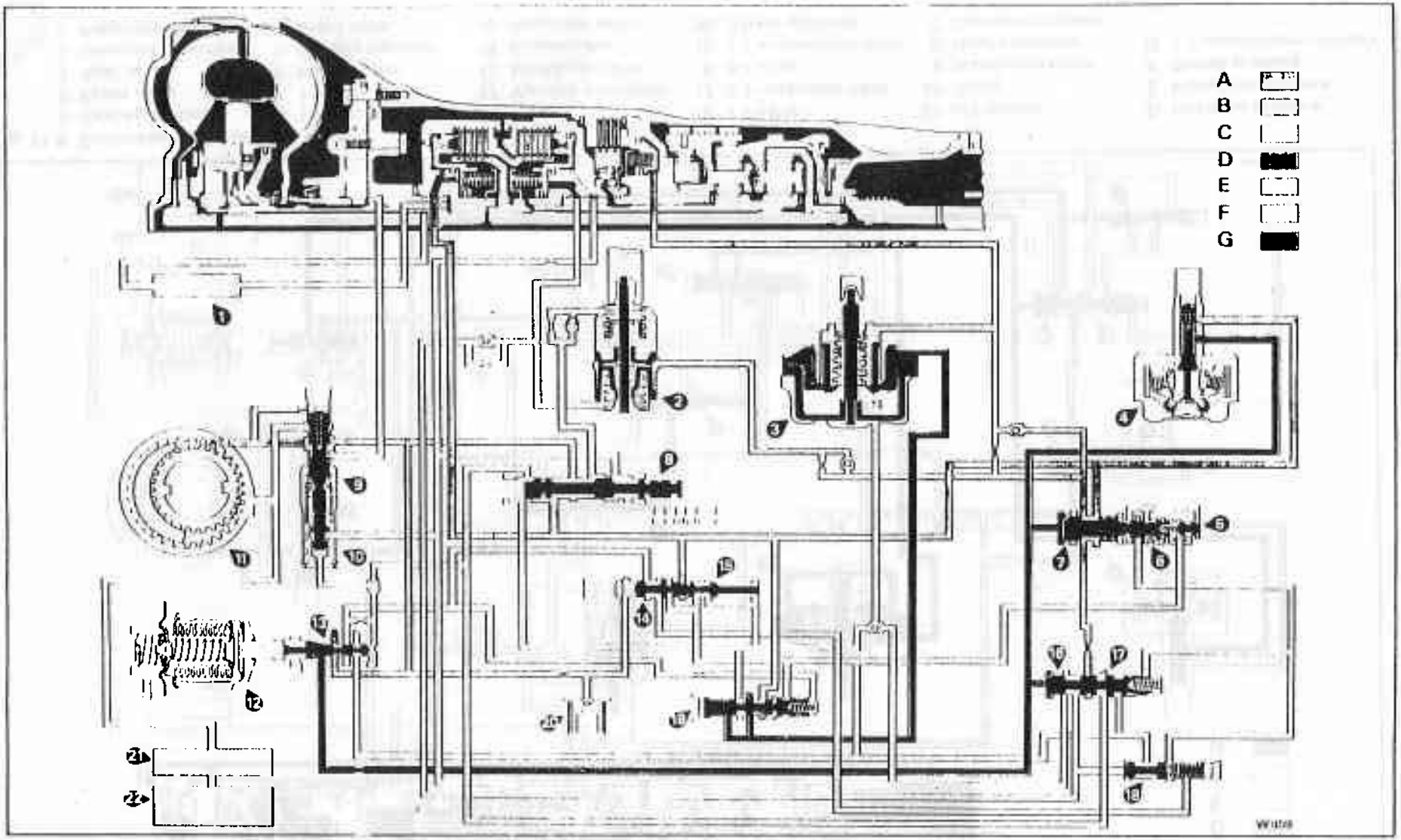

Fig. T1-7 Part throttle down-change

1 Heat exchanger
2 Front servo
3 Rear servo
4 Governor assembly
5 Regulator plug
6 1-2 detent valve
7 1-2 valve
8 Manual valve
9 Pressure regulator
10 Boost valve
11 Pump
12 Vacuum modulator
13 Modulator valve
14 Detent valve
15 Regulator valve
16 2-3 valve
17 2-3 modulator valve
18 3-2 valve
19 1-2 accumulator valve
20 Detent solenoid
21 Oil strainer
22 Sump
A Mainline pressure
B Intake pressure
C Converter pressure
D Governor pressure
E Modulator pressure
F Detent pressure
G 1-2 accumulator pressure

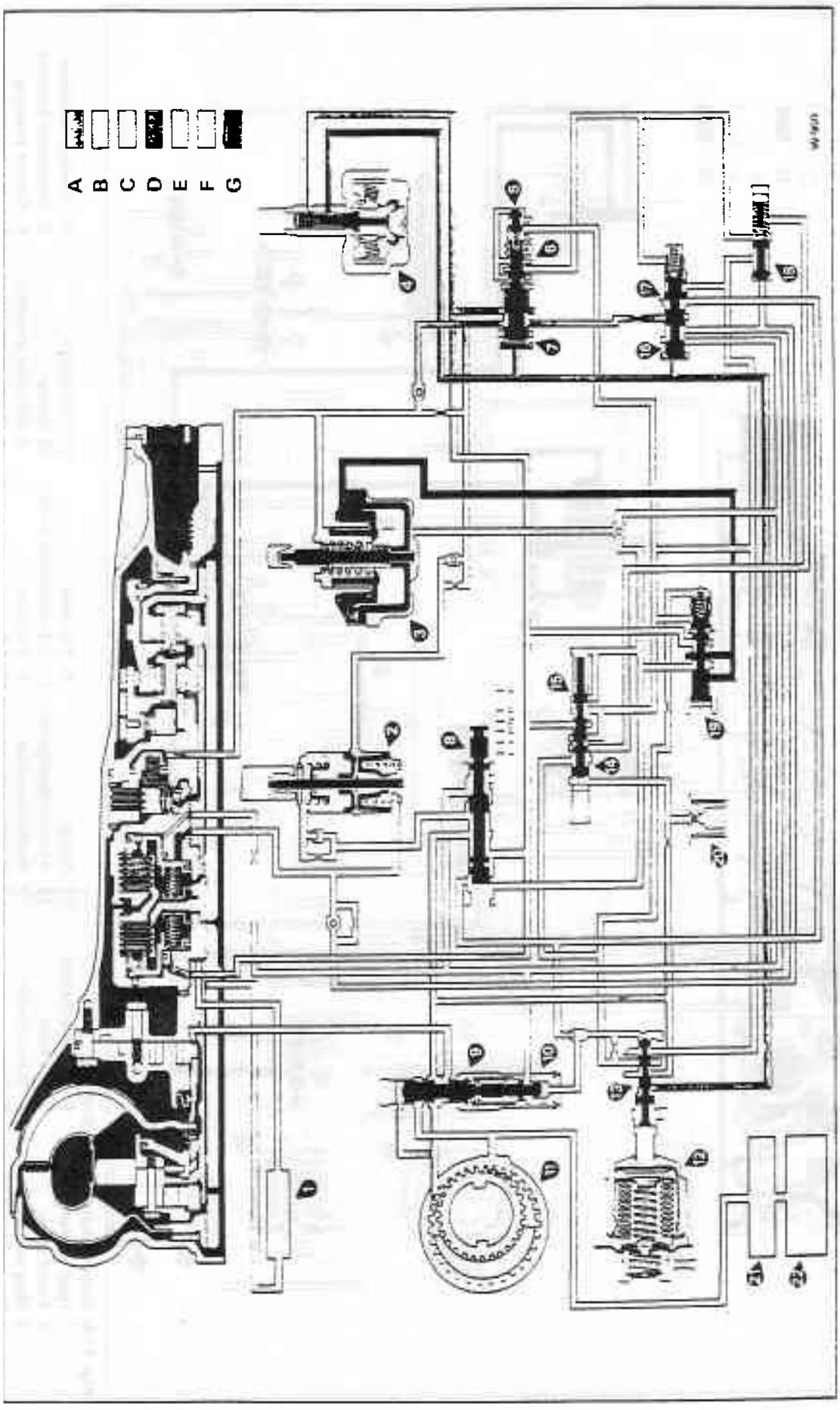

Fig. T1·8 Detent down-change

1 Heat exchanger
2 Front servo
3 Rear servo
4 Governor assembly
5 Regulator plug
6 1-2 detent valve
7 1-2 valve
8 Manual valve
9 Pressure regulator
10 Boost valve
11 Pump
12 Vacuum modulator
13 Modulator valve
14 Detent valve
15 Regulator valve
16 2-3 valve
17 2-3 modulator valve
18 3-2 valve
19 1-2 accumulator valve
20 Detent solenoid
21 Oil strainer
22 Sump
A Mainline pressure
B Intake pressure
C Converter pressure
D Governor pressure
E Modulator pressure
F Detent pressure
G 1-2 accumulator pressure

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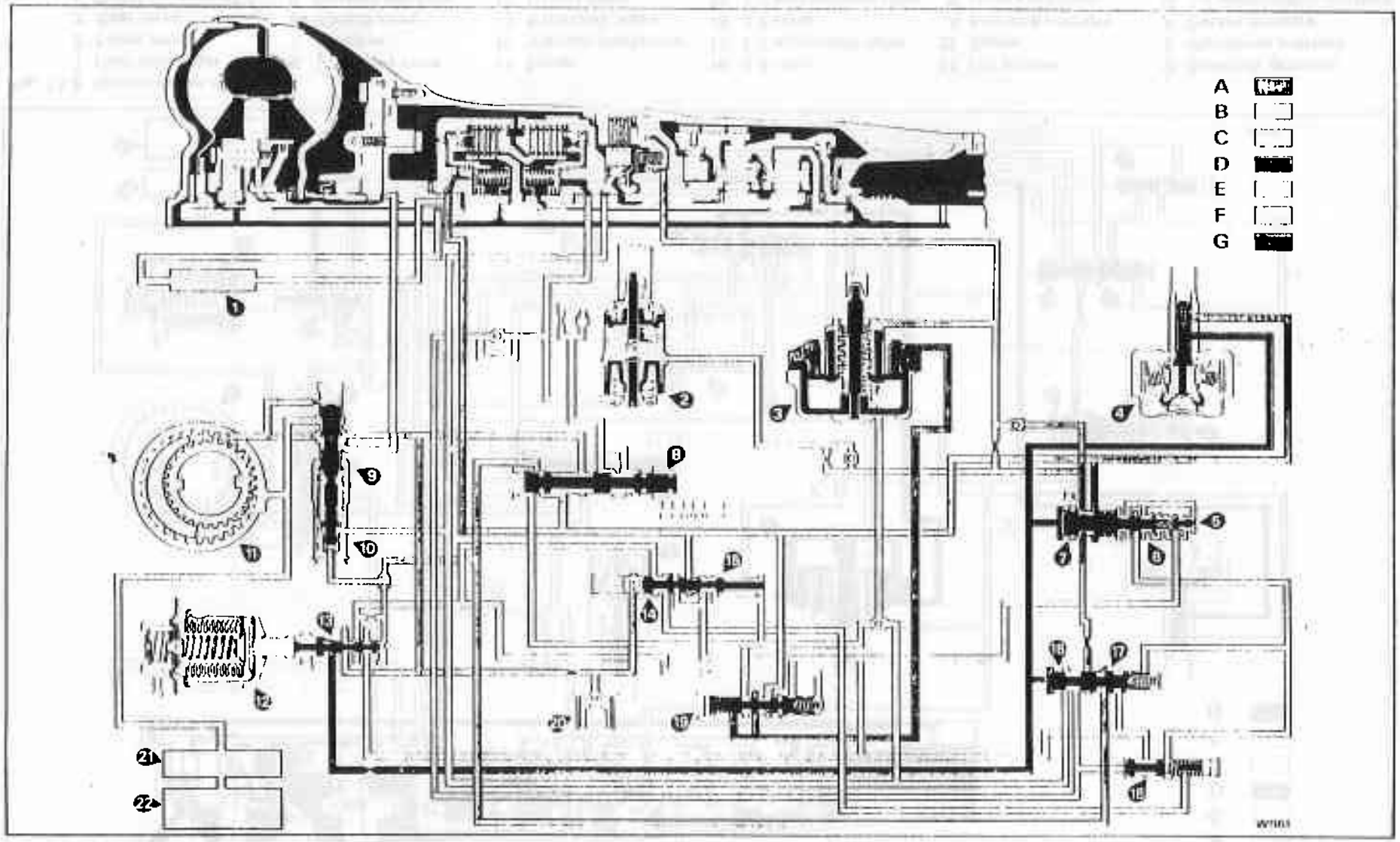

Fig. T1-9 Intermediate range – 2nd gear

1 Heat exchanger
2 Front servo
3 Rear servo
4 Governor assembly
5 Regulator plug
6 1-2 detent valve
7 1-2 valve
8 Manual valve
9 Pressure regulator
10 Boost valve
11 Pump
12 Vacuum modulator
13 Modulator valve
14 Detent valve
15 Regulator valve
16 2-3 valve
17 2 3 modulator valve
18 3-2 valve
19 1-2 accumulator valve
20 Detent solenoid
21 Oil strainer
22 Sump
A Mainline pressure
B Intake pressure
C Converter pressure
D Governor pressure
E Modulator pressure
F Detent pressure
G 1-2 accumulator pressure

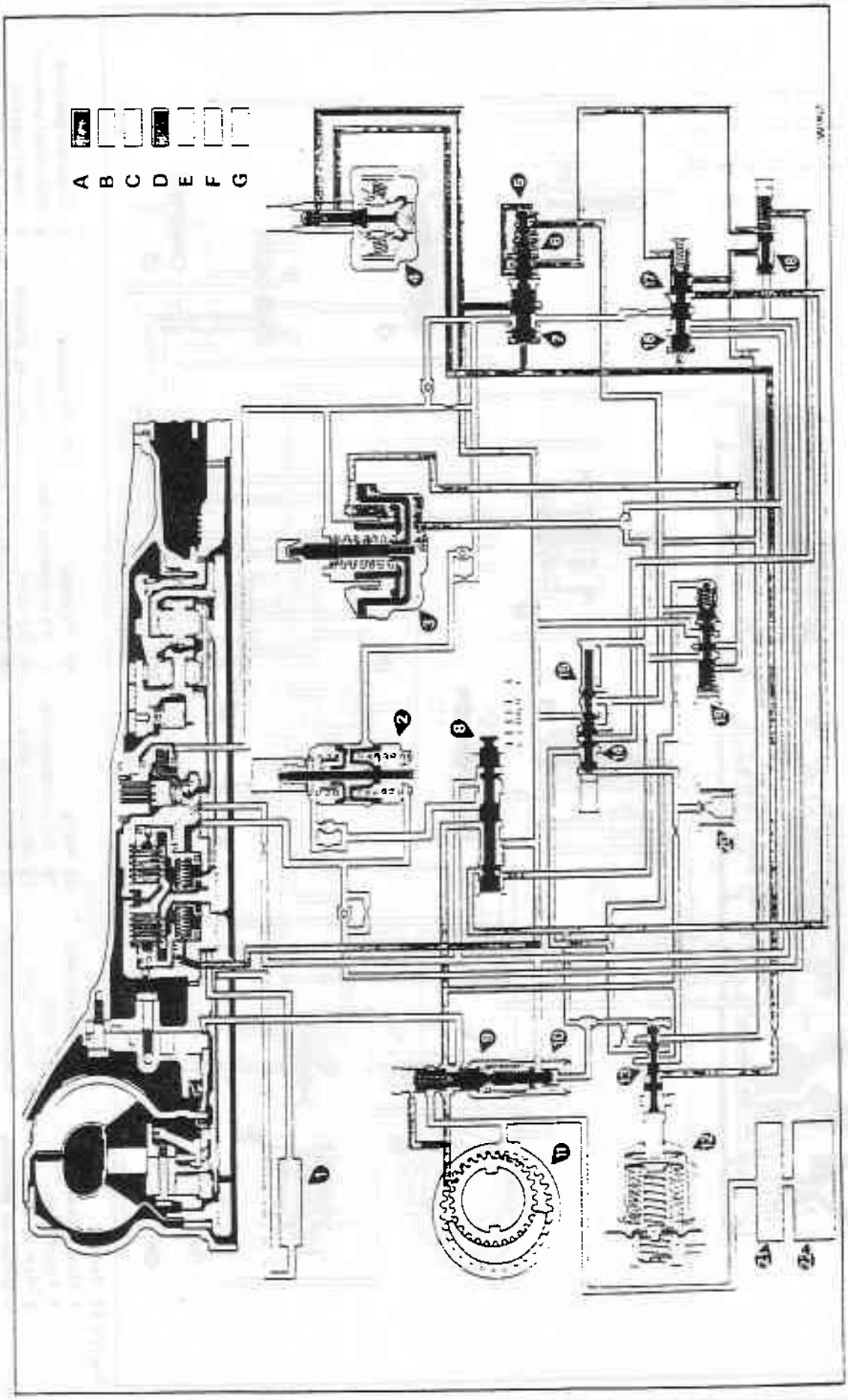

Fig. T1.10 Low range – 1st gear

1 Heat exchanger
2 Front servo
3 Rear servo
4 Governor assembly
5 Regulator plug
6 1-2 detent valve
7 1-2 valve
8 Manual valve
9 Pressure regulator
10 Boost valve
11 Pump
12 Vacuum modulator
13 Modulator valve
14 Detent valve
15 Regulator valve
16 2-3 valve
17 2-3 modulator valve
18 3-2 valve
19 1-2 accumulator valve
20 Detent solenoid
21 Oil strainer
22 Sump

A Mainline pressure
B Intake pressure
C Converter pressure
D Governor pressure
E Modulator pressure
F Detent pressure
G 1-2 accumulator pressure

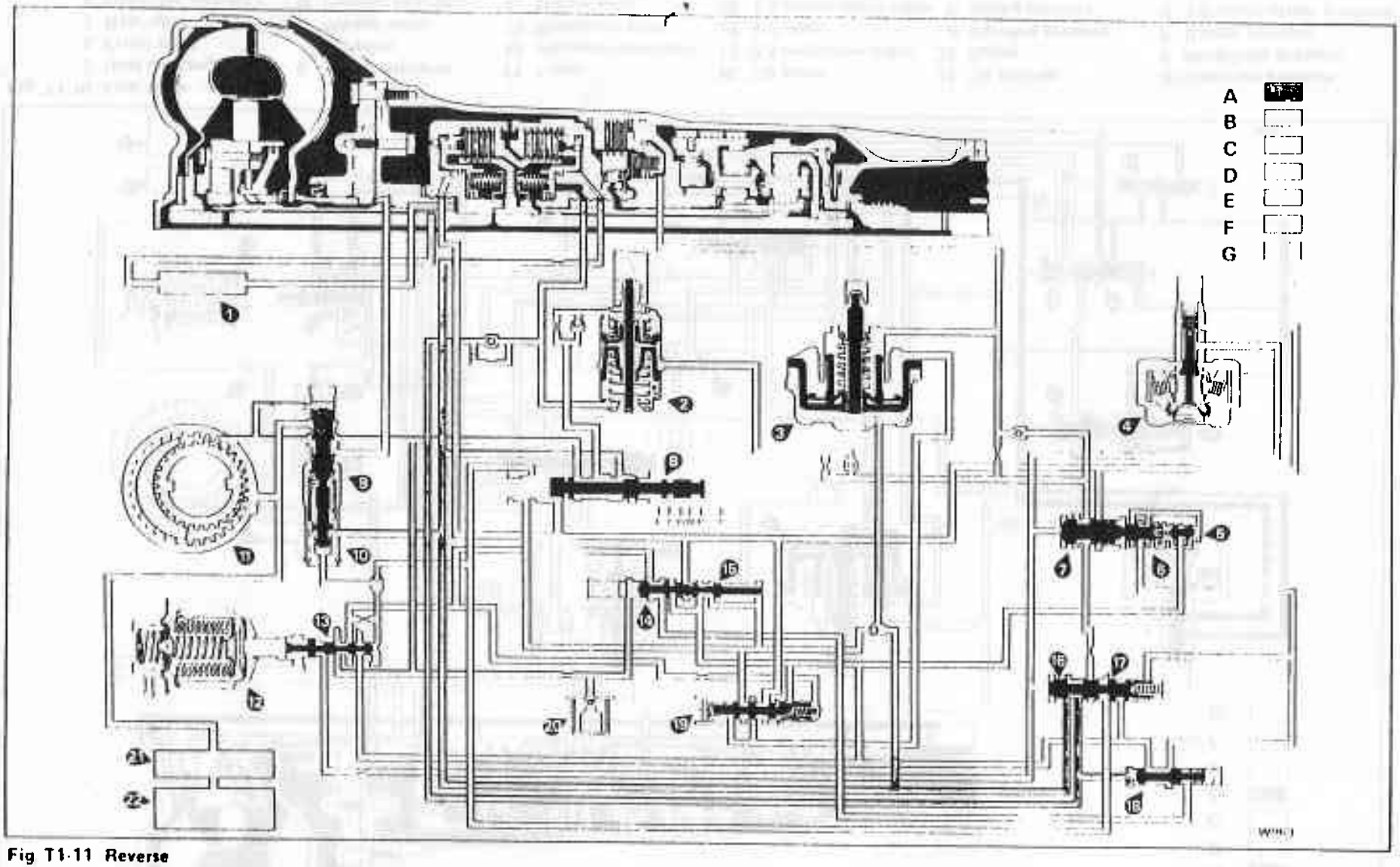

Fig T1-11 Reverse

1 Heat exchanger
2 Front servo
3 Rear servo
4 Governor assembly
5 Regulator plug
6 1-2 detent valve
7 1-2 valve
8 Manual valve
9 Pressure regulator
10 Boost valve
11 Pump
12 Vacuum modulator
13 Modulator valve
14 Detent valve
15 Regulator valve
16 2-3 valve
17 2-3 modulator valve
18 3-2 valve
19 1-2 accumulator valve
20 Detent solenoid
21 Oil strainer
22 Sump
A Mainline pressure
B Intake pressure
C Converter pressure
D Governor pressure
E Modulator pressure
F Detent pressure
G 1-2 accumulator pressure

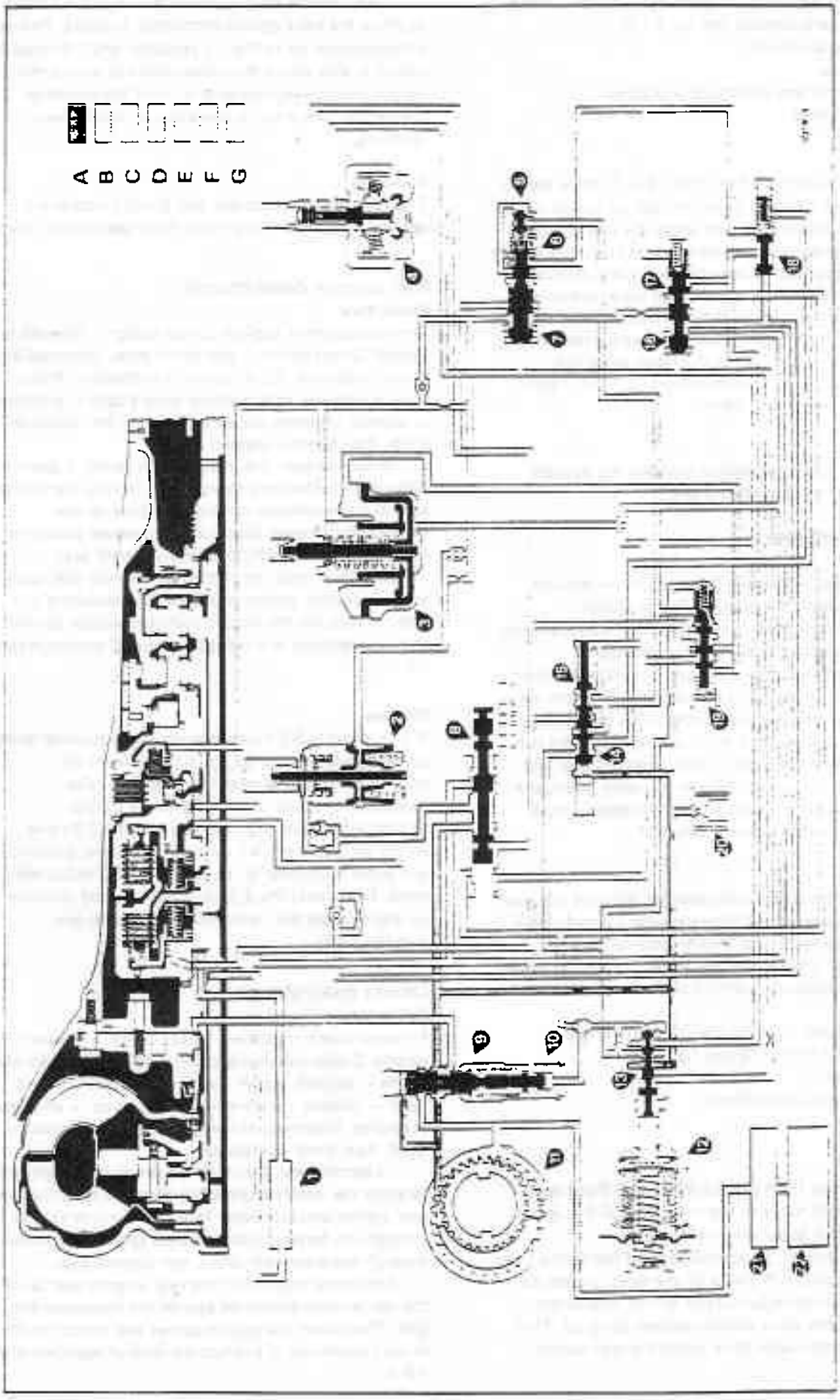

Fig. T1-12 Neutral – Engine running

1 Heat exchanger
2 Front servo
3 Rear servo
4 Governor assembly
5 Regulator plug
6 1-2 detent valve
7 1-2 valve
8 Manual valve
9 Pressure regulator
10 Boost valve
11 Pump
12 Vacuum modulator
13 Modulator valve
14 Detent valve
15 Regulator valve
16 2-3 valve
17 2-3 modulator valve
18 3-2 valve
19 1-2 accumulator valve
20 Detent solenoid
21 Oil strainer
22 Sump
A Mainline pressure
B Intake pressure
C Converter pressure
D Governor pressure
E Modulator pressure
F Detent pressure
G 1-2 accumulator pressure

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Intermediate clutch oil from the 1-2 shift valve is directed to the following (see fig. T1-5).

Intermediate clutch
Rear servo
Front servo and accumulator pistons
2-3 shift valve

Basic control

Intermediate clutch oil from the 1-2 shift valve seats a one-way check ball and flows through an orifice to the intermediate clutch piston to apply the intermediate clutch. At the same time, intermediate clutch oil moves the accumulator piston against the 1-2 accumulator oil and accumulator spring to maintain lower pressure in the clutch during a 1-2 shift for a smooth clutch application. Intermediate clutch oil seats a second one-way check ball and flows to the front servo and accumulator pistons. Intermediate clutch oil is also directed to the 2-3 shift valve.

Summary

The forward and intermediate clutches are applied. The transmission is in second gear.

Drive — Third gear

Power flow

Forward clutch — applied. Direct clutch — applied. Intermediate clutch — applied. Roller clutch — ineffective. Front band — released. Intermediate sprag clutch — ineffective. Rear band — released.

In direct drive, engine torque is transmitted from the converter, through the forward clutch to the mainshaft and rear internal gear. Because the direct clutch is applied, equal power is also transmitted to the sun gear shaft and the sun gear. Since both sun gear and internal gears are now turning at the same speed, the planetary gear set is essentially locked and turns as one unit in direct drive or a ratio of 1:1.

Oil flow

As the speed of the car and governor pressure increase, the force of governor oil acting on the 2-3 shift valve overcomes the force of 2-3 shift valve spring and modulator oil. This allows the 2-3 shift valve to move, feeding intermediate clutch oil to the direct clutch passage.

Direct clutch oil from the 2-3 shift valve is directed to the following (see fig. T1-6).

Direct clutch
Front accumulator piston
3-2 valve

Basic control

Direct clutch oil from the 2-3 shift valve flows past a one-way check valve to the inner area of the direct clutch piston to apply the direct clutch.

Simultaneously, direct clutch oil is fed to the front accumulator piston. Pressure of the direct clutch oil, combined with the accumulator spring, moves the accumulator and servo pistons against servo oil. This acts as an accumulator for a smooth direct clutch application.

Direct clutch oil is supplied also to the 3-2 valve to move the valve against modulator pressure. This cuts off modulator oil to the 1-2 regulator and 2-3 modulator valves. It also allows the transmission to utilize the torque multiplying characteristics of the converter during medium throttle operation without down-changing.

Summary

The forward, intermediate, and direct clutches are applied. The transmission is in third gear (direct drive).

Part throttle down-change

Power flow

Forward clutch — applied. Direct clutch — released in second. Direct clutch — applied in third. Intermediate clutch — applied. Roller clutch — ineffective. Front band — released. Intermediate sprag clutch — effective in second. Intermediate sprag clutch — ineffective in third. Rear band — released.

In second gear, the intermediate clutch is applied to allow the intermediate sprag clutch to hold the sun gear against anti-clockwise rotation. Turbine torque through the forward clutch is then applied clockwise through the mainshaft to the rear internal gear.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output shaft and output carrier to turn clockwise in a reduction ratio of approximately 1.5:1.

Oil flow

A part throttle 3-2 down-change can be accomplished below approximately 53 km/h (33 mile/h) by depressing the accelerator far enough to raise modulator pressure to approximately 6,0 bar (87 lbf.in^2). Modulator pressure and the 3-2 valve spring will move the 3-2 valve against direct clutch oil and allow modulator oil to act on the 2-3 modulator valve. This moves the 2-3 valve train against governor oil and changes the transmission to second gear (see fig. T1-7).

Detent down-change

Power flow

Forward clutch — applied. Direct clutch — released in second. Direct clutch — applied in third. Intermediate clutch — applied. Roller clutch — ineffective. Front band — released. Intermediate sprag clutch — effective in second. Intermediate sprag clutch — ineffective in third. Rear band — released.

In second gear, the intermediate clutch is applied to allow the intermediate sprag clutch to hold the sun gear against anti-clockwise rotation. Turbine torque through the forward clutch is then applied clockwise through the mainshaft to the rear internal gear.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.5:1.

Oil flow

While operating at speeds below approximately 113 km/h (70 mile/h) a forced or detent 3-2 down-change is possible. The down-change is effected by depressing the accelerator pedal so that the kick-down button is depressed and the kick-down switch actuates the detent solenoid. The detent solenoid opens an orifice that allows line oil at the detent valve to be exhausted, thus permitting the detent regulator valve to operate. Line oil acting on the detent valve and solenoid is supplied by a small orifice.

Drive oil on the detent regulator valve is then regulated to a pressure of approximately 4,8 bar (70 lbf/in^2) and called detent oil. Detent oil is then routed to the following (see fig. T1-8).

Modulator passage
1-2 regulator valve
2-3 modulator valve
3-2 valve
1-2 primary accumulator valve
Vacuum modulator valve

Detent oil in the modulator passage and at the 2-3 modulator valve will close the 2-3 shift valve, changing the transmission to second gear.

A detent 2-1 down-change can also be accomplished below approximately 32 km h (20 mile/h) because detent oil is directed to the 1-2 regulator valve exhaust port. This allows detent oil to act on the 1-2 regulator, and 1-2 detent valve to close the 1-2 shift valve, changing the transmission to first gear.

Detent oil is directed also to the modulator valve to prevent modulator pressure from regulating below 4,8 bar (70 lbf/in^2) at high speeds or at high altitudes.

Intermediate — Second gear

Power flow

Forward clutch — applied. Direct clutch — released. Intermediate clutch — applied. Roller clutch — ineffective. Front band — applied. Intermediate sprag clutch — effective. Rear band — released.

In second gear, the intermediate clutch is applied to allow the intermediate sprag clutch to hold the sun gear against anti-clockwise rotation. Turbine torque through the forward clutch is now applied clockwise through the mainshaft to the rear internal gear.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.5 :1.

In second gear, engine braking is provided by the front band as it holds the sun gear fixed. Without the band applied, the sun gear would overrun the intermediate sprag clutch.

Oil flow

When the selector lever is in Intermediate range, intermediate oil from the manual valve is directed to the following (see fig. T1-9).

Pressure boost valve
2-3 shift valve

Intermediate oil at the boost valve will increase line pressure to 10,3 bar (150 lbf/in^2). This increased intermediate oil pressure at the 2-3 shift valve will close the 2-3 shift valve, regardless of car speed.

For engine braking the front band is applied by exhausting servo oil at the manual valve. This allows intermediate clutch oil, acting on the servo piston, to move the piston and apply the front band. Once the transmission is in second gear — Intermediate range, it cannot change to third gear regardless of car speed.

Summary

The forward and intermediate clutches and front band are applied. The transmission is in second gear (Intermediate range).

Low range — First gear

Power flow

Forward clutch — applied. Direct clutch — released. Intermediate clutch — released. Roller clutch — effective. Front band — released. Intermediate sprag clutch — ineffective. Rear band — applied.

With the selector lever in Low range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear clockwise. (Converter torque ratio is approximately 2.2 : 1 at stall).

Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear anti-clockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier, and output shaft clockwise in a reduction ratio of approximately 2.5 : 1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and roller clutch assembly to the transmission case. (Total stall ratio is approximately 5.5 : 1).

Downhill or overrun braking is provided in Low range by applying the rear band as this prevents the reaction carrier from overrunning the roller clutch.

Oil flow

Maximum downhill braking can be attained at speeds below 64 km/h (40 mile/h) with the selector lever in Low position as this directs Low oil from the manual valve to the following (see fig. T1-10).

Rear servo
1-2 accumulator valve
Detent regulator valve
1-2 shift valve

Basic control

When in Low range oil flows past a check ball to the apply side of the rear servo piston and to the 1-2 accumulator valve to raise the 1-2 accumulator oil to line pressure for a smooth band application.

Low range oil acts on the detent regulator valve. Combined with the detent spring, Low range oil holds the detent valve against line oil acting on the detent valve, causing drive oil to flow through the detent regulator valve into the detent and modulator passages. Modulator and detent oil at line pressure acting on the 1-2 regulator and 1-2 detent valve overcomes

governor oil and Low oil on the 1-2 shift valve at any vehicle speed below approximately 64 km/h (40 mile/h) and the transmission will change to first gear.

In first gear (Low range), the transmission cannot up-change to second gear regardless of car or engine speed.

Summary

The forward clutch and rear band are applied. The transmission is in first gear (Low range).

Reverse

Power flow

Forward clutch – released. Direct clutch – applied. Intermediate clutch – released. Roller clutch – ineffective. Front band – released. Intermediate sprag clutch – ineffective. Rear band – applied.

In Reverse, the direct clutch is applied to direct turbine torque to the sun gear shaft and sun gear. The rear band is also applied, holding the reaction carrier.

Clockwise torque to the sun gear causes the front pinions and front internal gear to turn anti-clockwise in reduction. The front internal gear is connected directly to the output shaft, thus providing the reverse output gear ratio approximately 2 : 1. The reverse torque multiplication at stall (converter and gear ratios) is approximately 4.4 : 1.

Oil flow

When the selector lever is moved to the Reverse position, the manual valve is repositioned to allow oil at line pressure to enter the reverse circuit. Reverse oil then flows to the following (see fig. T1-11).

Direct clutch
2-3 shift valve
Rear servo piston
Pressure boost valve

Basic control

Reverse oil from the manual valve flows to the large area of the direct clutch piston and to the 2-3 shift valve. From the 2-3 shift valve, it enters the direct clutch passage and is directed to the small area of the direct clutch piston to apply the direct clutch.

Reverse oil flows to the rear servo and acts on the servo piston to apply the rear band. Reverse oil acts also on the pressure boost valve to boost line pressure.

Summary

The direct clutch and the rear band are applied. The transmission is in Reverse.

Park or Neutral – Engine running

Power flow

Forward clutch – released. Direct clutch – released. Intermediate clutch – released. Roller clutch – ineffective. Front band – released. Intermediate sprag clutch – ineffective. Rear band – released.

In Neutral or Park no bands or clutches are applied therefore no power is transmitted.

Oil flow

Whenever the engine is running at idle with the selector lever in P or N, oil from the pump is directed to the following (see fig. T1-12).

Pressure regulator valve
Torque converter
Oil cooler
Lubrication system
Manual valve
Detent valve
Detent solenoid
Vacuum modulator valve
Front servo (Neutral only)

Cooling and lubrication

Oil flows from the pump to the pressure regulator valve which regulates pump pressure. When the pump output exceeds the demand of line pressure, oil from the pressure regulator is directed to the converter feed passage to fill the converter. Oil from the converter is directed to the transmission heat exchanger. Oil from the heat exchanger is directed to the transmission lubrication system.

Line pressure acts on the following.
Manual valve
Detent valve
Detent solenoid
Modulator valve
Front servo

Line pressure at the modulator valve is regulated to a pressure called modulator oil, which acts on the pressure boost valve, 1-2 accumulator, and primary valves. It then passes through the detent valve and 3-2 valve to the 1-2 and 2-3 valve trains.

Summary

The torque converter is filled, and all clutches and bands are released. The transmission is in Neutral.

Servicing

Careful and regular maintenance of the transmission is necessary to ensure maximum reliability.

For details of the servicing and maintenance requirements of the transmission, refer to the Service Schedules Manual - TSD 4406.

It is absolutely essential that attention be paid to cleanliness whenever the interior of the transmission is exposed and when work is being carried out on a particular unit belonging to the transmission. The smallest particle of dirt in the oil may interfere with the correct operation of the valves, particularly in the control valve unit.

Fluid level - To check and top-up

The fluid level in the torque converter transmission can be checked accurately only when the car is standing on a level surface, the engine is running at the idle speed, and the transmission fluid is at normal operating temperature, approximately 77°C. This is only obtained after 24 kilometres (15 miles) of highway/motorway driving or after 16 kilometres (10 miles) of city driving.

As an initial check, the fluid level may be checked after starting from cold as follows.

1. With the car on a level surface, apply the parking brake and chock the road wheels.
2. On Silver Spirit, Silver Spur, and Mulsanne (including Turbo) cars, remove a windscreen wiper relay, preferably number three, situated adjacent to the windscreen washer reservoir. Then, remove the windscreen wiper motor drive mechanism cover (if fitted).
3. On all cars, start the engine and run at the fast-idle speed, with the gear range selector lever in the Park position.
4. Whilst sitting in the driver's seat, apply the footbrake and move the selector lever through each range, pausing briefly in each range, before returning to the Park position.
5. Immediately, check the fluid level with the engine at the idle speed. The level should be up to the dimple on the the dipstick (see fig. T2-1, B), or approximately 10 mm (0.375 in) **below** the MIN mark (see fig. T2-1, A), depending upon which type of dipstick is fitted.

A further check should then be carried out as follows.

6. Drive the car for approximately 24 kilometres (15 miles) of highway/motorway driving or 16 kilometres (10 miles) of city driving.
7. With the car on a level surface, apply the parking brake and chock the road wheels.

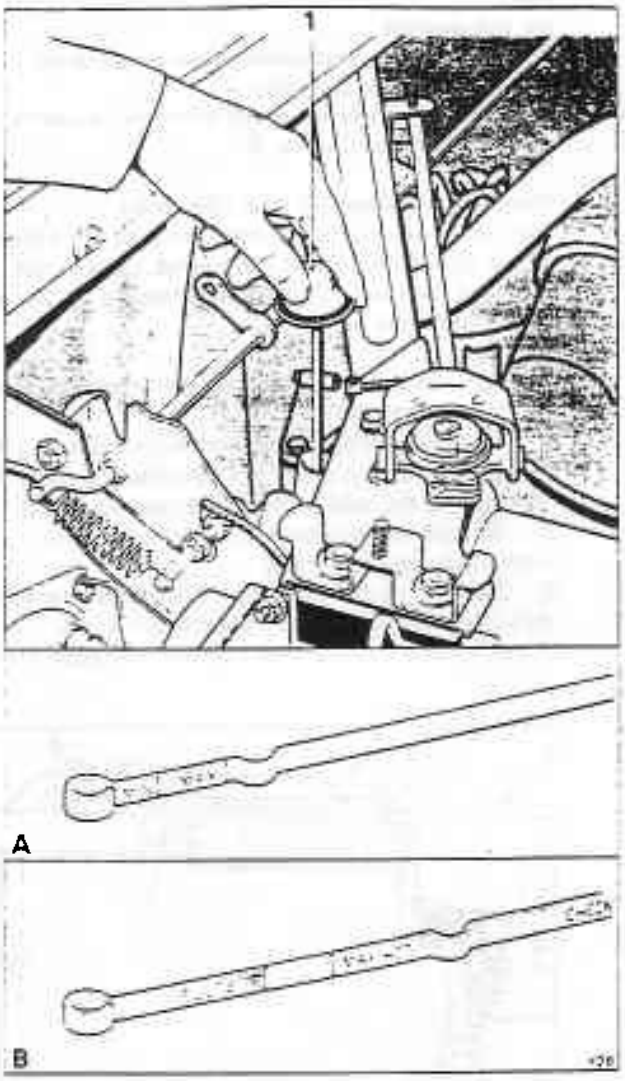

Fig. T2-1 Checking the oil level
1 Transmission oil dipstick
A Original dipstick markings
B Revised dipstick markings

8. On Silver Spirit, Silver Spur, and Mulsanne (including Turbo) cars, remove a windscreen wiper relay, preferably number three, situated adjacent to the windscreen washer reservoir. Then, remove the windscreen wiper motor drive mechanism cover (if fitted).
9. On all cars, start the engine with the gear range selector lever in the Park position.
10. Whilst sitting in the driver's seat, apply the footbrake and move the selector lever through each

range, pausing briefly in each range, before returning to the Park position.
11. Immediately, check the fluid level with the engine at the idle speed. The level should be between the FILL and MAX HOT marks (see fig. T2-1, B), or between the MIN and MAX marks (see fig. T2-1, A), depending upon which type of dipstick is fitted.
12. With the engine running, add fluid as required by pouring it down the filler tube.
Note
Do not overfill.
13. Replace the windscreen wiper motor drive mechanism cover and relay.

For a complete list of the lubricants currently approved refer to Chapter D.

Transmission dipstick and filler tube
The transmission dipstick and filler tube are situated on the right-hand side of the engine, close to the bulkhead. The word GEARBOX is marked on the top of the dipstick (see fig. T2-1).

To drain the sump and renew the intake strainer
1. Position the car on a ramp.
2. Place a clean container, minimum capacity 3 litres (5 Imp pt, 6 US pt) under the nut which secures the filler tube to the side of the sump (see fig. T2-2).
3. Remove the windscreen wiper motor drive mechanism cover (if fitted).
4. Slacken the nut securing the dipstick filler tube to the right-hand side of the transmission sump. Withdraw and move to one side the filler tube and drain the fluid into the container.
5. Remove the setscrews securing the sump.
6. Remove the sump and discard the gasket.
7. Drain the remainder of the fluid from the sump.
8. Clean the sump with paraffin and dry with compressed air.
9. Unscrew and remove the stepped bolt securing the intake pipe and strainer assembly to the transmission casing; remove the strainer assembly.
10. Discard the intake strainer but retain the intake pipe which connects the strainer to the casing.
11. Fit a new rubber 'O' ring onto the intake pipe, lubricate the 'O' ring with transmission fluid.
12. Ensure a new rubber seal is fitted to the bore in the new intake strainer. Fit the strainer to the intake pipe and secure the strainer with the stepped bolt.
13. Fit the sump, using a new gasket. Torque tighten the setscrews (refer to Section T22).
14. Fit the oil filler tube and tighten the nut.
15. Add 4½ litres (8 Imp pt,9½ US pt) of an approved fluid (see Chapter D) to the sump, pouring the fluid down the dipstick filler tube.
Note
When draining the sump but not renewing the intake strainer, add only 2,8 litres (5 Imp pt, 6 US pt).
16. Apply the parking brake and chock the road wheels.
17. Start and run the engine at the fast-idle speed.
18. Whilst sitting in the driver's seat, apply the footbrake and move the selector lever through each range, pausing briefly in each range, before returning to the Park position.
19. Immediately, check the fluid level with the engine at the idle speed. Add fluid as necessary to bring the level to the dimple (see fig. T2-1, B), or approximately 10 mm (0.375 in) **below** the MIN mark (see fig. T2-1,A), depending upon which type of dipstick is fitted.

Note
Do not overfill, as foaming may occur when the fluid warms up. If the fluid level is too low, especially when cold, complete loss of drive may result after quick stops. Extremely low fluid levels will result in damage to the transmission.
20. Finally, check the transmission fluid level is correct (see Fluid level - To check and top-up, Operations 6 to 13 inclusive).

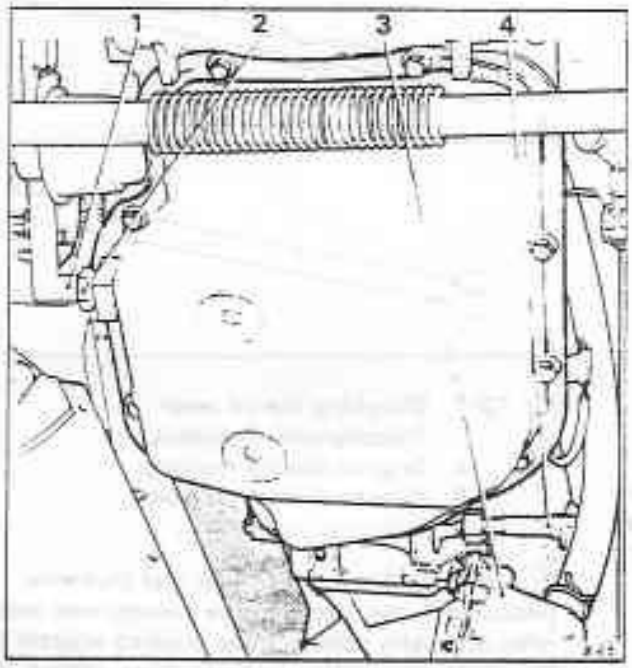

Fig. T2-2 Transmission sump
1 Fluid filler tube
2 Fluid drain point
3 Gearchange actuator
4 Electronic impulse transmitter

Transmission unit (dry) - To fill
The fluid capacity of the torque converter transmission, including the torque converter, is approximately 10,6 litres (18.75 Imp pt, 22.5 US pt), but the correct level is determined by the marks on the dipstick rather than by the quantity of fluid added.

It is important that the correct level is maintained. When the transmission has been overhauled or a new one fitted and a complete fill is required, including the torque converter, proceed as follows.
1. Pour approximately 6.5 litres (11.5 Imp pt, 14 US pt) down through the filler tube.
2. With the car on a level surface, apply the parking brake and chock the road wheels.

3. Start and run the engine at the fast-idle speed.
4. Whilst sitting in the driver's seat, apply the footbrake and move the selector lever through each range, pausing briefly in each range, before returning to the Park position.
5. Immediately, check the fluid level with the engine at the idle speed. Add fluid as necessary to bring the level to the dimple (see fig. T2-1, B), or approximately 10 mm (0.375 in) **below** the MIN mark (see fig. T2-1,A), depending upon which type of dipstick is fitted.
6. Drive the car for approximately 24 kilometres (15 miles) of highway/motorway driving or 16 kilometres (10 miles) of city driving, then check the fluid level again. Top-up if necessary, as described in Fluid level - To check and top-up.

The transmission sump should be drained at the intervals specified in the Service Schedule Manual (TSD 4406). New fluid should be added to maintain the correct level on the dipstick.

The fluid intake system incorporates an intake strainer. This strainer should be renewed at the intervals specified in the Service Schedule Manual. In the event of a major failure in the transmission, the strainer must be renewed.

Transmission unit - To check for leaks

Whenever the transmission has been dismantled, completely or partially, the following procedure must be observed to minimise the possibility of fluid leakage.
1. Always fit new gaskets and 'O' ring seals.
2. Use a small amount of petroleum jelly to hold a gasket in position during assembly.
3. Do not use a sealing compound (e.g. Wellseal) with a gasket.
4. Ensure that the cork and paper gaskets are not wrinkled or creased when fitted, or have distorted during storage.
5. Ensure that the square-sectioned 'O' rings are correctly fitted and are not twisted.
6. Ensure that all mating faces are clean and free from burrs and damage.
7. Torque tighten bolts, setscrews, etc., to the torque figures given in Section T22 and Chapter P.
8. When examining the transmission for leaks, determine whether the fluid originates from the transmission or the engine. The original factory fill fluid is red in colour, this assists in locating the source of leakage. If however, the colour cannot be detected in the transmission fluid, add a red aniline dye preparation to the fluid. Red dye appearing in the leaking fluid will positively identify the source of the leak.

If the fluid is known to be leaking from the transmission, examine the following areas.

Front end

It will be necessary to remove the bell housing bottom cover and the lower front cover plate in order to examine the transmission for leakage at the front end.

To correct a leak at the front end the transmission will have to be removed from the car.
1. If the pump oil seal is suspected of leaking fluid, ensure that the seal has been correctly fitted and is not damaged.

When fitting a new seal (see Section T16) ensure that the seal bore in the case is clean. Examine the finish on the converter neck and the bearing surface in the pump body.
2. Examine the pump square-sectioned 'O' ring and the gasket for damage, renew if necessary.
3. Ensure that the rubber coated washers on the pump securing setscrews are correctly fitted and are not damaged.
4. Examine the torque converter for leakage (see Section T7).

Rear extension

1. Examine the rear extension housing oil seal for damage.
2. Examine the finish on the sliding coupling.
3. Ensure that the gasket fitted between the joint faces has been correctly fitted and is not damaged.
4. Check the securing setscrews for correct torque tightness (see Chapter P).
5. Examine the housing for cracks or porosity.

Transmission case

1. Examine the speedometer electronic impulse transmitter drive 'O' ring and lip-type seal. Ensure that the securing setscrew is torque tightened.
2. Examine the governor cover gasket. Ensure that the setscrews are torque tightened (see Section T22).
3. Examine the electrical connector 'O' ring for damage.
4. Examine the parking pawl shaft cup plug for damage.
5. Examine the manual shaft 'O' ring for damage.
6. Examine the vacuum modulator 'O' ring for damage. Ensure the retaining setscrew is torque tightened (see Chapter P).
7. Examine the vacuum modulator for possible damage to the diaphragm.

Note

If the transmission is found to be consistently low on fluid, check the modulator to ensure that there is no split in the diaphragm. Apply suction to the vacuum tube and check for leaks. A split diaphragm would allow transmission fluid to be drawn into the engine induction manifold and vacuum line. This condition can usually be detected because the exhaust will be excessively smokey due to the transmission fluid being added to the combustion mixture.
8. Examine the sump gasket. Check the torque tightness of the securing setscrews (see Chapter P).
9. Check the torque tightness of the main line pressure tapping plug (see Section T22).
10. Examine the breather pipe for damage.
11. Ensure that the transmission has not been overfilled.
12. Check for coolant in the transmission fluid.
13. Examine the case for cracks or porosity.

14. Ensure that the pump to case gasket is not incorrectly positioned.
15. Ensure that foreign matter is not between the pump and case, or between the pump cover and body.
16. Ensure that the breather hole in the pump cover is not obstructed.
17. Ensure that the 'O' ring on the filter assembly is not cut.

Heat exchanger connections
Ensure that the heat exchanger transmission fluid pipes are correctly fitted and are not damaged. Ensure that the nuts are tight.

Dipstick and filler tube
Examine the flared end of the dipstick and filler tube for cracks or damage. Examine the spherical seat in the sump. Ensure that the sleeve nut is tightened sufficiently to nip the tube securely to the sump.

Internal leaks
Note
Ensure that the manual linkage is set correctly before removing the sump, as incorrect settings can cause internal leaks at the valves.

If the manual linkage is set correctly, remove the sump.

1. Check the governor pipes for security and damage.
2. Examine the rear servo cover gasket for damage. Ensure that the square-sectioned 'O' ring is fitted correctly and is not damaged. Torque tighten the cover securing setscrews (see Section T22).
3. Examine the control valve unit assembly and oil spacer (guide) plate gaskets. Check the torque tightness of the unit securing setscrews (see Section T22).
4. Check the torque tightness of the solenoid securing setscrews (see Section T22).
5. Examine the intake pipe 'O' ring for damage.
6. Check that the case valve body mounting face is not distorted.

Control joints - To lubricate
During initial assembly, the clevis pins in the control linkage are lubricated with Rocol MTS 1000 grease and should be similarly treated whenever they are removed.

When a car is being serviced, the opportunity should be taken to check the controls for correct operation and to lubricate all the control joints with a few drops of engine oil.

Manual shaft - To lubricate
As part of the linkage maintenance procedure, it is recommended that the manual shaft be lubricated with a few drops of oil at the point where it enters the transmission case.

Testing

Before road testing the car to check the funtioning of the transmission, carry out the following checks.

The car can then be road tested, using all the selector ranges. Note when any operating faults occur. Check the gearchange pattern as follows.

1. Check the fluid level, top-up if necessary.
2. Ensure that the engine and transmission are at normal operating temperature 77°C.
3. Ensure that the gearchange actuator is operating satisfactorily.
4. Check the operation of the kick-down switch, adjust if necessary (see Chapter K).
5. If the oil pressure is to be checked, fit a gauge.
6. Check the manual linkage.

Gearchange pattern check

Drive range

1. Select D range, then accelerate the car from standstill.
2. A 1-2 and a 2-3 up-change should occur at all throttle openings.

Note

The change points will vary according to throttle opening.

3. As the speed of the car decreases to a stop, the 3-2 and the 2-1 down-changes should occur.

Intermediate range

1. Select I range.
2. Accelerate the car from standstill.
3. A 1-2 up-change should occur at all throttle openings.
4. A 2-3 up-change cannot be obtained in this range.
5. The 1-2 up-change point will vary according to throttle opening.
6. As the speed of the car decreases to a stop, the 2-1 down-change should occur.

Low range

1. Select L range.
2. No up-change should occur in this range, regardless of throttle opening.

2nd gear – overrun braking

1. Select D range.
2. When a speed of approximately 56 km/h (35 mile/h) has been reached, move the selector lever to the I range position.
3. The transmission should change down to 2nd gear.
4. An increase in the speed of the engine as well as an engine braking effect should be observed.
5. Line pressure should change from between 4,1 bar and 6,2 bar (60 lbf/in^2 and 90 lbf/in^2) to approximately 10,3 bar (150 lbf/in^2).

1st gear – downhill or overrun engine braking

1. Select I range.
2. When the speed of the car is approximately 48 km/h (30 mile/h) [ensure that it does not exceed 64 km/h (40 mile/h)] and at constant throttle, move the selector to L range.
3. An increase in engine rev/min and a braking effect should be noticed as the down-change occurs.

Oil pressure – To check

Before attempting to check the oil pressure or to road test the car, always ensure that the level of fluid in the transmission is correct (see Section T2).

The pressure can be checked with the transmission in the car by using an oil pressure gauge coupled to the main line tapping in the left-hand side of the transmission case.

1. Clean any dirt from around the line pressure plug; remove the plug.
2. Fit the adapter RH 7914 into the main line tapping; tighten the adapter.
3. Screw a pressure gauge, capable of reading between 0 bar and 20,6 bar (0 lbf/in^2 and 300 lbf/in^2) onto the adapter then position the gauge so that it can be seen from the driver's seat.
4. Connect a tachometer to the engine; this will enable the gear change points to be positively identified.
5. Drive the car until the transmission has reached normal operating temperature 77°C.
6. Check the fluid level, top-up if necessary.

Road testing the car

The following checks should be carried out during road testing.

Engine idle pressure check

1. Select D range. Drive the car at approximately 48 km/h (30 mile/h) with the throttle eased back. The line pressure should be 4,8 bar (70 lbf/in^2).
2. Select I range. Drive the car to obtain a steady road speed of 40 km/h (25 mile/h). Line pressure should be between 10,0 bar and 10,7 bar (145 lbf/in^2 and 155 lbf/in^2).

Full throttle pressure check

1. Jack up the rear of the car and position blocks so that the rear wheels are clear of the ground.
2. Disconnect the vacuum line at the induction manifold.
3. Blank off the orifice in the manifold.
4. Run the engine at fast-idle (between 800 rev/min and 1000 rev/min) in Neutral. The oil pressure should be 10,0 bar (145 lbf/in^2).

5. Repeat the procedure in Reverse. Reverse pressure should be between 10,0 bar and 10,7 bar (145 lbf/in^2 and 155 lbf/in^2).
6. Connect the vacuum pipe.

Towing

The car must not be towed if any mechanical damage to the transmission components is suspected, or if the torque converter transmission fluid level is low.

Before towing, check the fluid level in the transmission. The level must be above the MAX mark on the dipstick when the engine is not running.

Should it be necessary to tow the car, even for a short distance, a solid tow bar must be used. This is important, as without the engine running to maintain the pressure in the hydraulic systems, the efficiency of th the braking systems is reduced.

If the pressure in the hydraulic systems has been exhausted by operating the footbrake pedal without the engine running, the footbrake would not stop the car. If a solid tow bar is not available, the car must be transported.

Always tow the car with the torque converter transmission in Neutral.

To select Neutral it is first necessary to insert the ignition key in the switchbox and turn it to the RUN position. Providing that the battery is in a charged condition, this action will energise the gearchange actuator mechanism and Neutral can then be selected by operating the gear range selector lever. Should the battery be in a discharged condition however, turning the ignition key will not energise the gearchange mechanism and operating the gear range selector lever therefore will not activate the actuator mechanism. In this event, it will not be possible to move the transmission out of the Park position and it will be necessary to disconnect the gearchange actuator linkage at the manual shaft lever. Then, before the car can be towed or transported, engage Neutral by moving the manual shaft lever two positions rearwards from the fully forward position.

Normally, when the ignition key is removed from the switchbox, Park position is automatically engaged and the parking pawl locks the transmission. If it is required to remove the ignition key and still leave the car in Neutral for towing, this can be accomplished by first removing the gearchange actuator thermal cut-out from the fuseboard and then removing the key from the switchbox.

The car can only be towed for distances of up to 80 kilometres (50 miles) and the maximum towing speed must not exceed 56 km/h (35 mile/h). For greater distances the propeller shaft must be disconnected or the car must be transported.

Removal of units

Removable units – Transmission in car

The following units can be removed from the transmission without the transmission being removed from the car.

The removal procedure for all the units is described in the appropriate section, with the exception of the pressure regulator valve, details of which are included in this section.

Gearchange actuator (see Section T5).
Vacuum modulator and valve (see Section T8).
Governor assembly (see Section T9).
Speedometer drive (see Section T10).
Sump, strainer and intake pipe (see Section T11).
Control valve unit (see Section T12).
Rear servo (see Section T13).
Detent solenoid, connector, control valve spacer and front servo (see Section T14).
Rear extension (see Section T15).
Control rods, levers and parking linkage (see Section T17).

Pressure regulator valve – To remove

The pressure regulator valve is a solid type (see fig. T4-1) and must only be used in the pump cover with the squared pressure regulator boss (see fig. T4-2).

Earlier pressure regulator valves had oil holes and an orifice cup plug (see fig. T4-1). This type of regulator valve may be used to service either type of pump cover.

1. Run the car onto a ramp. Drain the oil from the sump.
2. Remove the sump as described in Section T11.
3. Withdraw the intake pipe and strainer assembly.
4. Remove and discard the intake pipe 'O' ring.
5. Remove the setscrew which secures the detent roller spring; remove the spring and roller.
6. Slacken the lock-nut which secures the detent lever to the manual shaft.
7. Remove the manual shaft pin from the case.
8. Remove the gearchange lever from the manual shaft.
9. Prise the detent lever from the manual shaft then remove the parking actuator rod and detent lever.
10. Ensure that the manual valve does not slide out of its bore in the control valve unit.
11. Push the manual shaft through the bore in the case in order to gain access to the pressure regulator valve bore.
12. Using a screwdriver or a steel rod, push the regulator boost valve sleeve against the pressure regulator spring (see fig. T4-3).

Caution

The pressure regulator spring is under extreme pressure and will force the valve sleeve out of its bore when the circlip is removed unless the sleeve is firmly held.

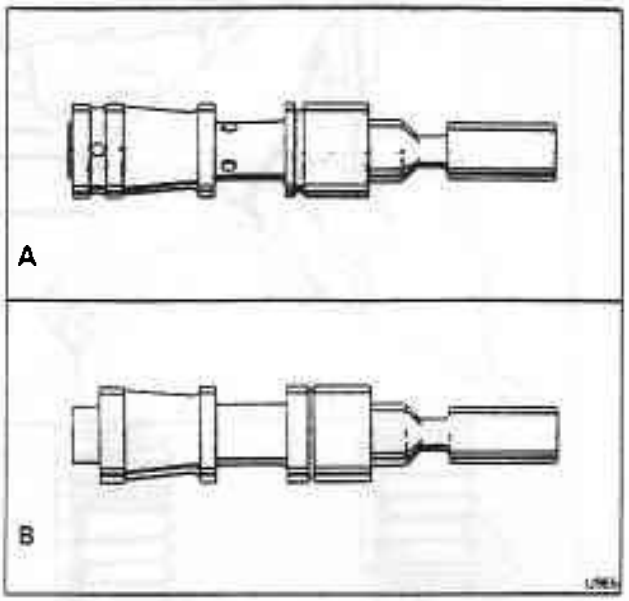

Fig. T4-1 Pressure regulator valve
A Early type with orifice plug
B Solid type

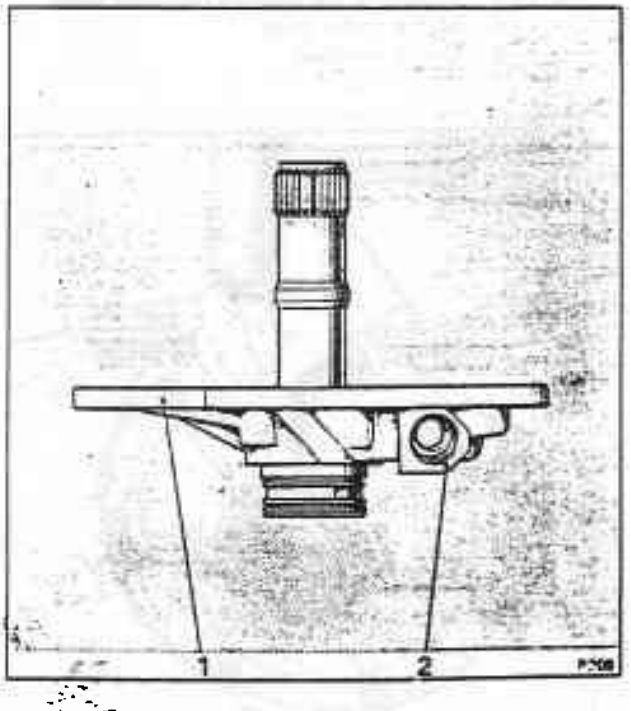

Fig. T4-2 Pump cover assembly
1 Pump cover
2 Pressure regulator boss

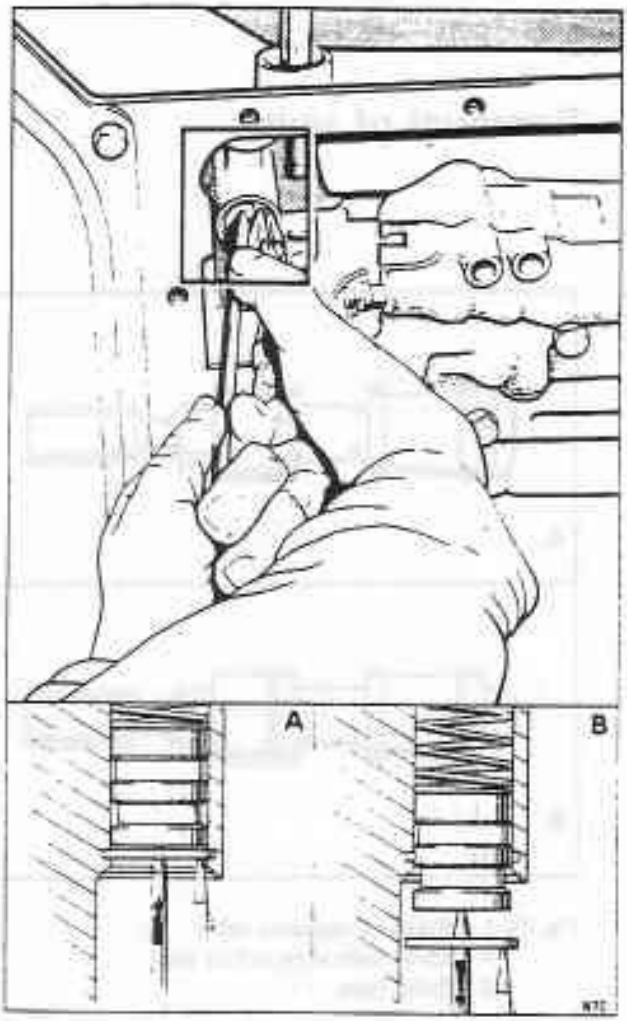

Fig. T4-3 Removing the pressure regulator valve
A Spring compressed
B Circlip removed

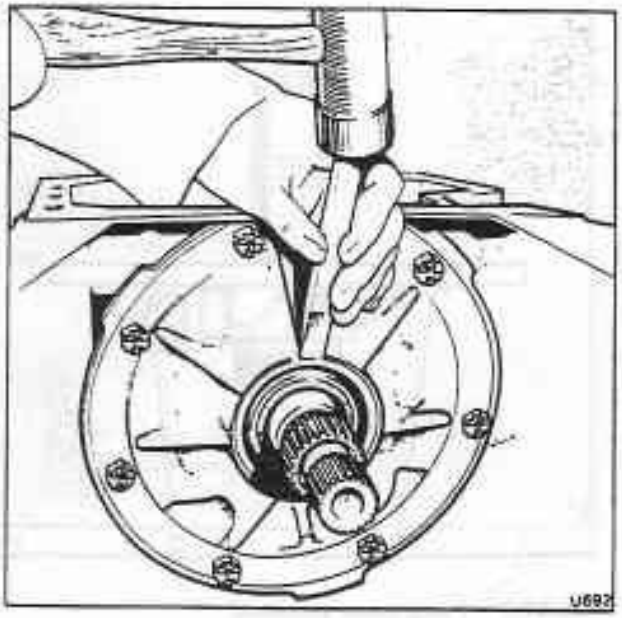

Fig. T4-4 Removing the oil pump seal

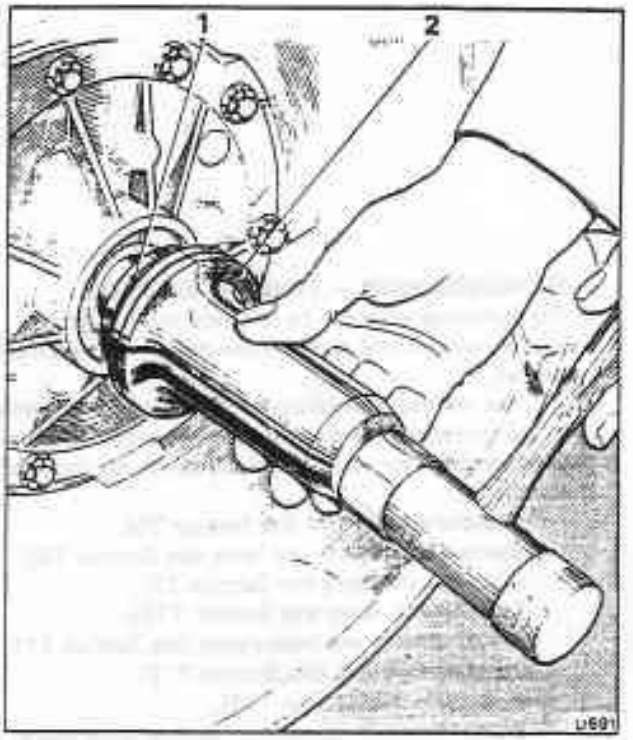

Fig. T4-5 Fitting the oil pump seal
1 Oil seal
2 Seal fitting tool

13. Continue to exert pressure on the valve sleeve then remove the circlip. Gradually relax the pressure on the valve sleeve until the spring pressure is released.
14. Carefully remove the regulator boost valve sleeve and valve, then withdraw the regulator spring. Take care not to drop the valves.
15. Remove the pressure regulator valve and spring retainer. Remove the spacers (if fitted).

Pressure regulator valve — To fit

Before fitting, wash and examine all parts.
1. Fit the spring retainer onto the pressure regulator spring. Fit any spacers which were previously removed.
2. Fit the pressure regulator valve, stem end first, onto the spring.
3. Fit the boost valve into the sleeve with the valve stem outward. Then, hold together all the parts so that the pressure regulator spring is against the valve sleeve.
4. Fit the complete assembly into the pressure regulator valve bore, taking care that the parts do not fall.
5. Using a screwdriver or a steel rod, push the regulator boost valve sleeve against the regulator spring pressure until the end of the sleeve has passed beyond the circlip groove.
6. Fit the circlip then relax the pressure on the sleeve.
7. Fit the parking actuator rod and detent lever, ensuring that the rod plunger is under the parking brake bracket and over the parking pawl.
8. Slide the manual shaft into the case and through the detent lever.
9. Fit the gearchange lever.

10. Fit the lock-nut onto the manual shaft. Torque tighten the nut.
11. Ensure that the manual valve is engaging with the pin on the detent lever.
12. Retain the manual shaft with the pin. Straighten the pin to lock it into position.
13. Fit the detent spring and roller assembly; torque tighten the setscrew.
14. Fit the intake pipe and strainer assembly, also the sump as described in Section T11.
15. Top-up the transmission with an approved fluid (see Chapter D).

Oil pump seal — To renew

1. Remove the transmission from the car (see Section T6).
2. Carefully drive the point of a chisel under the lip of the seal then prise the seal out of the pump body (see fig. T4-4).
3. Before fitting a new seal, ensure that the body bore is clean and free from burrs and that the garter ring is on the seal.
4. Check the finish of the converter neck and the bearing surface in the pump body.
5. Lightly smear the outer edge of the seal case with Wellseal then fit the seal to the pump using tool RH 7953 as shown in figure T4-5.
6. Fit the transmission to the car (see Section T6).

Gearchange actuator

The electric gearchange actuator (see fig. T5-1) is mounted on a bracket secured to the transmission rear extension.

When the ignition is switched on and the selector lever on the steering column is moved to one of the gear range positions, current is allowed to flow to the actuator motor via a relay.

The motor rotates and turns the wormshaft through the flexible coupling. As the worm gear rotates, the slip ring, which is secured to the worm gear also rotates until an insulated slot in the slip ring is aligned with the live contact. When this position is reached, the current is cut off and the motor ceases to rotate.

The electric actuator is wired such that the transmission can be locked by moving the selector lever to the Park position, with the ignition switched either on or off. However, to move the transmission out of the Park position, the ignition has to be switched on, with the battery in a charged condition.

Note

The actuator will also lock the transmission when the ignition key is removed from the switchbox.

Gearchange electric actuator — To remove

The gearchange electric actuator includes a thermal cut-out which is located on the fuseboard. This cut-out prevents the motor from being overloaded should the gearchange linkage become obstructed and as a result, gives the impression of actuator failure.

Before removing the actuator, ensure that the controls are free and adequately lubricated, also that the actuator electrical system is sufficiently cooled for the thermal cut-out to permit the motor to operate. Press the reset button in the main fuse-board to reset the cut-out.

It is recommended that the easiest and quickest method of dealing with actuator failure, is by substituting the faulty actuator for a service exchange unit. If a service exchange unit is not obtainable proceed as follows.

1. Disconnect the battery.
2. Remove the split pin and clevis pin from the actuating lever on the electric actuator; disconnect the rod from the lever.
3. Pull the carpet to one side and disconnect the electrical plugs from the left-hand side of the lower facia and unclip the loom from the automatic air conditioning servo unit. Remove the setscrew securing the electrical cable to the transmission tunnel. Also the three nuts securing the loom/breather connection. Lower the electrical lead, plugs, etc., down through the transmission tunnel opening.
4. Remove the three bolts which secure the actuator to the rear extension bracket, then remove the actuator.

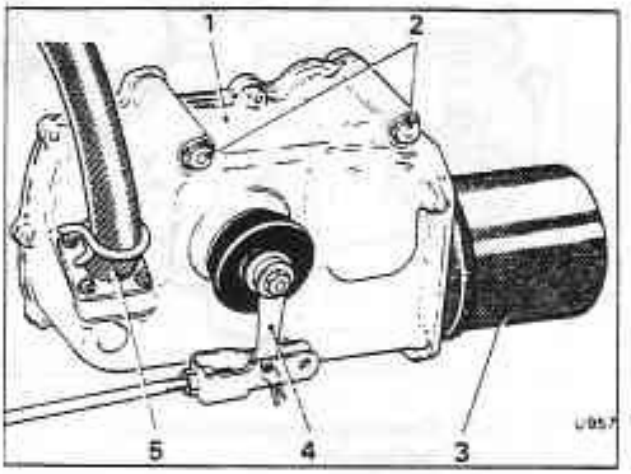

Fig. T5-1 Electric gearchange actuator

1 Actuator casing
2 Actuator securing bolts
3 Motor cover
4 Actuating lever
5 Cable entry

Gearchange electric actuator — To dismantle

1. Disconnect the transmission linkage and the actuator loom plugs. Remove the actuator from the car.
2. Withdraw the side casing by carefully removing the nuts and washers.
3. Remove the cam securing nut and washer and withdraw the cam.
4. Disconnect all terminals on the contact plate and micro-switches.
5. Withdraw the contact plate by removing the nuts and washers. Remove the relay connections.
6. Remove the nuts and bolts which secure the micro-switches, relay mounting bracket, relays, and motor cable connection posts.
7. Remove the securing setscrew and washer and withdraw the output lever.
8. Withdraw the washer and the rubber boot.
9. Remove the circlip and thrust washer.
10. Withdraw the slip ring and gear assembly from the actuator case.
11. Remove the contact segments from the slip ring.
12. Remove the setscrews and washers from the side of the actuator casing and remove the motor assembly and drive coupling. Remove the sealing ring from the actuator case.
13. Remove the internal circlip holding the wormshaft; push the wormshaft and bearings out of the casing.
14. Carefully cut and remove the tie wrap from around the electrical wiring.

15. Remove the securing clips from around both ends of the conduit; withdraw the conduit from the cast elbows.

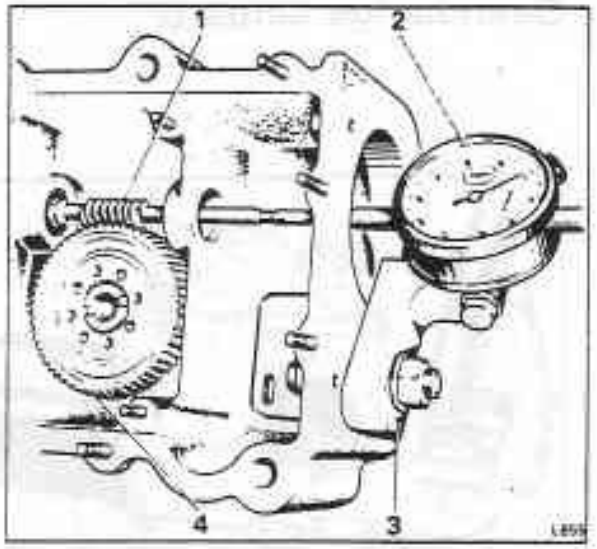

Fig. T5-2 Checking wormshaft end-float
1 Wormshaft
2 Dial indicator gauge
3 Gauge arm
4 Slave gear

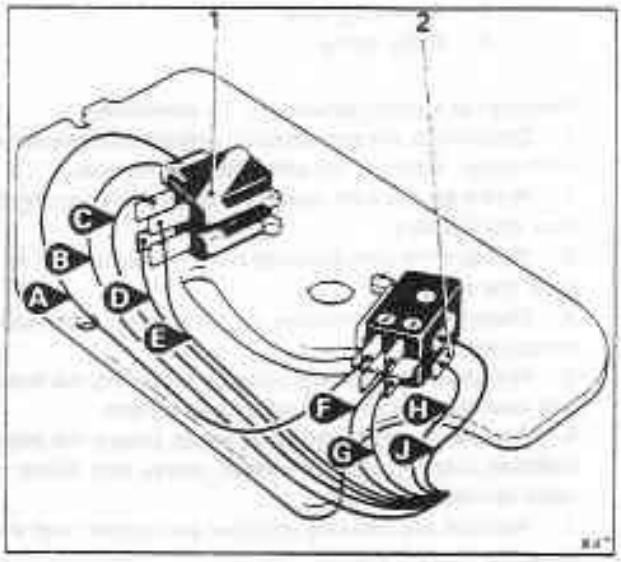

Fig. T5-3 Micro-switch connections
1 Reverse micro-switch
2 Neutral start switch
A Green/yellow cable
B Blue/brown cable
C White/brown cable
D Brown/slate cable
E Green/blue cable
F Green/black cable
G White/red cable
H White/yellow cable
J Light green/green cable

16. Push out the electrical leads from the loom plugs. Collect the loom plugs, conduit elbow (tunnel connection), securing clips, and conduit.
17. Fasten together the electrical cables with tape and pull them back through the cable exit of the actuator casing.

Gearchange electric actuator — To inspect

1. Examine the magnesium casing for cracks or other damage.
2. Ensure that the joint faces are clean and free from burrs.
3. Examine the driving dog slot for excessive wear, also the mating shaft on the drive end of the motor armature shaft. The dog should be an easy sliding fit on the shaft but without excessive side play.
4. Examine the general condition of the plugs.
5. Examine the eight spring contacts for security on the insulated base.

Care must be taken when handling the assembled base plate so that the contacts and the relays are not damaged.

6. Check the height of the contacts from the base plate. The contact point should be approximately 12,32 mm (0.485 in) from the contact (lower) side of the base. If excessive wear has occured on the contact points the base assembly should be renewed.
7. If a Bosch relay assembly is faulty, it is recommended that a new assembly be fitted.
8. Ensure that the terminals and the terminal blocks are secure on the insulated base.
9. Examine the general condition of the wiring.
10. If the components are satisfactory, retain them with adhesive tape until they are required for final assembly.
11. Check the tightness of the setscrews which secure the slip ring assembly to the shaft.
12. Ensure that a 0,64 mm (0.025 in) air gap exists on each side of the silver plated segments which are secured to the slip ring.
13. Ensure that the edges of the slip ring around the air gap are free from burrs.
14. Examine the slip ring face for signs of tracking. This should not normally occur but, if signs of tracking are found, the slip ring assembly must be renewed.
15. Examine the teeth on the worm gear and the worm for damage or uneven wear.
16. Examine the bearing bores in the main casing for signs of fretting. The bearing should be a light push fit in the casing. Reject the casing if the push fit cannot be obtained.
17. Examine the bush which supports the output shaft for wear. The shaft should be a running fit in the bush, without excessive clearance i.e. the shaft should not rock in the bush.

Actuator plugs and cable assembly

1. Inspect the cables where they enter the plugs.
2. Ensure that no corrosion exists and that none of the individual cable strands are broken.

Actuator casing

1. Inspect all the sealing faces and the actuator casing

and the side cover.
2. Remove all traces of sealing joint and sealing compound.

Wormwheel
1. Inspect the wormwheel for abnormal wear of the teeth.

Wormshaft bearing
1. Inspect the bearings for undue wear or signs of roughness when rotated.

Micro-switch contacts — To set
1. Remove the low tension cable from the ignition coil, switch on the ignition and check that the actuator will select all six gear stations correctly.
2. Move the gear selector lever to D and fit the micro-switch cam to the actuator output shaft. When tightening the nut, the torque reaction should be taken by gripping the output lever such that the tightening force is not absorbed by the nylon teeth of the wormwheel.
3. Move the gear range selector lever to the Park position.
4. Locate the two right-hand micro-switches (see fig. T5-3).

Move the switches towards the peak of the cam until the switch plungers are in the centre of the peak and are depressed to within 0,51 mm (0.020 in) of the switch body as shown in figure T5-5. When both switches are in the correct position, tighten the mounting bolts.
5. Repeat this procedure on the left-hand micro-switches keeping the switch body on the Reverse micro-switch parallel to the bottom micro-switch body.
6. Select Reverse gear and check that all the other three switches are clear of the cams.
7. Select Neutral and ensure that the right-hand pair of switch plungers are correctly depressed and that the Reverse micro-switch is clear of the cam.
8. Switch off the ignition and fit the coil low tension cable.
9. Remove the actuator from the car and fit the casing side cover, painting both sides of the new gasket provided with a suitable jointing compound. Fit the actuator to the transmission, connecting the loom plugs and the actuator linkage.

Gearchange electric actuator — To assemble
1. Fit the main output shaft bearing into the actuator casing. The bearing should be fitted such that it is slightly proud on both the inside and outside of the casing.
2. Inspect the inside edge of the cable entry hole and ensure that it is free from burrs and sharp edges.
3. Check the gear form on the wormshaft is free from burrs and that no foreign particles are trapped between the gear teeth.
4. Fit the bearings to the wormshaft ensuring they are lubricated with Retinax A grease. These should be a push fit.
5. Assemble the wormshaft and bearings into the actuator case. The bearings must be a push fit in the casing bores; on no account should they require a hammer load to assemble them.
6. Adjust the end-float of the wormshaft to between 0,005 mm and 0,012 mm (0.002 in and 0.005 in) using a suitable washer. Fit the circlip. Check the end-float on the end of the shaft using a dial indicator gauge (see fig. T5-2).

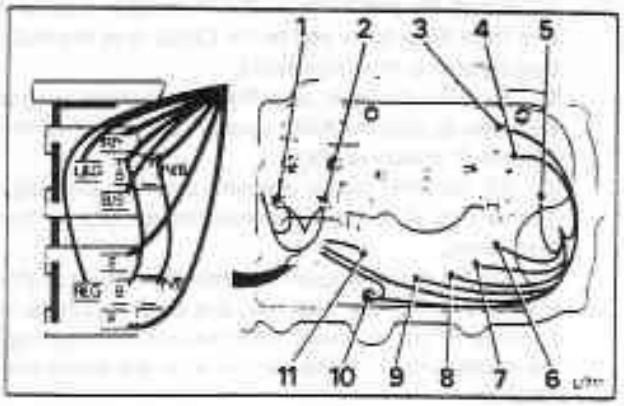

Fig. T5-4 Cable connections
1 Red/light green to motor
2 Blue/light green to motor
3 Red to relay
4 Black/brown to loom
5 Black/red to loom
6 Black/blue to loom
7 Black/green to loom
8 Black/yellow to loom
9 Black/white to loom
10 Black to earth terminal
11 Red/yellow to relay

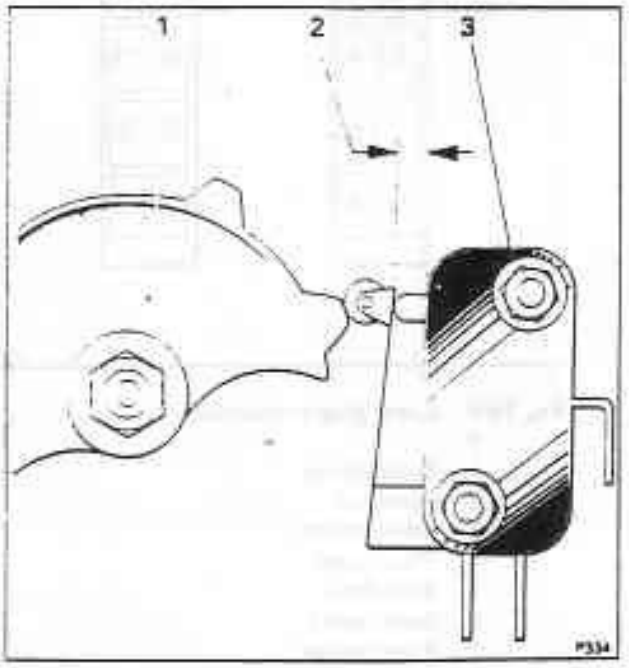

Fig. T5-5 Adjustment of micro-switches
1 Cam
2 Gap 0,51 mm (0.020 in)
3 Micro-switch

7. Check the gear form on the nylon gear is good and free from blow holes and burrs. Check that the shaft bearing area is free from burrs.
8. Fit the nylon gear onto the output shaft using four setscrews so that the holes used are at the end of the 'double D' machined flats.
9. Fit the silver plated segments onto the slip ring base. The corners of the segments must be completely free from burrs.
10. Fit the slip ring assembly onto the output shaft assembly, using four setscrews and washers. Check the tightness of the setscrews after the initial tightening as the nylon tends to settle slightly after the initial compression.

Note

It is essential that the slip ring runs true to the main output shaft.

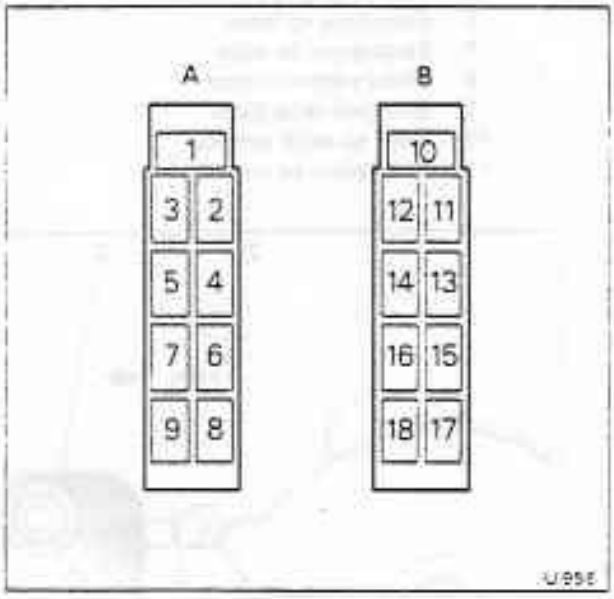

Fig. T5-6 Loom plug connections

A	
1	Brown/black
2	Black/red
3	Black/brown
4	Black/green
5	Black/blue
6	Black/white
7	Black/yellow
8	Black
9	Black/slate
B	
10	Green/black
11	Not used
12	Light green/green
13	Green/blue
14	White/brown
15	White/yellow
16	White/red
17	Brown/slate
18	Blue/brown

11. Ensure that both the shaft bearing surface and the inside of the porous bronze bush are clean. Do not clean the bronze bush with any degreasing agent.
12. Fit the main output shaft and slip ring assembly into the bush. This should slide in and no attempt should be made to force it into position.
13. Lift out the shaft and check it has received a smear of oil from the porous bronze bush. Lubricate the nylon gear with Retinax A grease and then fit the assembly into the casing.
14. Fit a bronze washer onto the outside of the shaft and then fit the circlip.

Note

Ensure the wormshaft can turn freely. Rotate the assembly until the slip ring open circuit sections are approximately at 90° to the wormshaft, and the flat side of the 'D' on the shaft is uppermost.

15. Fit the rubber gaiter to the outside of the casing and over the shaft. Then fit a bronze washer, connecting shaft, securing setscrew, and washer.
16. Fit the nylon coupling onto the driving dog of the wormshaft.
17. Seat the 'O' ring in its groove in the actuator casing and pass the motor feed wires through the hole in the casing. Mate the nylon coupling on the wormshaft with the motor shaft and hold the motor in position.
18. Fit the three mounting setscrews and washers and tighten evenly. Check that the wormshaft can be rotated easily.
19. Fit the sealing gasket and outlet elbow to the cable exit of the casing; secure with nuts and spring washers.
20. Feed the loom cables through the actuator casing from the inside. A strip of tape around the cable ends may assist in this operation. Pull the loom through until sufficient length of cable is left inside the casing to connect to the contact plate assembly.
21. Check the inside edges of the conduit elbow (tunnel connection) are free of burrs. Feed the loom through the conduit and elbow; push the conduit over the cable exit connection of the casing and the conduit elbow, secure both ends with spring clips. Remove the tape from the cable ends; connect the cables into the plugs (see fig. T5-6).
22. At the inside of the actuator casing fit a tie wrap to the loom at the cable exit. This should be passed through the centre of the loom and then wrapped around the loom 1½ times and fixed tightly. The position of the tie wrap must be such that when the actuator is suspended by the loom, the tie wrap takes the load and no electrical connections are under stress.
23. Connect the electrical connections to the relays on the underneath of the contact plate assembly. Fit a tie wrap around the cables and bracket to avoid a foul between the wires and motor shaft.
24. Loosely fit the contact plate assembly into the casing, taking care not to damage the relays. Guide the motor feed wires between the casing and the indentation in the contact plate tufnol base.
25. Fit the four nuts and washers, tightening them evenly.
26. View the layout of the contacts onto the slip ring through the elongated hole in the contact plate, and

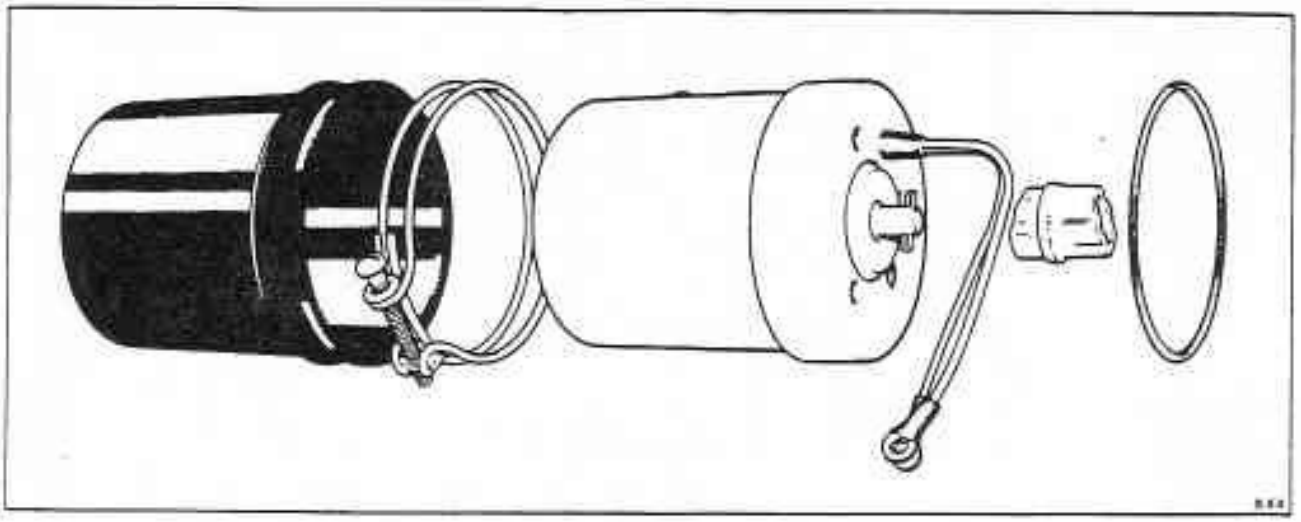

Fig. T5-7 Gearchange actuator motor

ensure that there is a minimum of 1,27 mm (0.050 in) between adjacent contacts. Also, ensure that there is approximately 1,58 mm (0.062 in) from either the edge of the segments or the countersinks for the retaining screws.

27. Fit the electrical connections, starting with the longest connections on the contact base, progressing to the shorter wires and then finally the micro-switches, suppressor, and motor terminations (see figs. T5-3 and T5-4).

28. Fit the casing lid, with its gasket painted with Wellseal on both sides. Tighten down using nuts and spring washers.

29. Fit the rubber boot over the motor. A smear of grease inside the leading edge of the boot assists the fitting. Retain the boot onto the motor using a wire clip, which, while needing reasonable tightening should not be allowed to cut into the rubber.

Gearchange actuator motor – To dismantle

1. Tap out the driving pin from the driving shaft (see fig. T5-7).
2. Unscrew and withdraw the two bolts securing the motor housing, remove the housing.
3. Remove the armature from the end plate.

Gearchange actuator motor – To inspect

1. Examine the magnets for any damage, cracks, or fractures.
2. Examine the brushes for wear; fit new brushes if necessary.
3. Examine the armature commutator for wear or damage; if scored polish with fine emery cloth. If the score marks are heavy and cannot be removed with light polishing, fit a new armature.
4. After polishing carefully clean the commutator slots to remove particles of carbon.
5. Examine the bearing bushes for wear, replace if necessary.
6. Examine the armature shaft for wear on the bearing diameter.

Gearchange actuator motor – To assemble

Assemble the actuator motor (see fig. T5-7) by reversing the procedure given for dismantling. Test the motor after assembly, if the current consumption exceeds 7.5 A, the armature has an electrical fault and should be renewed.

Gearchange electric actuator – To fit

1. Fit the actuator to the rear extension of the transmission.
2. Torque tighten the bolts.
3. Feed the plugs through the hole in the transmission tunnel. Secure the elbow to the tunnel ensuring that a new gasket is fitted. Feed the wiring loom behind the automatic air conditioning servo unit clips and connect the electrical plugs.
4. Connect the linkage.
5. Connect the battery.

Transmission - To remove and fit

Transmission – To remove

1. Drive the car onto a ramp.
2. Ensure that both front road wheels and one rear road wheel are suitably chocked to prevent the car moving.
3. Switch on the ignition and select Neutral position with the gearchange selector lever. This ensures that the transmission and propeller shaft are not locked in the Park position.
4. Switch off the ignition and remove the gearchange thermal cut-out from the fuseboard.
5. Disconnect the battery.
6. Jack up the un-chocked rear road wheel to enable the propeller shaft to be rotated.
7. Disconnect the propeller shaft at the gearbox end.
8. Lower the rear road wheel and suitably chock.
9. Raise the bonnet.
10. Drain the transmission fluid (see Section T2).
11. Remove the dipstick and filler tube, together with the vacuum modulator pipe. Blank off the hole in the sump to prevent any remaining transmission fluid from running out as the transmission is removed.
12. Disconnect the speedometer electronic impulse transmitter electrical connections, noting the cable colours to assist when fitting. Slacken and remove the transmitter retaining nut and withdraw the transmitter.
13. Disconnect the top gear switch and detent solenoid electrical connections.
14. Remove the gearchange actuator electrical connections (see Section T5).

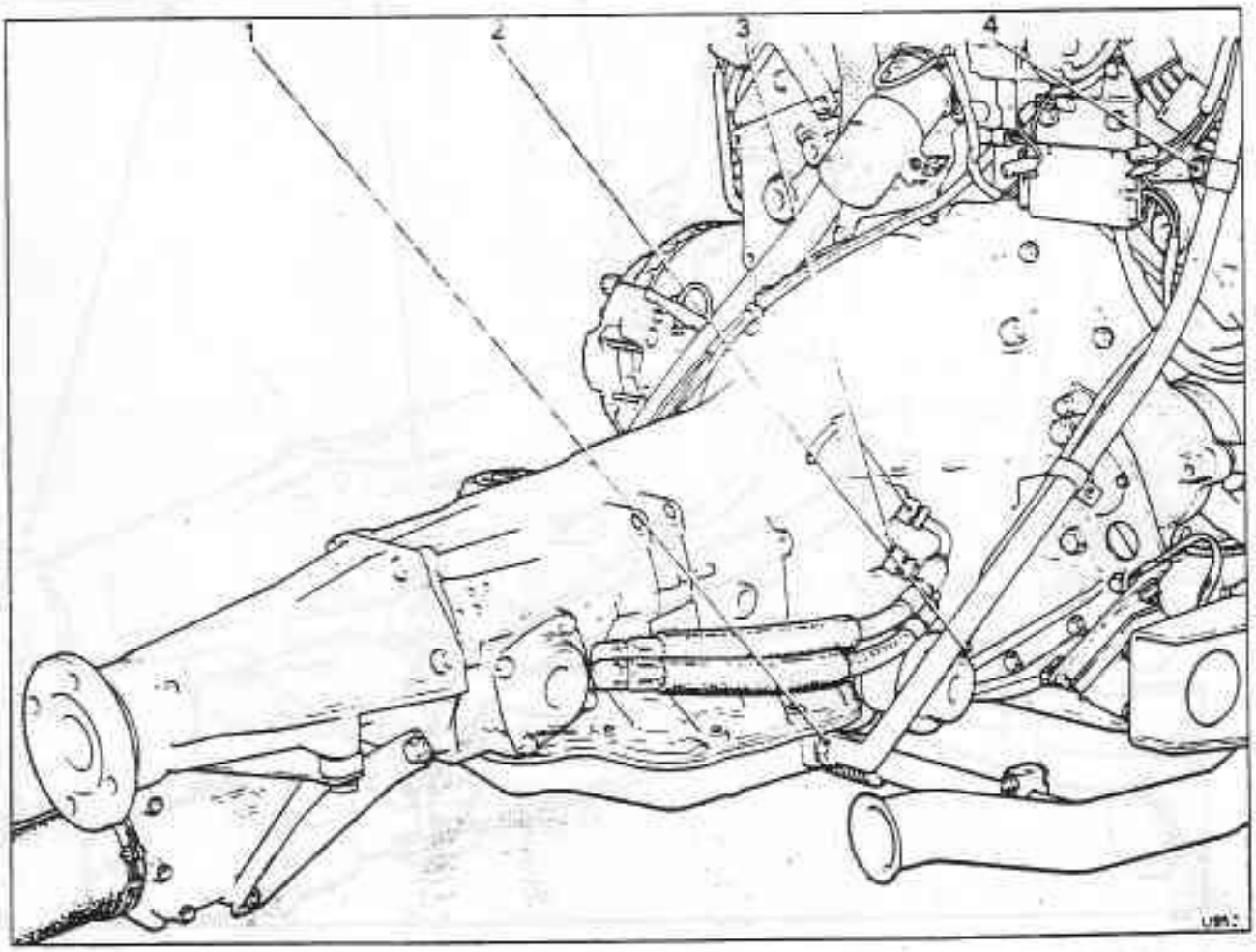

Fig. T6-1 Transmission disconnecting points – Right-hand side

1 Fluid drain point
2 Modulator pipe
3 Transmission oil cooler pipe connections
4 Dipstick/filler tube clip

15. Disconnect the operating rod from the side of the transmission case.
16. Remove the bolts securing the gearchange actuator to the rear extension; remove the actuator.

Note

Operations 14, 15 , and 16, are only required to assist the handling of the transmission.

17. Remove the right-hand front silencer/catalytic converter and fire shield (if fitted).
18. Remove the front balance/E.G.R. balance pipe (if fitted).
19. On cars with a fuel injection system remove the front section of the exhaust system (see Chapter Q).
20. On left-hand drive cars remove the throttle linkage cross-shaft.
21. Disconnect the two transmission fluid flexible pipes leading to and from the heat exchanger situated in the engine coolant radiator. The pipes should be disconnected where the flexible pipe joins the solid metal pipe.

Note

There may be a small quantity of transmission fluid in the pipes which will drain out when the pipes are disconnected therefore, ensure a suitable container is available.

22. Remove the setscrews which secure the front cover plate and bell housing bottom cover; remove the plate and cover.
23. Scribe correlation marks onto the converter and flexplate. Then, remove the setscrews which secure the engine flexplate to the torque converter.

Note

Take care not to damage the flexplate or starter ring when turning the torque converter to gain access to the setscrews.

24. Using a suitable platform to fit around the transmission sump, support the transmission with the aid of a trolley jack and extension.
25. Unscrew the setscrews which secure the transmission to the adapter.
26. Carefully move the transmission towards the rear of the car until the dowels in the transmission are clear of the mounting plate.
27. Fit the retaining clamp RH 7952 to prevent the converter from becoming disengaged from the transmission.

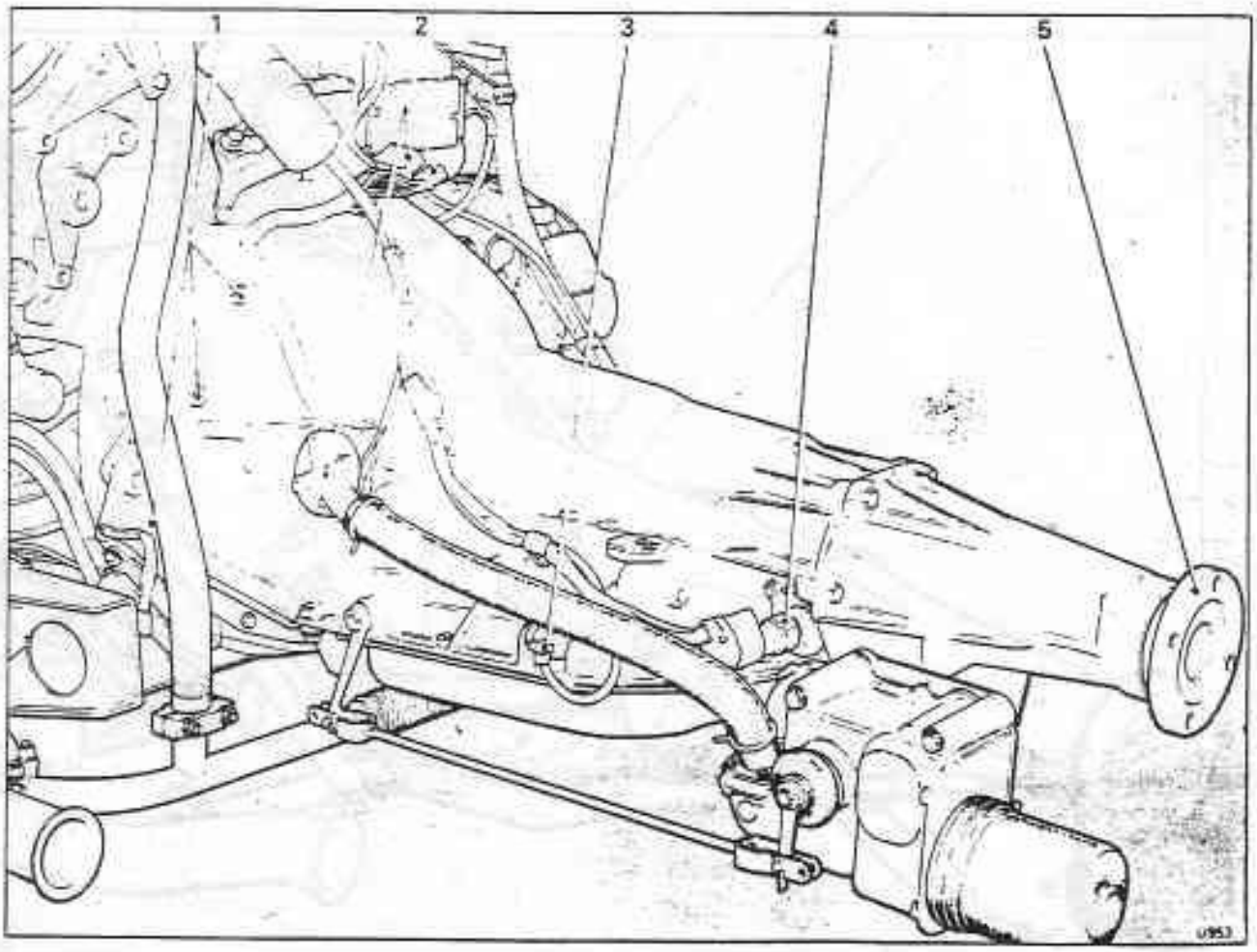

Fig. T6-2 Transmission disconnecting points – Left-hand side

1 Transmission securing setscrews
2 Gearchange actuator connections
3 Top gear switch/detent solenoid connections
4 Electronic impulse transmitter
5 Coupling flange

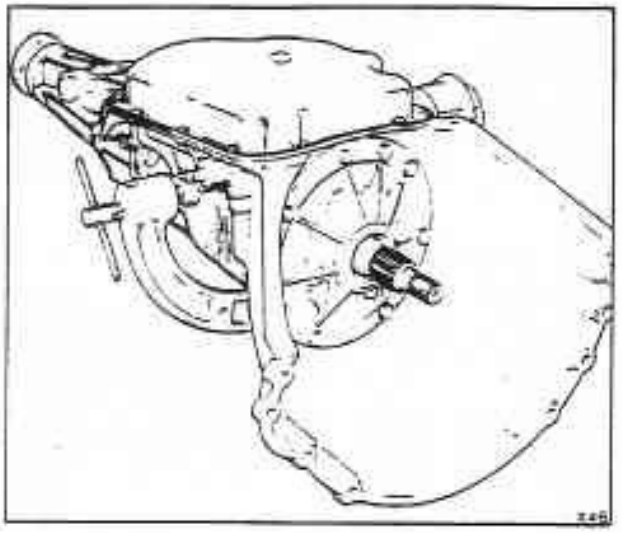

Fig. T6-3 Transmission in holding fixture

Note
The retaining clamp must be used, otherwise the converter may fall as the transmission is being removed.

28. Lower the jack until the transmission is clear of the body, then remove the transmission from beneath the car.
29. If overhaul work is to be carried out, remove the retaining clamp and withdraw the converter.

Note
A converter containing oil weighs approximately 23 kg (50 lb).

30. Fit the transmission into the holding fixture RH 7955 as shown in figure T6-3.

Transmission – To fit

Fit the transmission by reversing the procedure given for removal, noting the following.

1. Ensure the mating faces of the transmission and the mounting plate are clean and free from damage.
2. Torque tighten the various nuts, bolts, setscrews, etc. to the figures quoted in Section T22 and Chapter P.
3. A liberal coating of Retinax A grease should be applied all over the converter pilot spigot prior to fitting the converter.
4. Rotate the converter until the correlation marks (scribed on during removal) are aligned and then fit the setscrews. Do not lever on the starter ring when rotating the converter.
5. If a new transmission is being fitted, the heavy spot marked on the rear face of the flexplate by a radial line of either white or yellow paint must be positioned as close as possible to the light spot (white letter L) on the converter.
6. After completion of the fitting operation, fill the transmission with fluid (see Section T2).
7. Finally, road test the car for satisfactory operation.

Torque converter

The torque converter serves two primary functions. It acts as a fluid coupling to transmit engine torque smoothly to the transmission. It also multiplies the engine torque when additional performance is required.

The torque converter comprises three basic elements: a pump, a turbine, and a stator (see fig. T7-1).

The converter cover is welded to the pump to seal all three members in an oil filled housing.

On Turbocharged cars, the vanes are welded to the outer casing and the converter to flexplate securing lugs are more positively secured for added strength.

On 1985 model year Turbocharged cars and onwards, a modified torque converter is introduced together with an improved part throttle downshift (3-2). **The new torque converter can be fitted to pre 1985 turbo (RT) transmissions, providing the new control valve unit is also fitted.**

Note
Modified turbo torque converters must never be fitted to non-turbocharged cars.

An engine driven flexplate bolts directly onto the converter cover in three places (six places on Turbocharged cars), so that the converter pump is mechanically connected to the engine and turns whenever the engine rotates.

When the engine is running and the converter pump is rotating, oil is picked up at the centre of the pump and discharged at the rim, between the pump blades.

The pump shell and blades are designed so that the oil leaves the pump rotating clockwise, towards the turbine blades. As the oil strikes the turbine blades, it causes the turbine to rotate.

When the engine is idling, the converter pump rotates slowly and the force of oil is not sufficient to rotate the turbine with any efficiency. This situation enables the car to stand in gear with the engine idling. As the engine throttle is opened, the pump speed increases and the force of oil striking the turbine causes it to transmit torque to the gear train. After the oil has imparted its force to the turbine, the oil follows the contour of the turbine shell and blades, leaving the centre of the turbine, and rotating anti-clockwise.

Because the turbine member has absorbed the force required to reverse the direction of the clockwise rotating oil it now has greater torque than is being delivered by the engine.

To prevent the anti-clockwise spinning oil from striking the pump blades at an angle that would hinder its rotation, a stator assembly is interposed between the pump and the turbine. The purpose of the stator is to redirect the oil returning from the turbine so that its direction is altered to suit that of the pump.

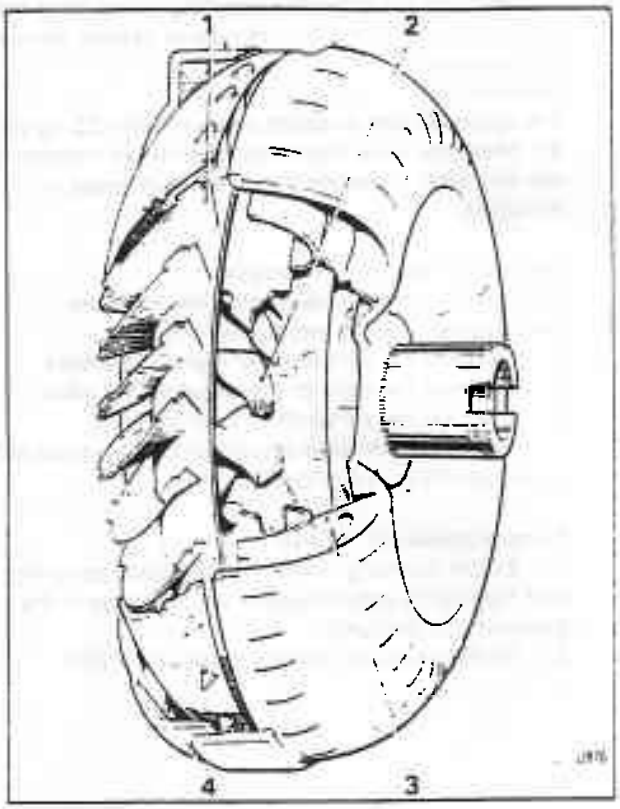

Fig. T7-1 Torque converter
1 Turbine
2 Stator
3 Pump
4 Converter cover

The energy of the oil is then used to assist the engine in turning the pump. This increases the force of the oil driving the turbine and as a result, multiplies the torque.

The force of the oil flowing from the turbine to the stator blades tends to rotate the stator anti-clockwise. However, a clutch on which the stator is mounted, prevents this.

As both turbine and car speeds increase, the direction of the oil leaving the turbine changes. The oil flows clockwise against the rear side of the stator vanes. If the stator was fixed, the flow of the oil would be impeded, but the clutch allows the stator to rotate on its shaft. Once the stator becomes inactive there is no further torque multiplication and the converter functions as a fluid coupling at a ratio of 1:1.

Torque converter – To remove

1. Remove the transmission as described in Section T6.

Note

Do not forget to fit the converter holding clamp RH 7952 otherwise the converter may fall when the transmission is removed.

2. Position a drip tray underneath the converter.
3. Remove the converter retaining clamp from the bell housing end of the transmission casing; remove the converter.

Caution

The converter and oil weigh approximately 23 kg (50 lb). Therefore, care should be taken when removing the converter to ensure that it is not dropped or damaged.

Torque converter – To inspect

After removing the torque converter from the transmission visually inspect as follows.

1. Examine the converter for signs of damage.
2. Examine the neck of the converter for wear.
3. Examine the pump drive slots for wear.

For a more detailed procedure of inspection refer to Section T21 – Fault Diagnosis.

Torque converter – To fit

1. Fit the converter to the transmission, ensuring that the driving slots engage with the tangs in the transmission oil pump.
2. Fit the converter holding clamp RH 7952.

Loss of Torque at Low Engine Speed

On high-mileage vehicles under regular city use, it may occur that there is a sudden and permanent loss of torque by a factor of two on start-off. This is usually accompanied by a rattling noise from the region of the torque converter. In this circumstance, the cause is often due to the collapse of the one-way stator sprag clutch within the torque converter. If this is the case, either a service exchange torque converter must be fitted or the fitted torque converter rebuilt. In each case, the torque converter's input neck should be replaced if there is any noticeable wear groove whatsoever. A new front pump oil seal should be fitted at the same time. Whilst the vehicle may continue to drive in the defective mode, the transmission will be subject to fluid overheating and to mechanical damage by broken sprag clutch debris.

Transmission Leaks from the Bellhousing

On high-mileage vehicles, it has may occur that there is transmission fluid leakage from beneath the bellhousing. In this circumstance, the cause is often due to the failure of the front pump oil seal. In such cases, the torque converter should be removed, the seal replaced, and the torque converter input neck should be replaced if there is any noticeable wear groove whatsoever. In this situation, it is also advisable to renovate the torque converter, fitting a new one-way stator sprag clutch.

Vacuum modulator and valve

The vacuum modulator is secured to the right-hand side of the transmission case and is connected by a pipe to the engine induction system. The modulator consists of a metal case which encloses an evacuated metal bellows, a diaphragm and two springs. These components are arranged so that when fitted, the bellows and an external spring apply a force that acts on the modulator valve to increase modulator pressure. Engine vacuum and an internal spring act in the opposite direction to decrease modulator pressure.

To reduce the effect of altitude on shift points, the effective area of the diaphragm is different than that of the bellows. Atmospheric pressure acts on the resulting differential area to reduce modulator pressure.

The vacuum modulator fitted to a transmission can vary dependent upon 'model year' and original build specification of the car. It is therefore, of utmost importance to ensure that the correct parts are fitted to a transmission should replacement parts be required.

To identify the modulator check the prefix letters of the transmission i.e. RR, RR-A, RT, or RC.

Blue modulator – RT and RR transmissions
Cars other than those conforming to an Australian, Japanese, or North American specification.

Black modulator – RR-A transmissions
Cars conforming to an Australian specification.

Brown modulator – RC transmissions
Cars conforming to a Japanese or North American specification.

A restrictor is fitted at the bottom of the modulator pipe and an error in assembly at this point could result in a blocked signal line especially on cars fitted with full emission control systems.

On Turbocharged cars, a 'T' piece and a one-way valve are used in the vacuum modulator line to prevent pressure build-up. With normal vacuum the system works as other modulator systems, but, when pressure builds-up, the one-way valve opens and allows pressure relief into the compressor side of the turbocharger.

Modulator pressure is directed to the 1-2 regulator valve which reduces it proportionally. This tends to hold the 1-2 shift valve in the closed or down-change position. Modulator pressure is directed also to the 2-3 modulator valve to apply a variable pressure proportional to

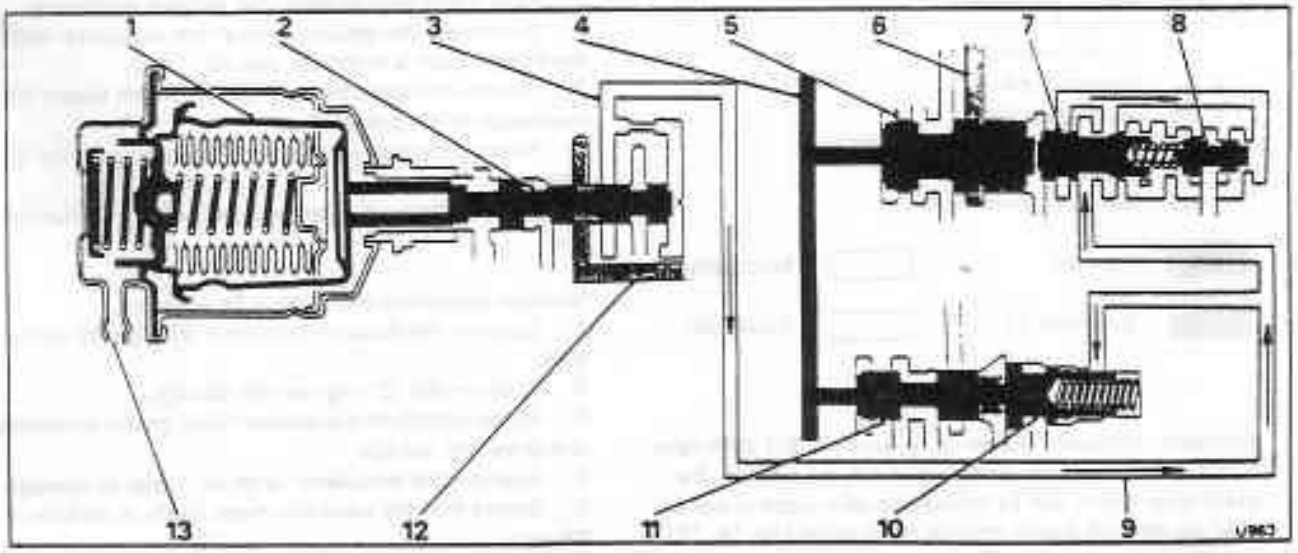

Fig. T8-1 Vacuum modulator and valve showing modulator pressure

1	Vacuum modulator	6	Drive oil	10	2-3 modulator valve
2	Modulator valve	7	1-2 detent valve	11	2-3 valve
3	Modulator oil	8	Regulator valve	12	Line oil
4	Governor oil	9	Modulator oil	13	Vacuum connection
5	1-2 valve				

Drive or Line oil | Governor oil | Modulator oil

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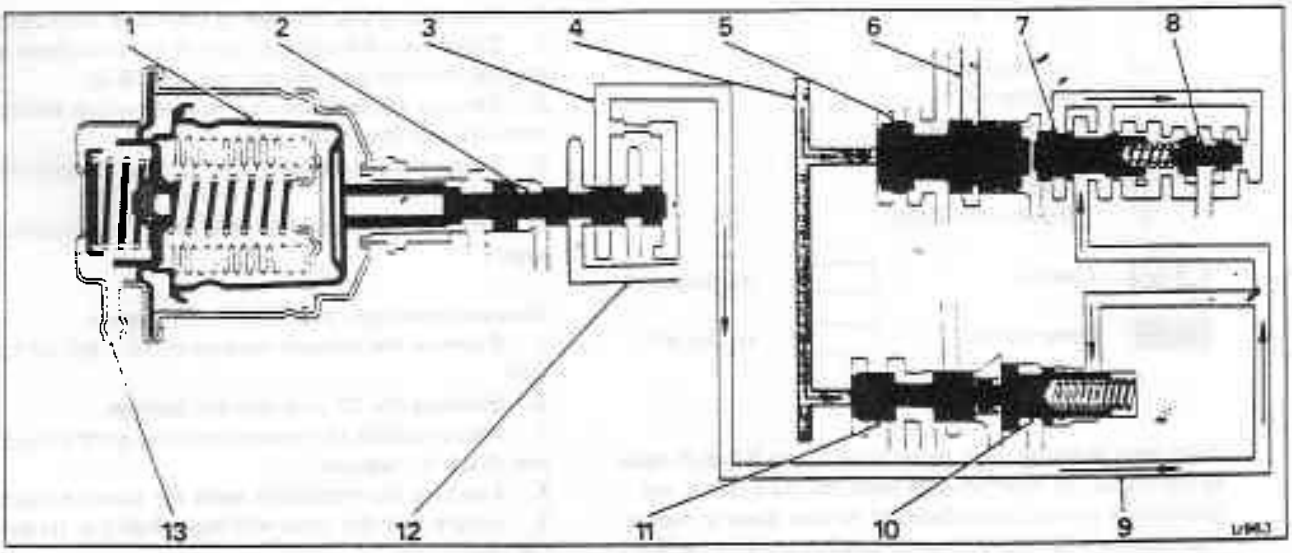

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4	Governor oil	9	Modulator oil	13	Vacuum connection
5	1-2 valve				

Drive or Line oil — Governor oil — Modulator oil

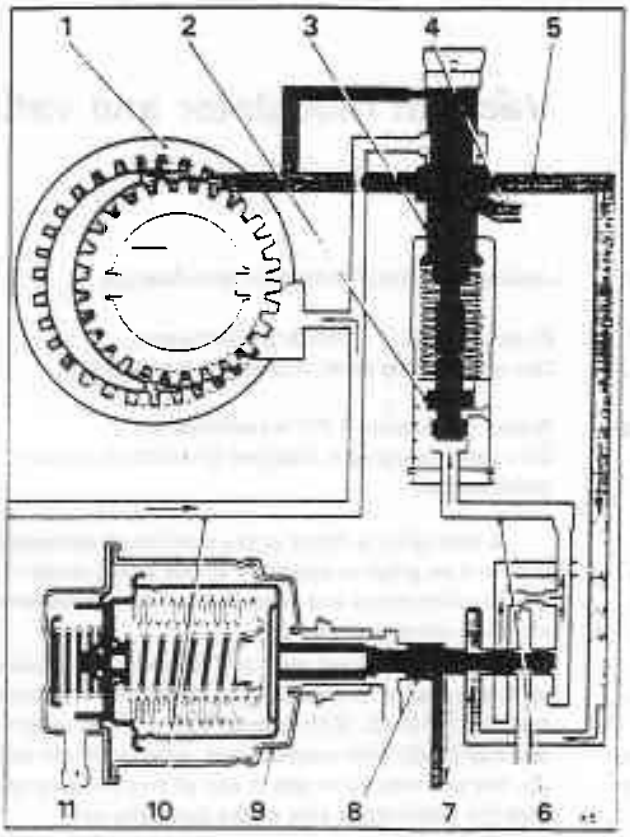

Fig. T8-2 Vacuum modulator and valve showing line pressure control

1 Pump assembly
2 Boost valve
3 Regulator valve
4 Converter passage
5 Line oil
6 Modulator oil
7 Governor oil
8 Modulator valve
9 Vacuum modulator assembly
10 Intake oil
11 Vacuum connection

Line oil — Modulator oil

Governor oil — Intake oil

modulator pressure. This tends to hold the 2-3 shift valve in the closed, or down-change position. As a result, the gearchange points can be delayed to take place at higher road speeds with heavy throttle application (see fig. T8-1).

Main line oil pressure is controlled in Drive range so that it will vary with torque input to the transmission. Since torque input is a product of engine torque and converter ratio, modulator pressure is directed to a pressure regulator boost valve, to adjust main line (pump) pressure for changes in either engine torque or converter ratio (see fig. T8-2).

To regulate modulator pressure (and in turn line pressure), with the torque converter ratio (which

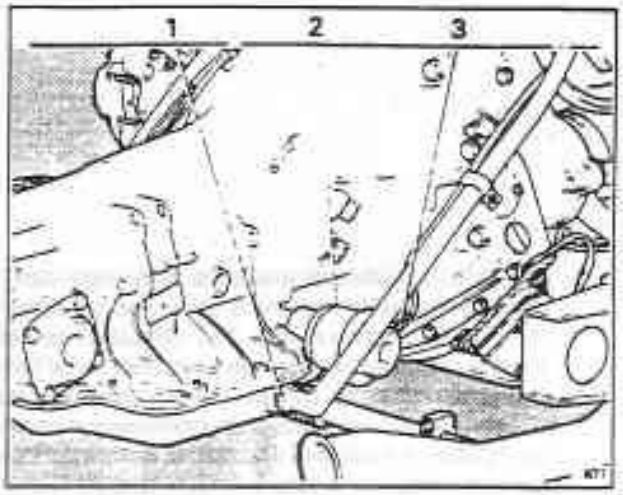

Fig. T8-3 Vacuum modulator and vacuum pipe

1 Fluid drain point
2 Vacuum modulator
3 Vacuum pipe

decreases as car speed increases), governor pressure is directed to the modulator valve to reduce modulator pressure with increases in car speed. In this way, line pressure is regulated to vary with torque input to the transmission for smooth changes with sufficient capacity for both heavy and light acceleration.

Vacuum modulator and valve – To remove

The vacuum modulator can be removed from the transmission without removing the transmission from the car. The following instructions apply whether or not the transmission has been removed.

1. Place a drip tray beneath the vacuum modulator.
2. Disconnect the vacuum pipe at the modulator end if the transmission is in the car (see fig. T8-3).
3. Remove the setscrew and retainer which secure the modulator to the transmission.
4. Remove the modulator and 'O' ring; discard the 'O' ring.
5. Remove the modulator valve from the transmission case.

Vacuum modulator and valve – To inspect

1. Examine the vacuum modulator for signs of distortion.
2. Examine the 'O' ring seat for damage.
3. Apply suction to the vacuum tube on the modulator and check for leakage.
4. Examine the modulator valve for scores or damage.
5. Ensure that the valve will move freely in its bore in the case.
6. Examine the modulator for damaged bellows. The modulator plunger is under approximately 71 N (16 lbf) pressure. If the bellows are damaged, very little pressure will be applied to the plunger.

Vacuum modulator and valve – To fit

1. Fit the valve into the bore in the case with the stem outward.
2. Fit a new 'O' ring to the modulator.

3. Fit the modulator to the case with the vacuum pipe connection toward the front of the car.
4. Fit the retainer together with the retaining setscrew and torque tighten (see Section T22).
5. Connect the vacuum pipe, ensuring that the restrictor is fitted.

3. Fit the modulator to the case with the vacuum pipe connection toward the front of the car.
4. Fit the retainer together with the retaining setscrew and torque tighten (see Section T22).
5. Connect the vacuum pipe, ensuring that the restrictor is fitted.

Governor assembly

The governor assembly (see fig. T9-1) fits into the rear of the transmission casing on the right-hand side. The car speed signal for the gear changes is supplied by the governor, which is driven by a gear on the transmission output shaft.

The assembly comprises a regulating valve, two primary weights, two secondary weights, secondary springs, body, and driven gear. The weights are arranged so that only the secondary weights act on the valve. The primary weights contribute to the secondary weights through the secondary springs.

On 1984 model year Mulsanne Turbo cars and onwards, the governor springs and weights have been uprated. These governor assemblies are only interchangeable with 'European' specification transmissions (e.g. RR and RT).

Slight changes in output shaft rev/min at low speeds result in small governor pressure changes.

The primary weights add additional force to the secondary weights to obtain greater changes in pressure as road speed and output shaft rev/min increase. As the primary weights move out at higher car speeds they reach a stop and no longer become effective. From this point, the secondary weights and springs only are used to apply pressure on the governor valve.

Drive oil pressure is fed to the governor where it is regulated by the governor and gives an oil pressure that is proportional to car road speed.

To initiate the gear change from first to second, governor oil pressure is directed to the end of the 1-2 shift valve where it acts against spring pressure which is holding the valve in the down-change (closed) position (see fig. T9-2).

As the road speed of the car and subsequently the governor oil pressure increases sufficiently to overcome the spring resistance, the 1-2 shift valve train moves, allowing drive oil to flow into the intermediate clutch passage and through an orifice to apply the intermediate clutch. This makes the intermediate clutch effective which moves the transmission into second gear. Further increases in road speed and governor pressure will cause the transmission to change into third gear when governor pressure overcomes the 2-3 shift valve spring pressure.

Governor pressure is directed also to the modulator valve to regulate modulator pressure as described in Section T8.

Governor lubrication is provided by a flat in the governor sleeve which allows oil to pass to the moving parts of the governor.

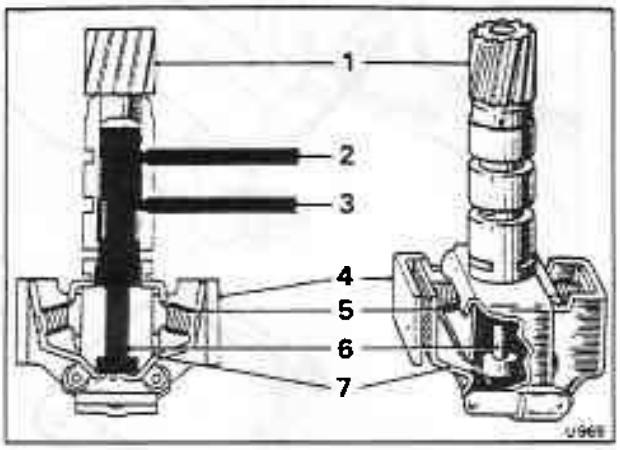

Fig. T9-1 Governor assembly

1 Driven gear
2 Drive oil
3 Governor oil
4 Primary weight
5 Spring
6 Valve
7 Secondary weight

Drive oil Governor oil.

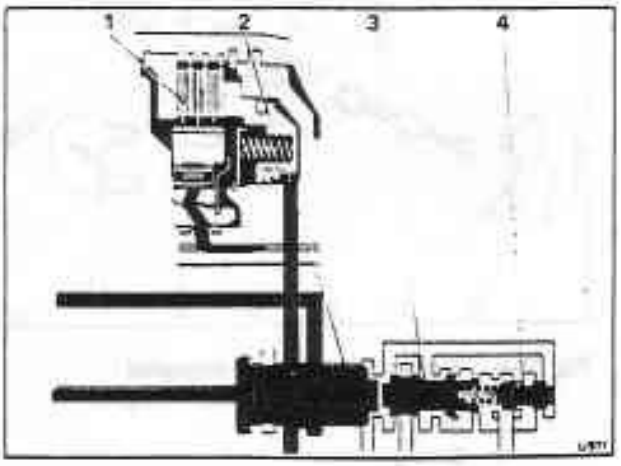

Fig. T9-2 Governor oil acting on the 1-2 shift valve

1 Intermediate clutch
2 1-2 valve
3 1-2 detent valve
4 Regulator valve

Drive and Intermediate clutch oil

Governor oil

Governor assembly — To remove

The governor assembly can be removed from the transmission whether the transmission is fitted to the car or not.

1. Position a drip tray beneath the governor cover plate.

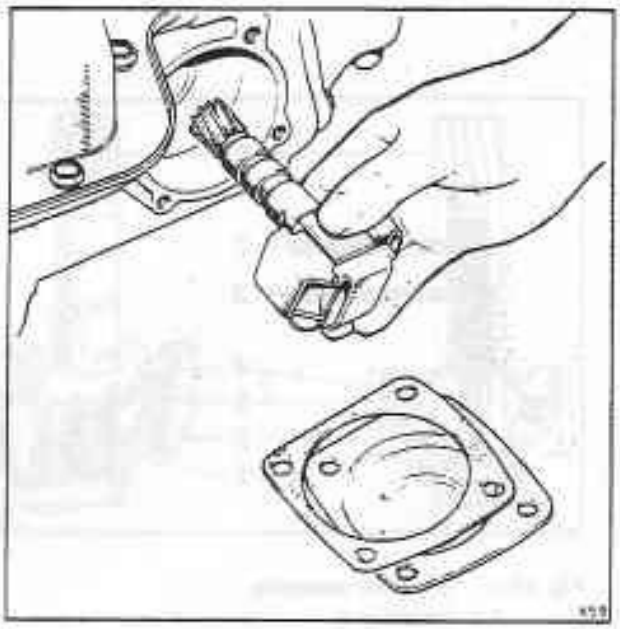

Fig. T9-3 Removing the governor assembly

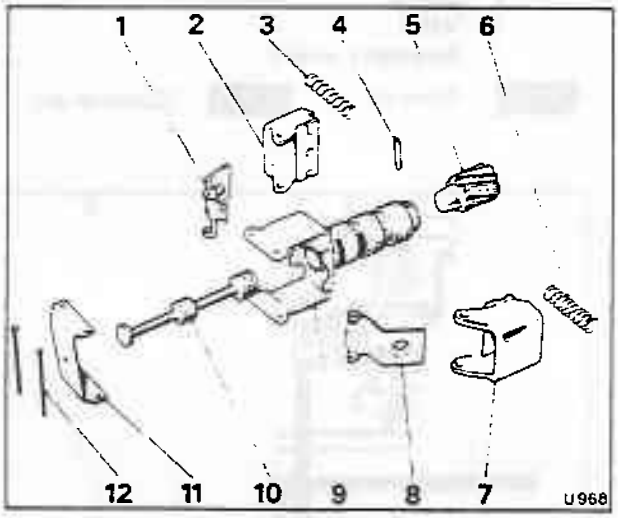

Fig. T9-4 **Governor assembly — exploded**

1 Spring retainer (secondary weight)
2 Weight (primary)
3 Spring
4 Gear retaining pin
5 Driven gear
6 Spring
7 Weight (primary)
8 Spring retainer (secondary weight)
9 Sleeve and carrier assembly
10 Valve
11 Thrust cap
12 Retaining pins

2. Remove the four setscrews which secure the plate to the case; remove the plate and discard the gasket.
3. Withdraw the governor assembly from the case (see fig. T9-3).

Possible causes of governor binding or locking are the pipes to the control valve unit. These may have been fitted too deep into the transmission case, so entering the governor bore.

Therefore, if difficulties are experienced when removing the governor assembly, withdraw the pipes approximately 3,17 mm (0.125 in).

Governor assembly — To dismantle

All the governor assembly components, with the exception of the driven gear, are selectively assembled and each assembly is calibrated. Therefore, it is recommended that if the governor assembly becomes unserviceable, it be renewed as an assembly. If the driven gear is damaged, it can be renewed separately.

It is necessary to dismantle the governor assembly in order to renew the driven gear. Dismantling may be necessary also to thoroughly clean the governor should dirt cause it to malfunction. In such cases proceed as follows.

1. Cut off one end from each of the governor weight retaining pins.
2. Remove the pins, thrust cap, governor weights, and springs (see fig. T9-4). The weights are interchangeable and need not be marked for identification.
3. Carefully remove the governor valve from the sleeve.

Governor assembly — To inspect

1. Wash all the components in clean paraffin, then dry them with compressed air.
2. Examine the governor sleeve for scores or burrs.
3. Ensure that the governor sleeve will slide freely into its bore in the transmission casing.
4. Examine the valve for scores and burrs.
5. Ensure that the valve will slide freely in the govenor sleeve bore.
6. Examine the driven gear for damage. Ensure that the gear is secure on the shaft.
7. Examine the springs for damage or distortion.
8. Ensure that the weights operate freely in their retainers.
9. Hold the governor as shown in figures T9-5 and T9-6. Then, check that there is a minimum of 0,51 mm (0.020 in) at the inlet and exhaust openings.

Governor driven gear — To renew

1. Drive out the gear retaining pin using a hammer and drift (see fig. T9-7).
2. Support the governor sleeve on two 2,77 mm (0.109 in) thick plates inserted in the exhaust slots in the sleeve.
3. Position the plates on the bed of a press with provision for the gear to pass through, then, using a long drift, press the gear out of the sleeve.
4. Thoroughly clean the governor sleeve to remove any swarf which may be present from the original gear assembly operation.

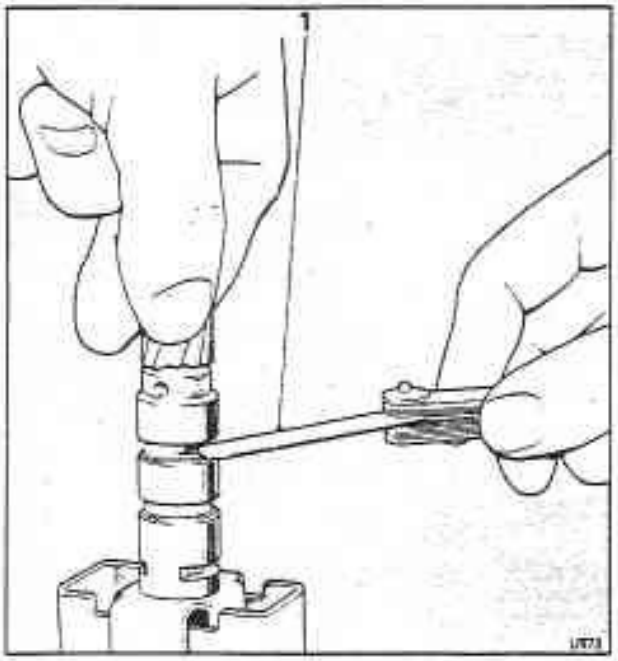

Fig. T9-5 Check valve opening (inlet)
1 0,51 mm (0.020 in) feeler gauge

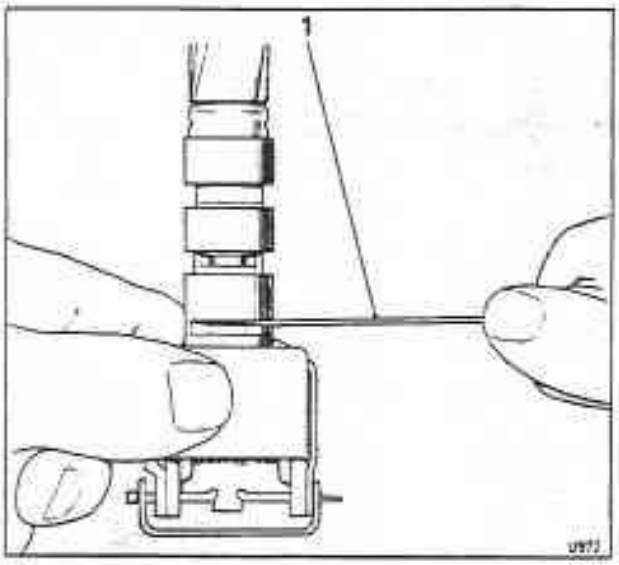

Fig. T9-6 Check valve opening (exhaust)
1 0,51 mm (0.020 in) feeler gauge

Note
Ensure that the new gear is the correct one for the transmission casing in which it is to be fitted.

5. Support the governor sleeve on the two 2,77 mm (0.109 in) plates.
6. Position the new gear in the sleeve then, using a suitable drift, press the gear into the sleeve until it is nearly seated.
7. Carefully remove any swarf which may have shaved off the gear hub, then, press the gear down until it abuts the sleeve.
8. Mark the position of a new hole on the sleeve at 90° to the original hole, then using a drill of 3,17 mm (0.125 in) diameter, drill a new hole through the sleeve and gear.
9. Fit the gear retaining pin.
10. Thoroughly wash the gear and sleeve assembly in clean paraffin and dry with compressed air.

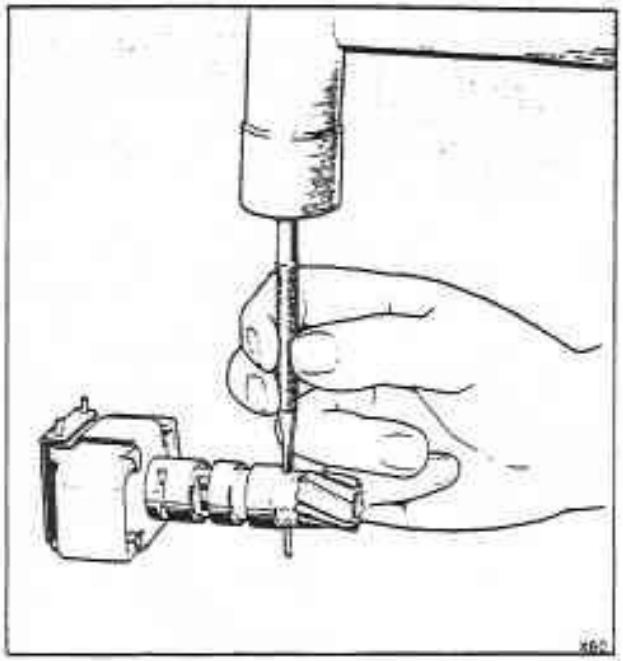

Fig. T9-7 Removing governor driven gear retaining pin

Governor assembly – To assemble

1. Lightly oil the valve then fit it into the governor sleeve.
2. Fit the governor weights, springs, and thrust cap onto the governor sleeve.
3. Align the pin holes in the thrust cap, governor weight assemblies, and governor sleeve.
4. Fit new pins and crimp both ends of the pins.
5. Ensure that the governor weights are free to operate on the pins and check that the valve moves freely in the sleeve bore.

Governor assembly – To fit

1. Lightly lubricate the governor sleeve and gear then fit the governor assembly into the transmission case.
2. Fit the cover, together with a new gasket.
3. Fit the four setscrews and torque tighten (see Section T22).
4. When installing the governor assembly ensure that a clearance of approximately 6,35 mm (0.250 in) is maintained between the governor pipes and transmission case, at a point 25,40 mm (1 in) from the right-angle bend of the pipes.

Speedometer drive

The speedometer drive is secured to the left-hand side of the transmission main casing by a setscrew and retainer. It is driven by a gear on the transmission output shaft at a ratio of 43:19. The driven gear has 43 teeth and is colour coded purple for identification purposes.

On Mulsanne Turbo cars, the speedometer driven gear is altered to suit the 13/35 axle ratio. Therefore, the speedometer ratio changes to 38:19. The driven gear has 38 teeth and is blue in colour.

On Bentley Turbo R cars fitted with Pirelli P7 275/55 VR15 tyres, the speedometer driven gear has 39 teeth and is brown in colour. **However, if any larger radius tyres are fitted, the brown gear must be replaced by a blue one having 38 teeth.**

On cars produced from 1984 and onwards, the aluminium speedometer drive is replaced by a plastic assembly as shown in figure T10-2. This assembly is interchangeable with the original type provided that the speedometer transmitter is also changed.

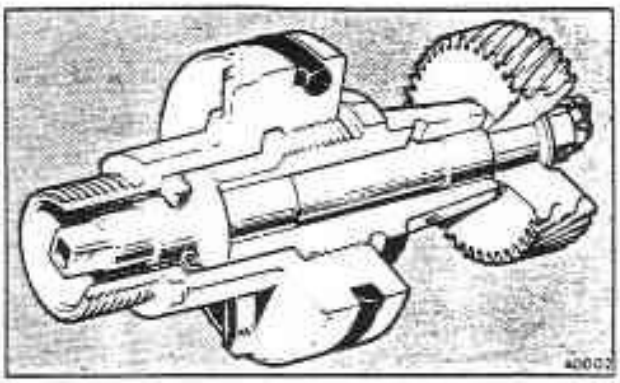

Fig. T10-1 **Speedometer drive** Cars produced prior to 1984

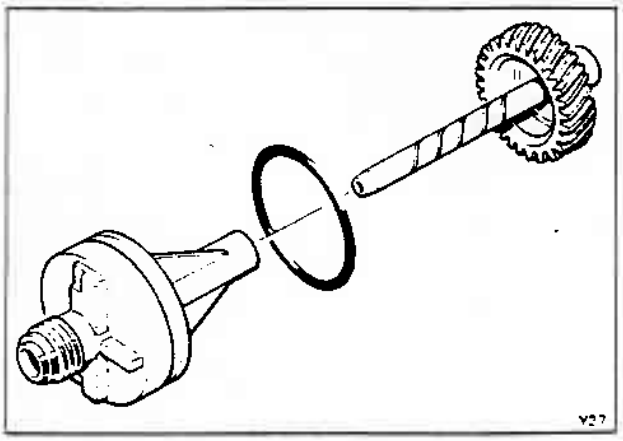

Fig. T10-2 **Speedometer drive** Cars produced from 1984 and onwards

Speedometer drive – To remove

1. Slacken and withdraw the hexagon nut securing the electronic impulse transmitter to the speedometer drive assembly.
2. Remove the setscrew and retainer; then withdraw the speedometer drive. Discard the 'O' ring.

Speedometer drive - To dismantle (see fig. T10-1)

1. Hold the gear between soft jaws in a vice.
2. Remove the split pin. Then, remove the nut and washer securing the gear to the drive-shaft.
3. Tap the gear off the shaft using a soft-headed mallet.
4. Utilizing the two machined flats on the oil seal housing, hold the housing between soft jaws in a vice. Then, unscrew the two halves of the assembly.
5. Withdraw the drive-shaft.

Speedometer drive - To inspect (see fig. T10-1)

1. Wash all the dismantled parts in clean paraffin.
2. Examine the gear teeth for damage or excessive wear.
3. Examine the squared end of the shaft for cracking.
4. Examine the threads on the oil seal retainer for damage.
5. If the oil seal is to be renewed it should be pressed out of the housing using a suitable drift.
6. Examine the drive-shaft for burrs or sharp edges which may damage the oil seal during assembly.

Speedometer drive - To assemble (see fig. T10-1)

To assemble the speedometer drive, reverse the procedure given for dismantling noting the following.

1. Torque tighten the castellated nut to the figures quoted in Chapter P; then tighten the nut to the nearest split pin hole.
2. Fit a new split pin.
3. Lightly lubricate the drive-shaft before passing it through the oil seal.
4. Ensure that the body and the seal housing are screwed tightly together.
5. Check the drive-shaft end-float; there should be a minimum of 0.38 mm (0.015 in).

Speedometer drive - To fit

1. Fit a new 'O' ring to the groove in the speedometer drive housing.
2. Lightly lubricate the 'O' ring to ease the fitting of the speedometer drive; fit the drive to the case.

3. Fit the retainer and setscrew. Torque tighten to the figures quoted in Section T22.
4. Connect the electronic impulse transmitter.

Sump and intake strainer

Sump — To remove

Transmission fitted in the car

1. Position the car on a ramp and raise to a suitable working height.
2. Place a clean container with a minimum capacity of 3 litres (5 Imp pt, 6 US pt) under the sleeve nut which secures the dipstick filler tube to the side of the sump.
3. Withdraw the transmission dipstick. Slacken the setscrew securing the filler tube clip to the cylinder head.
4. Release the nut securing the dipstick filler tube; withdraw the filler tube and move to one side, draining the fluid into the container.
5. Remove the setscrews securing the sump.
6. Remove the sump and discard the gasket.
7. Drain the remainder of the fluid from the sump.
8. Clean the sump with paraffin and dry with compressed air.

Transmission removed from the car

1. Position the transmission in the holding fixture RH 7955 with the sump upwards.
2. Carry out Operations 5 to 8 inclusive as described with the transmission fitted in the car.

Sump — To fit

To fit the sump reverse the procedure given for removal noting the following.

1. Ensure a new gasket is fitted.
2. Torque tighten the setscrews to the figures quoted in Section T22.
3. When filling the transmission with fluid refer to Section T2.

Note

The amount of fluid added depends on whether the intake strainer has been removed.

Intake strainer — To remove

1. Remove the sump.
2. Unscrew and remove the stepped bolt securing the intake strainer to the valve body assembly.
3. Remove the intake strainer assembly.
4. Discard the intake strainer and the 'O' ring from the intake pipe.

Intake strainer — To fit

1. Fit a new 'O' ring onto the intake pipe. Lubricate the 'O' ring with transmission fluid.
2. Ensure a new rubber seal is fitted to the bore in the new intake strainer, then fit the intake pipe into the strainer.
3. Fit the strainer assembly into the transmission case; secure with the stepped bolt. Torque tighten to the figures quoted in Section T22.
4. Fit the sump and fill with fluid. When filling the transmission with fluid refer to Section T2.

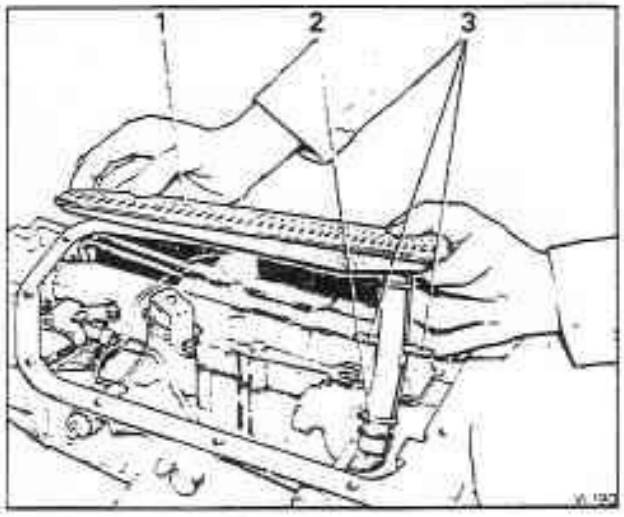

Fig. T11-1 Removing intake pipe and strainer assembly
1 Strainer assembly
2 Intake pipe with 'O' ring
3 Location tabs

Control valve unit

The control valve unit comprises a cast iron body containing shift valves and regulator valves that control the gear changes. The unit is secured to an oil spacer (guide) plate on the bottom face of the transmission.

Drive range

When the selector lever on the steering column is moved to D, the actuator moves the manual valve (through levers and rods) to allow main line oil pressure to be delivered to the forward clutch (see fig. T12-1). With the forward clutch applied, mechanical connection between the turbine shaft and the mainshaft is provided. The Low roller assembly becomes effective as the result of power flow through the compound planetary gear arrangement which moves the transmission into first gear.

As the speed of the car increases, first gear is no longer suitable and an up-change to second is required.

To initiate the change from first to second, governor pressure (see Section T9) is directed to the end of the 1-2 shift valve. As the car speed increases, governor pressure moves the valve to allow drive oil to apply the intermediate clutch. This makes the intermediate clutch effective and the transmission changes into second gear.

The change to third gear is controlled by the 2-3 shift valve. The operation of the 2-3 shift valve is similar to that of the 1-2 shift valve. Springs acting on the valve tend to hold the valve closed against governor pressure. When the speed of the car is sufficient, the 2-3 shift valve opens and allows intermediate clutch oil to apply the direct clutch. The transmission then moves into third (top) gear. Oil pressure to the direct clutch piston is applied only to a small inner area of the piston in third gear.

Down-change

When the accelerator pedal is released and the car is allowed to decelerate to a stop, the down-changes will occur automatically as the valve springs overcome the diminishing governor pressure.

Delayed up-change

If the hydraulic system was as basic as previously described, the gear change points would always occur at the same road speeds. When accelerating under heavy loads or when maximum performance is required, it is desirable to have the change points occurring at higher road speeds. To achieve this, a modulator valve is used (see Section T8).

Clutch application control

To introduce gearchange feel, and to ensure long clutch plate life, the clutch apply pressure is regulated to suit throttle application (see fig. T12-2). The intermediate

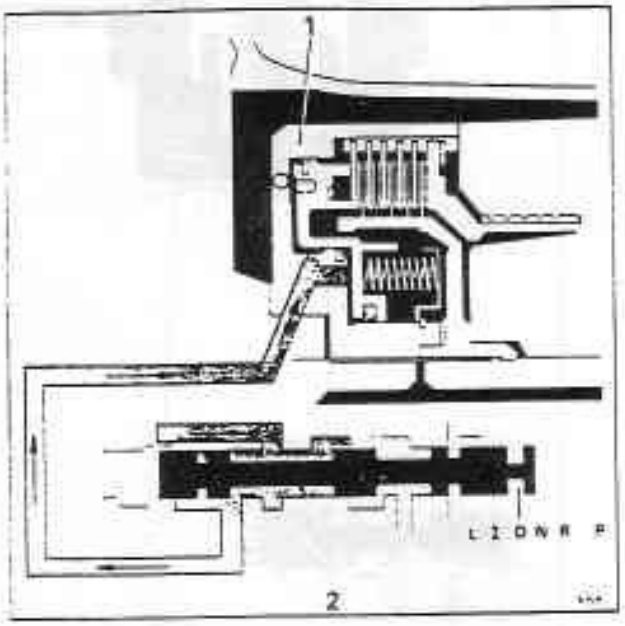

Fig. T12-1 Manual valve and forward clutch
1 Forward clutch
2 Manual valve

Line oil

clutch is controlled according to the throttle opening as follows.

Line pressure is varied by the modulator.

A 1-2 accumulator valve train provides a variable accumulator pressure to cushion the clutch application. The 1-2 accumulator valve train is supplied with drive oil and is controlled by modulator pressure. During light throttle application, drive oil is reduced to a low accumulator pressure. During heavy throttle applications, accumulator pressure approaches full main pressure. Accumulator pressure is made to act on one side of the rear accumulator piston in the rear servo (see Section T13). In first gear, the accumulator piston is stroked to its lower position to prepare it for the change to second gear.

When the 1-2 shift valve opens, intermediate clutch apply oil is also directed to the rear servo accumulator piston, stroking the piston against the 1-2 accumulator oil and the accumulator spring (see fig. T12-3). This action absorbs a small amount of the intermediate clutch apply oil and permits the clutch apply time and pressure to be controlled for the correct gear change feel.

The direct clutch apply rate is controlled by the front accumulator piston. Located in the control valve

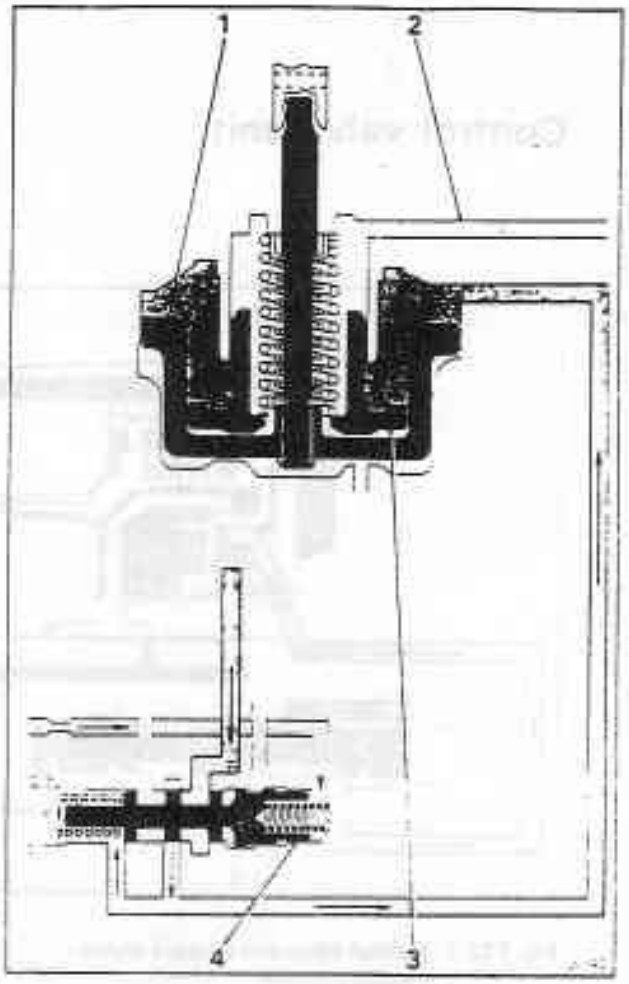

Fig. T12-2 Rear servo accumulator piston – Prior to 1-2 up-change
1 Servo piston
2 Intermediate clutch passage
3 Accumulator piston
4 1-2 accumulator valve

Drive oil

Modulator oil

1-2 accumulator oil

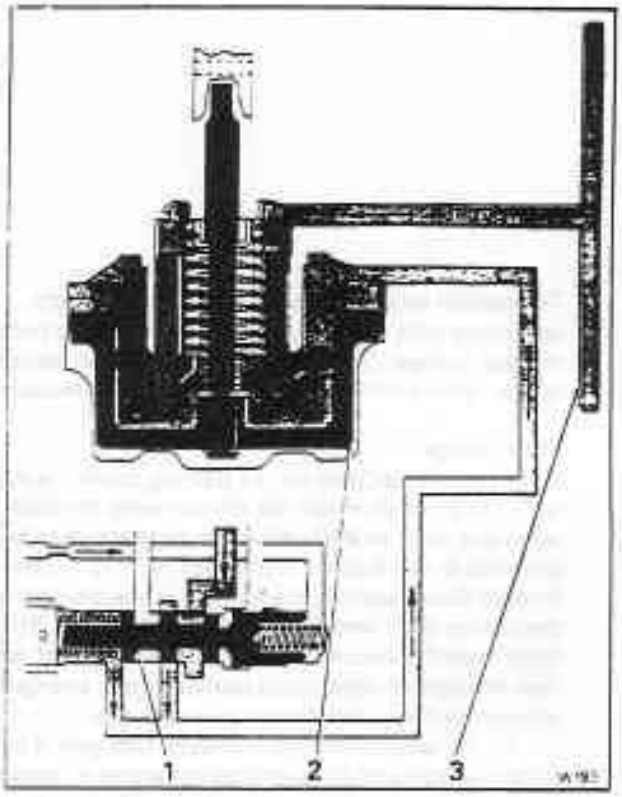

Fig. T12-3 Rear servo accumulator piston cushioning intermediate clutch application
1 1-2 accumulator valve
2 Servo piston
3 Intermediate clutch passage

Drive and intermediate clutch oil

Modulator oil

1-2 accumulator oil

assembly, it is part of the front accumulator and servo piston system (see fig. T12-4). In D range, second gear, the accumulator is stroked against the accumulator spring by servo oil. Because servo oil (main line pressure) varies with throttle opening, the pressure in the accumulator also varies, according to the throttle opening.

When the 2-3 shift valve opens, direct clutch oil flows to the direct clutch and the front accumulator piston (see fig. T12-5). Direct clutch pressure rises so that the force from it, plus the accumulator spring force, overcomes the force from the servo pressure and moves the accumulator piston to the stop on the accumulator piston pin. This in turn strokes the servo piston the same amount, allowing it to just contact the band apply washer on the servo pin. However, it will not move the pin or apply the band. The stroking of the accumulator piston absorbs an amount of direct clutch oil and permits the direct clutch to apply at a controlled rate for a smooth 2-3 change.

3-2 valve operation

To take full advantage of the torque converter's ability to multiply torque when required, a 3-2 valve is used. This valve permits the accelerator to be depressed for moderate acceleration at low speeds in third gear without causing the transmission to change down. This allows the torque converter to sense the changes in engine speed and and thus provide additional converter ratio for improved performance.

The 3-2 valve system is such that it will permit a 3-2 down-change during moderate to heavy acceleration when modulator pressure reaches approximately 7,4 bar (108 lbf/in^2) (see fig. T12-6). Modulated oil pressure, plus the 3-2 spring pressure, will move the 3-2 valve against the force of direct clutch oil allowing

modulator pressure to be directed to the 2-3 modulator valve. Modulator oil can then close the 2-3 valve train against governor pressure causing the part throttle 3-2 down-change.

Forced down-change (kick-down)

At road speeds below approximately 113 km/h (70 mile/h) a detent (forced) down-change can be obtained by depressing the accelerator pedal. When the accelerator pedal is fully depressed, the detent valve train takes over from the modulator as the change-point controller.

Main line oil is fed through a small orifice to one end of the detent valve. During normal operation, the port at the orifice end of the valve is sealed by the valve in the detent solenoid assembly. Line pressure thus holds the detent valve in an inoperative or normal position (see fig. T12-7).

When the throttle is wide open, an electric micro-switch is closed, energising the detent solenoid. This opens an exhaust port at the solenoid causing a pressure drop on the end of the detent valve. The detent valve is moved by the detent valve regulator valve spring and allows the detent regulator to regulate detent oil to a fixed pressure of approximately 4,8 bar (70 lbf/in^2).

When the detent valve moves, detent oil is allowed to flow into both the modulator and the detent oil passages to the shift valve trains. The points at which up-changes will then occur is controlled by detent pressure in the modulator passages. Detent down-changes are controlled by detent pressure in the detent passages. These change points are fixed at relatively high speeds by the constant oil pressure.

Detent pressure directed to the 1-2 regulator valve makes a detent 2-1 change available at car speeds below approximately 32 km/h (20 mile/h).

To preserve the clutch linings during 1-2 up-changes under full throttle conditions, detent oil is directed to the 1-2 accumulator valve to increase 1-2 accumulator pressure (see fig. T12-8).

Detent oil is also directed to the modulator valve to prevent modulator pressure from falling below 4,8 bar (70 lbf/in^2). This prevents main line pressure from falling below approximately 7,2 bar (105 lbf/in^2) regardless of altitude or car speed.

Intermediate range

When the selector lever is moved to the Intermediate I position, the manual valve is moved to uncover a passage which will allow intermediate oil to act on the 2-3 shift valve. Intermediate oil pressure on the 2-3 shift valve will cause the valve to move and the transmission will change down, regardless of car speeds (see fig. T12-9).

To provide overrun engine braking, the front band is applied by the front servo. Intermediate clutch oil flows to the apply side of the servo piston. An orifice is incorporated in the flow path to ensure a smooth piston movement and band application. Intermediate range oil is directed to a check ball which allows the oil to enter the modulator passage leading to the pressure regulator boost valve. The resultant increase of

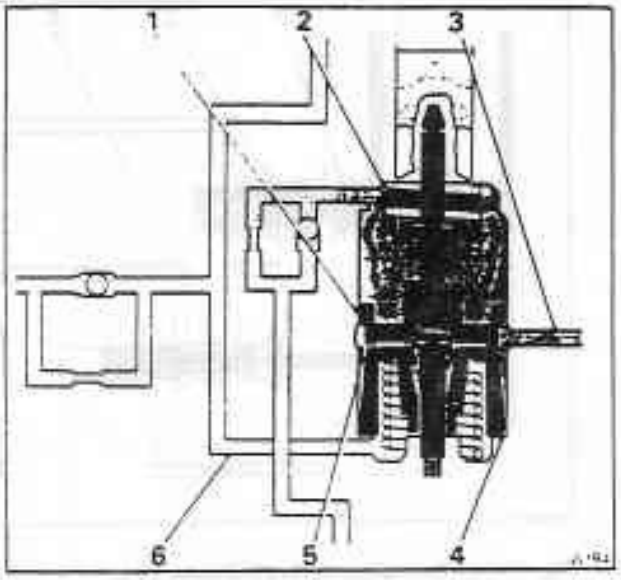

Fig. T12-4 Front servo accumulator piston – Prior to 2-3 up-change

1 Servo piston
2 Case
3 Intermediate clutch passage
4 Accumulator piston
5 Valve body
6 Direct clutch oil passage

Servo and intermediate clutch oil

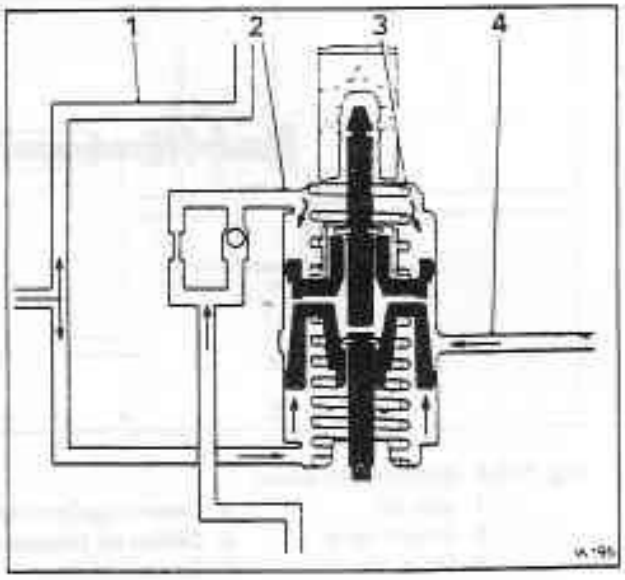

Fig. T12-5 Front servo accumulator piston cushioning direct clutch application

1 Direct clutch oil
2 Servo oil
3 Accumulator housing
4 Intermediate clutch oil

Direct clutch, front servo, and intermediate clutch oil

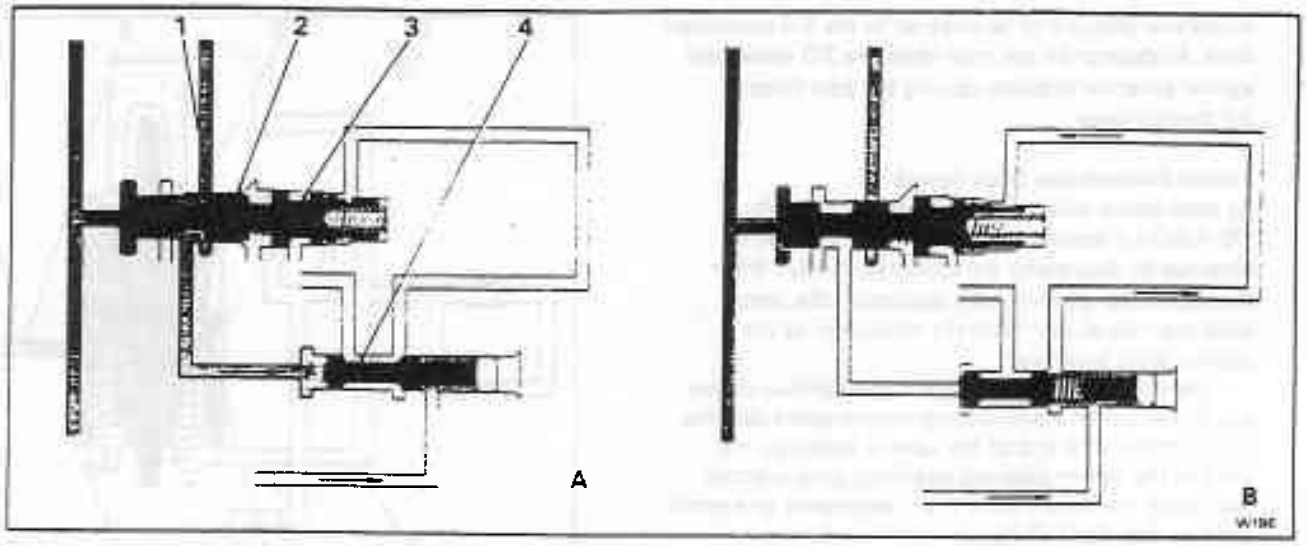

Fig. T12-6 Part throttle down-change (3-2)

1 Intermediate clutch oil
2 2-3 valve
3 2-3 modulator valve
4 3-2 valve

Intermediate clutch and direct clutch oil

Governor oil

Modulator oil

A Valves in 3rd gear position, modulator pressure below approximately 7,4 bar (108 lbf/in^2)

B Part throttle down-change valves in 2nd gear position, modulator pressure above 7,4 bar (108 lbf/in^2)

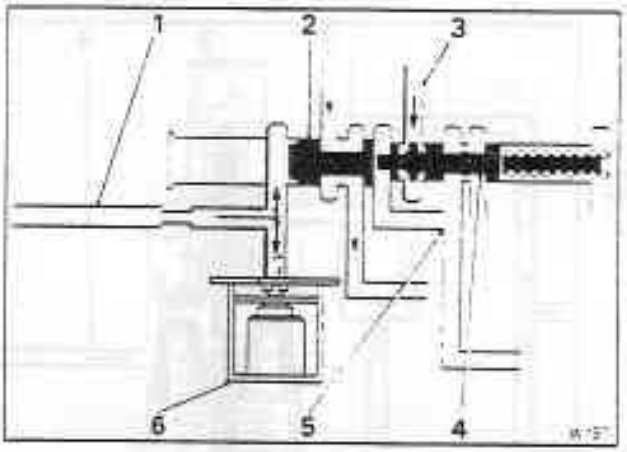

Fig. T12-7 Detent valve closed

1 Line oil
2 Detent valve
3 Drive oil
4 Detent regulator valve
5 Detent oil passage
6 Detent solenoid

Line and drive oil

Modulator oil

pressure on the end of the boost valve raises main line pressure to 10,3 bar (150 lbf/in^2) and provides sufficient holding forces for overrun engine braking.

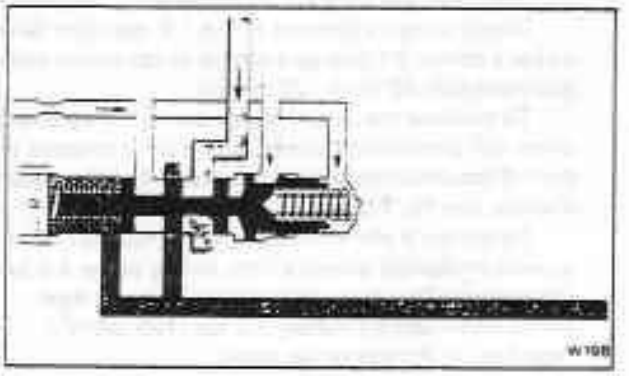

Fig. T12-8 1-2 Accumulator valve

Drive oil

Modulator oil

1-2 accumulator oil

Detent oil

Low range

When the selector lever is moved to the L range position, the manual valve is moved to allow Low range oil to flow to the detent regulator valve and spacer pin.

The spring behind the regulator valve then moves the regulator and detent valves to the opposite end of the valve bore. Low range oil then prevents the regulator valve from regulating and drive oil passes through the hole in the regulator valve into the detent and modulator passages at a Low range pressure of 10,3 bar (150 lbf/in^2).

As a result of this, the 1-2 shift valve will move to cause a down-change at road speeds below approximately 64 km/h (40 mile/h) and will prevent an up-change, regardless of the cars speed.

When the 1-2 shift valve closes, the exhausting intermediate clutch oil lifts two check balls off their

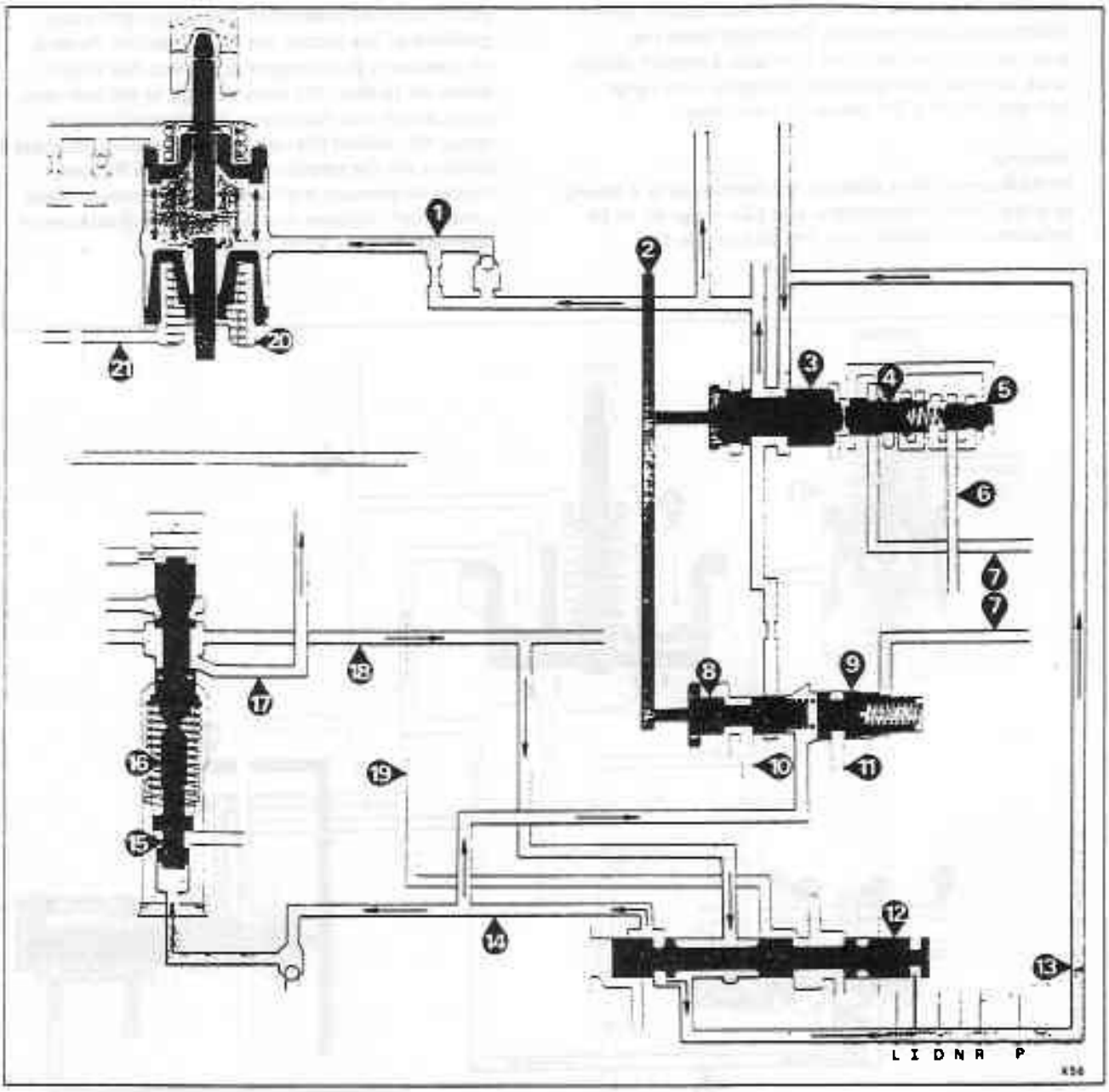

Fig. T12-9 Valves — Intermediate range — 2nd gear

1 Intermediate clutch oil	8 2-3 valve	15 Boost valve
2 Governor oil	9 2-3 modulator valve	16 Pressure regulator valve
3 1-2 valve	10 Direct clutch passage	17 Converter oil
4 1-2 detent valve	11 Detent passage	18 Line oil
5 Regulator valve	12 Manual valve	19 Servo oil passage
6 Detent passage	13 Drive oil	20 Front servo
7 Modulator oil	14 Intermediate oil	21 Direct clutch passage

Main line oil — Governor oil — Modulator oil

seats to enable the front band and the intermediate clutch to release quickly (see fig. T12-10).

To provide overrun engine braking, the rear band is applied by directing Low range oil pressure to the rear servo.

Low range oil is directed to the 1-2 accumulator valve during Low range operation to raise 1-2 accumulator pressure to line pressure. The increased pressure, directed to the rear servo accumulator piston, resists servo apply pressure. This slows down the application of the rear band to enable a smooth change to be obtained during manual change to Low range, first gear, or for a 2-1 change in Low range.

Reverse

When Reverse (R) is selected, the manual valve is moved to allow Drive, Intermediate, and Low range oil to be exhausted, and allows main line oil to enter the reverse passages (see fig. T12-11). Reverse oil pressure is directed from the manual valve to the large outer area of the direct clutch piston and to the 2-3 shift valve where it enters the direct clutch exhaust port. Reverse oil then flows past the 2-3 shift valve, which is in the down-change position, and enters the third gear direct clutch apply passage. This passage directs reverse oil pressure to the small inner area of the direct clutch piston. With oil pressure on both inner and outer positions of the piston, the clutch applies. Reverse oil pressure is also directed to a check ball which allows oil to enter the same passage to the rear servo apply piston that Low range oil occupied in Low range; this applies the rear band. To ensure adequate oil pressure for the torque requirements in Reverse, reverse oil pressure is directed to the pressure boost valve which increases line pressure to a maximum of approximately 17,9 bar (260 lbf/in^2).

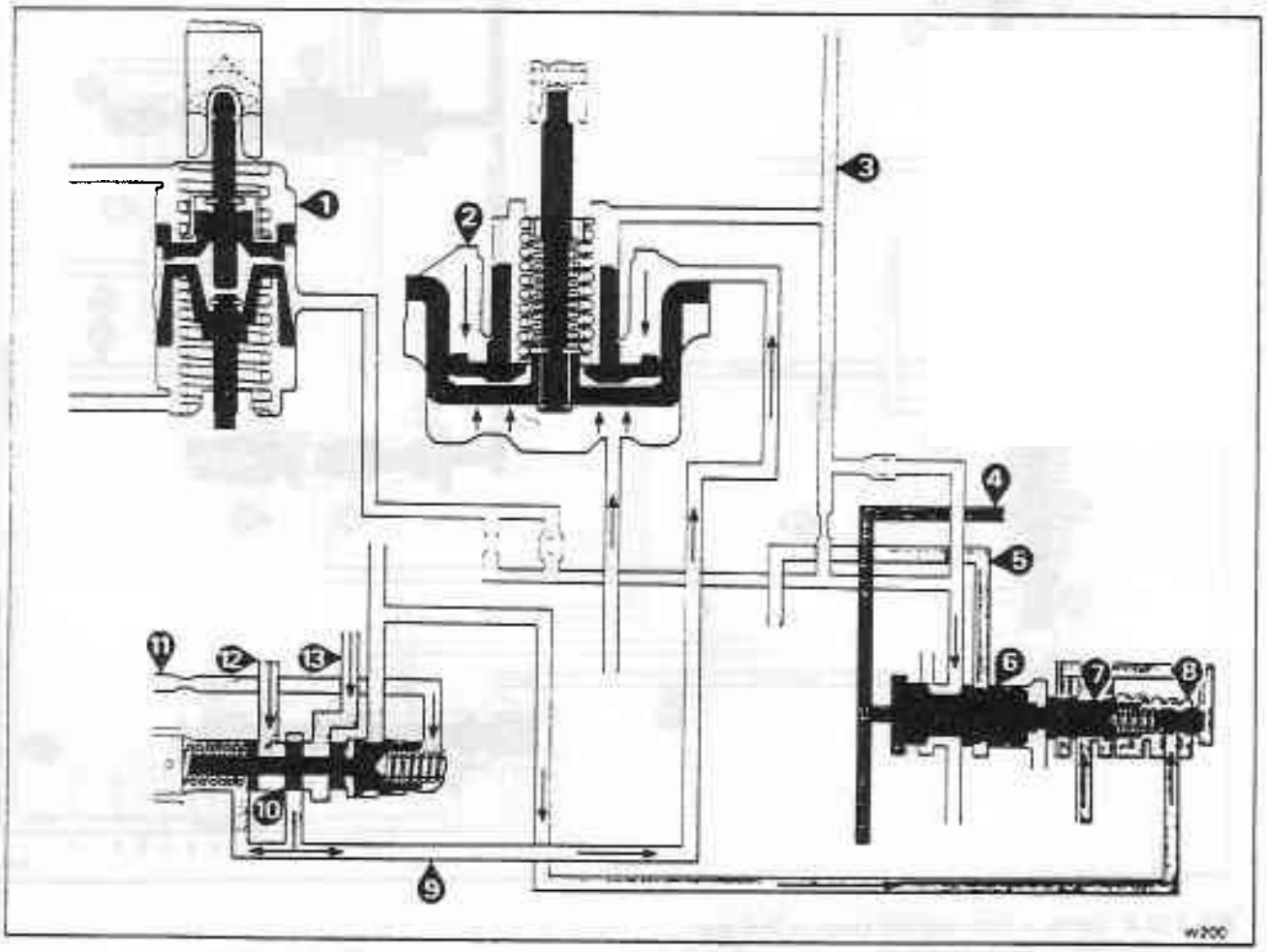

Fig. T12-10 Low range – 1st gear – rear band applied

1 Front servo
2 Rear servo
3 Intermediate clutch passage
4 Governor oil
5 Drive oil
6 1-2 valve
7 1-2 detent valve
8 Regulator valve
9 1-2 accumulator oil
10 1-2 accumulator valve
11 Modulator oil
12 Low oil
13 Drive oil

Main line oil
Governor oil

Control valve unit — To remove

Note

Before removing the control valve unit from a transmission installed in a vehicle, **take extreme care**, as the front servo piston and related parts may fall from the transmission due to the normal freeness of the Teflon oil sealing rings.

The control valve unit may be removed with the transmission in the car. The oil must be drained and the sump removed to gain access to the control valve unit.

1. Unscrew the setscrew which secures the detent spring and roller assembly. Remove the spring and roller assembly.
2. Remove the setscrews that secure the control valve unit to the transmission case.

Do not remove the solenoid securing screws, as the solenoid holds the spacer (guide) plate and gasket in position, therefore, keeping the check balls in their correct positions.

3. Remove the control valve unit, together with the two governor pipes (see fig. T12-12).

Caution

Ensure that the manual valve does not slide out of its bore. Take care to retain the front servo piston, should it come out with the control valve assembly.

Remove the governor screen assembly from the end of the governor feed pipe or governor feed pipe hole.

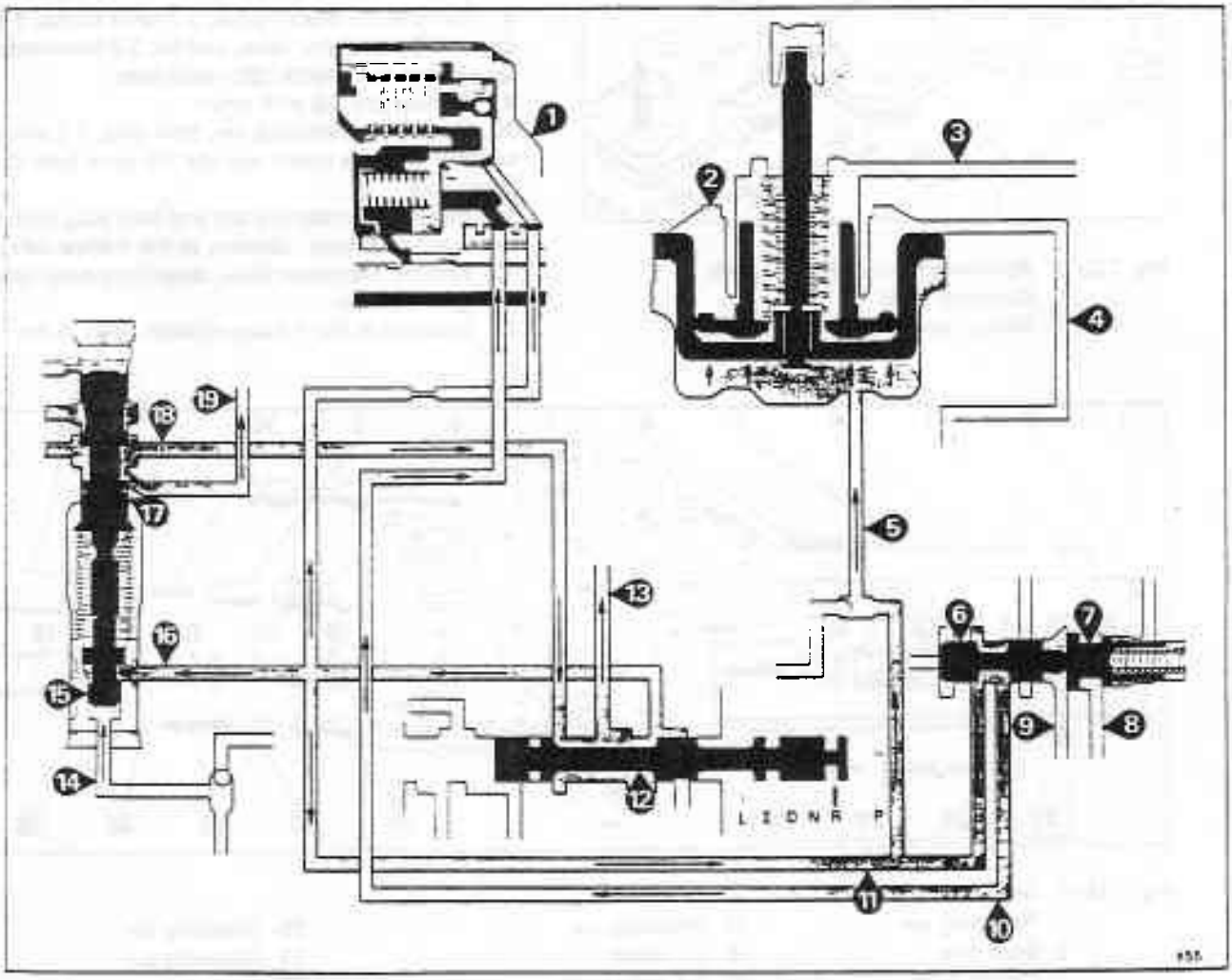

Fig. T12-11 **Reverse — rear band applied**

1 Direct clutch
2 Rear servo
3 Intermediate clutch passage
4 1-2 accumulator passage
5 Reverse oil
6 2-3 valve
7 2-3 modulator valve
8 Detent oil passage
9 Intermediate oil passage
10 Direct clutch oil
11 Reverse oil
12 Manual valve
13 Servo oil
14 Modulator oil
15 Boost valve
16 Reverse oil
17 Pressure regulator valve
18 Line oil
19 Converter oil

Modulator or intermediate oil

Main line oil

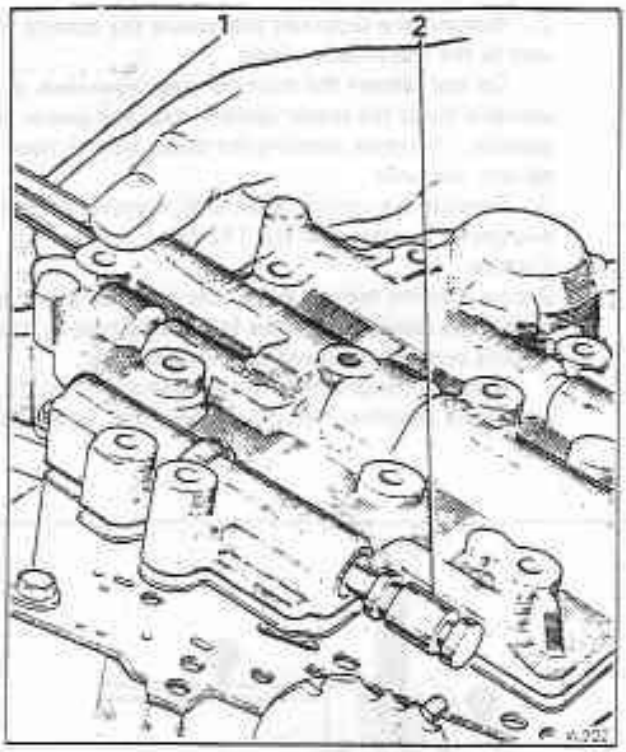

Fig. T12-12 Removing the control valve unit
1 Governor pipes
2 Manual valve

4. Withdraw the governor pipes from the control valve assembly; the pipes are interchangeable and need not be marked for identification.

Control valve unit – To dismantle

1. Hold the control valve unit with the cored passages uppermost and the accumulator piston bore to the front, as shown in figure T12-13.
2. Remove the manual valve from its bore.
3. Fit the control valve accumulator installing tool (J-21885) onto the accumulator piston.
4. Compress the accumulator piston and remove the 'E' ring retainer.
5. Remove the accumulator control valve and spring.
6. Remove the retaining pin, 1-2 sleeve, regulator valve, and spring from the upper right-hand bore.
7. Remove the 1-2 detent valve and the 1-2 valve.
8. Remove the retaining pin, 2-3 valve spring, 2-3 sleeve, 2-3 modulator valve, and the 3-2 intermediate spring from the middle right-hand bore.
9. Remove the 2-3 shift valve.
10. Remove the retaining pin, bore plug, 2-3 spring together with the spacer and the 3-2 valve from the lower bore.
11. Remove the retaining pin and bore plug from the upper left-hand bore, adjacent to the manual valve bore.
12. Remove the detent valve, detent regulator valve, spring, and spacer.
13. Ensure that the 1-2 accumulator valve in the

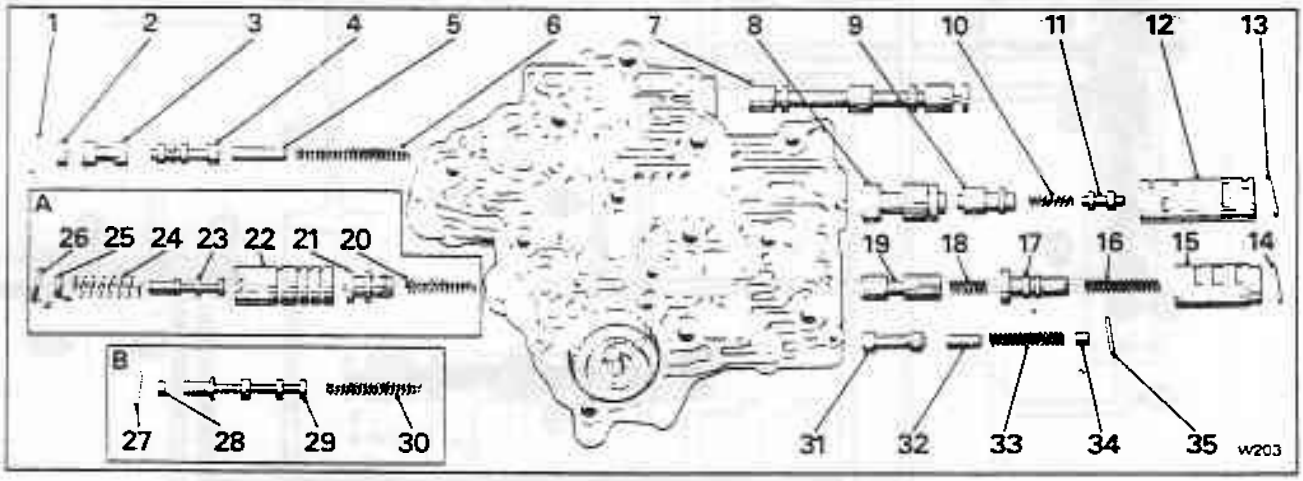

Fig. T12-13 Control valve unit

1 Retaining pin
2 Bore plug
3 Detent valve
4 Detent regulator valve
5 Spacer
6 Detent spring
7 Manual valve
8 1-2 valve
9 1-2 detent valve
10 1-2 regulator spring
11 1-2 regulator valve
12 1-2 sleeve
13 Retaining pin
14 Retaining pin
15 2-3 sleeve
16 2-3 valve spring
17 2-3 modulator valve
18 3-2 intermediate spring
19 2-3 valve
20 1-2 accumulator primary spring
21 1-2 accumulator primary valve
22 1-2 accumulator sleeve
23 1-2 accumulator secondary valve
24 1-2 accumulator secondary spring
25 Bore plug
26 Retaining pin
27 Retaining pin
28 Bore plug
29 1-2 accumulator valve
30 1-2 accumulator primary spring
31 3-2 valve
32 Spacer
33 3-2 spring
34 Bore plug
35 Retaining pin
A RR, RT, and RR-A models
B RC model

remaining bore is free, by moving the valve against the spring.

14. Remove the 1-2 accumulator valve retaining pin from the machined surface of the valve body; remove the plug.

15. (a) RR, RT, and RR-A transmissions

(i) Remove the 1-2 accumulator secondary spring and 1-2 valve.

(ii) Remove the 1-2 accumulator sleeve, 1-2 primary valve, and spring.

15. (b) RC transmissions

(i) Remove the 1-2 accumulator valve and spring.

Control valve unit – To inspect

1. Wash the control valve unit body, valves, and the remainder of the parts in Genklene. **Do not allow the valves to knock together as this may cause burrs, or damage to the shoulders of the valves.**
2. Examine all valves and sleeves to ensure that they are free from dirt. Any burrs should be carefully removed with a fine stone, or fine emery paper slightly moistened with oil. Do not round-off the shoulders of the valves.
3. When satisfactory, wash the parts and lightly smear all valves and sleeves with clean transmission fluid.
4. All valves and sleeves should be tested in their individual bores to ensure that free movement is obtainable.
5. The valves should fall under their own weight, with perhaps a slight tapping of the valve body to assist them. During these checks, ensure that the valves and valve bores are not damaged.
6. The manual valve is the only valve that can be renewed separately. If other valves are damaged or defective, a new control valve unit must be fitted.
7. Examine the valve body for cracks or scored bores.
8. Ensure that the cored face is free from damage.
9. Examine all springs for collapsed or distorted coils.

Control valve unit - To assemble

Before commencing assembly, ensure that all springs can be positively identified. If the springs are assembled incorrectly the transmission will not function correctly.

On 1984 model year Mulsanne Turbo cars and onwards, the control valve unit has been modified; larger bores and valves etc.

Note

The control valve units of RC, RR, RR-A, and RT transmissions are not interchangeable.

On 1985 model year Turbocharged cars and onwards, a new 3-2 part throttle downshift spring in the control valve unit is introduced, together with a modified torque converter. The new control valve unit can be fitted to pre 1985 transmissions without the modified torque converter, **but not vice versa.**

Refer to figure T12-13 during assembly procedure

1. Lightly lubricate all parts with clean transmission fluid before assembly.

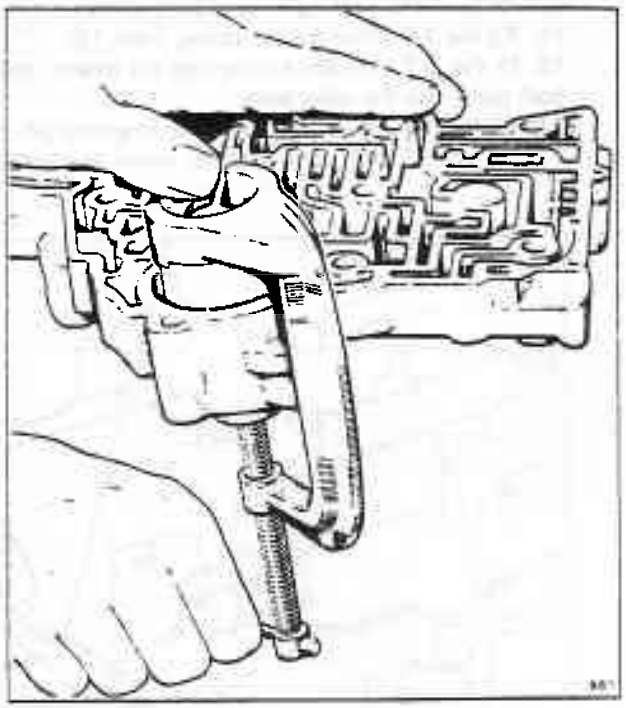

Fig. T12-14 **Fitting the front accumulator piston and spring**

2. Fit the front accumulator spring and piston into the valve body.
3. Fit the valve body accumulator installing tool (J-21885). Align the piston and spring with the bore then compress the spring and piston (see fig. T12-14).
4. Secure the piston with the 'E' ring retainer.
5. (a) **RR, RT, and RR-A transmissions**

(i) Fit the 1-2 primary spring into the primary 1-2 accumulator valve.

(ii) Fit the spring and valve (items 20 and 21) into the lower left-hand bore. Use a retaining pin to hold the valve in its position.

(iii) Fit the 1-2 accumulator secondary valve and spring into the 1-2 accumulator sleeve. Fit the sleeve into its bore.

(iv) Fit the bore plug and retaining pin.

5. (b) **RC transmissions**

(i) Fit the 1-2 accumulator primary spring (item 30) and 1-2 accumulator valve.

(ii) Fit the bore plug and retaining pin.

6. Fit the detent spring and spacer into the top left-hand bore.
7. Compress the spring and hold it with a small screwdriver.
8. Fit the detent regulator valve, wide land first.
9. Fit the detent valve, small land first.
10. Fit the bore plug with the hole facing outwards and fit the retaining pin. Remove the screwdriver.
11. Fit the 3-2 valve (item 31) into the lower right-hand bore.
12. Fit the spacer, the 3-2 spring, and bore plug with the hole facing outwards; secure with the retaining pin.
13. Fit the 2-3 shift valve (item 19) with the open end

outwards, in the next right-hand bore above.
14. Fit the 3-2 intermediate spring (item 18).
15. Fit the 2-3 modulator valve into the sleeve, then fit both parts into the valve bore.
16. Fit the 2-3 valve spring and the retaining pin.
17. Fit the 1-2 shift valve (item 8) (stem end out) into the next right-hand bore above.
18. Fit the 1-2 regulator valve (larger stem first), spring, and detent valve into the sleeve. Align the spring in the bore of the detent valve. Fit the parts into the valve bore.
19. Push the sleeve inwards against spring pressure and fit the retaining pin.
20. Fit the manual valve (item 7) with the detent pin groove to the right-hand side.

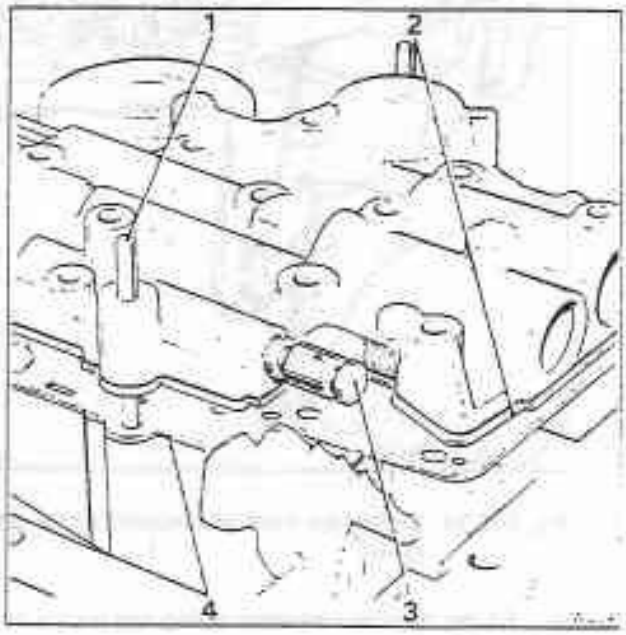

Fig. T12-15 Fitting the control valve unit
1 Guide pin
2 Control valve gasket
3 Manual valve
4 Spacer (guide) plate gasket

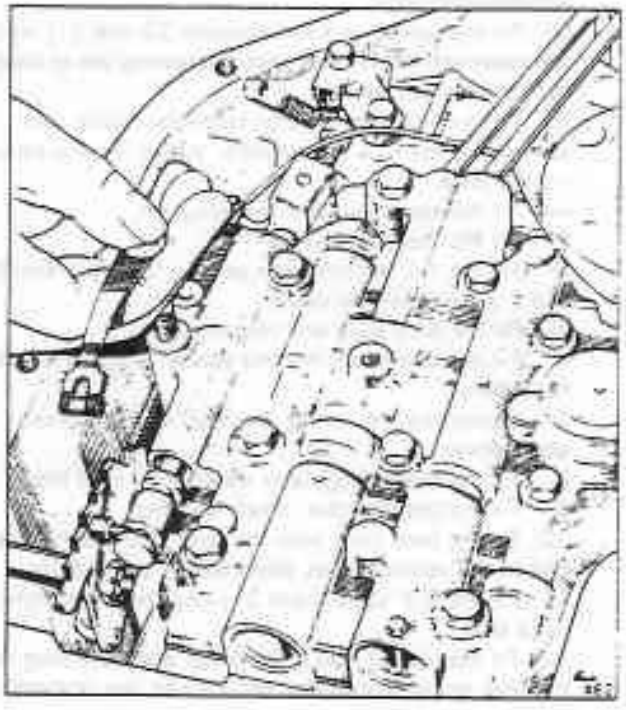

Fig. T12-16 Fitting the detent spring and roller

Control valve unit – To fit

1. Fit the governor pipes to the control valve unit.

Note

Fit the governor screen assembly, **open end first** into the governor feed pipe hole (hole nearest the centre of transmission).

2. Fit the front servo piston (if removed) ensuring it is correctly aligned in the bore.
3. Using two guide pins screwed into the casing, fit the control valve unit into position (see fig. T12-15), with a new valve body/spacer plate gasket.
4. Ensure that the gasket and oil spacer (guide) plate are correctly positioned.

Note

It is important that only a gasket which is a genuine service part be used.

5. Ensure that the governor pipes are correctly aligned and the feed pipe fits over the governor screen.
6. When installing the governor assembly ensure that a clearance of approximately 6.40 mm (0.250 in) is maintained between the governor pipes and transmission case, at a point 25.40 mm (1 in) from the right-angle bend of the pipes.

Ensure that the manual valve is correctly located by the pin on the detent lever.

7. Remove the guide pins and fit the control valve unit securing setscrews; do not fit the detent spring and roller securing screw.
8. Torque tighten the securing screws (see Section T22).
9. Fit the detent spring and roller assembly (see fig. T12-16); fit the securing screw and torque tighten to the figures quoted in Section T22.

Rear servo

The rear servo comprises an assembly of pistons and springs. It fits onto the bottom face of the transmission casing, adjacent to the control valve unit and is secured by six setscrews. The purpose of the servo is to act as an accumulator to absorb an amount of intermediate clutch oil, thus cushioning the application of the clutch, also to apply the rear friction band in Low range and Reverse.

Drive – Intermediate – first gear
In first gear, Drive and Intermediate ranges, 1-2 accumulator oil is directed to the rear servo accumulator piston in preparation for the 1-2 up-change.

Drive – Intermediate – second gear
Intermediate clutch apply oil is directed to the rear servo accumulator piston, stroking the piston against the 1-2 accumulator oil and the accumulator spring (see fig. T13-1). This action absorbs an amount of intermediate clutch apply oil and permits the intermediate clutch to apply at reduced pressure for a smooth 1-2 up-change.

Low range – first gear
Overrun engine braking in Low range (first gear) is provided by the rear servo which applies the rear band and prevents the reaction carrier from rotating clockwise (see fig. T13-2).

The 1-2 accumulator oil is directed to the accumulator piston which attempts to prevent application of the servo. Low range oil is directed to the servo piston, which, because it has a larger area, applies the rear band. Because 1-2 accumulator oil is present and is opposing the movement of the piston, the pressure applying the rear band is reduced. This provides a smooth band application.

Low range – second gear
In second gear the rear band is released. Intermediate clutch oil is directed to the release side of the servo piston and together with line oil in the 1-2 accumulator oil passage, balances out the Low range oil on the apply side of the servo piston (see fig. T13-3). The servo release spring then strokes the servo piston to the band release position.

Reverse
In Reverse, the rear band is applied to hold the reaction carrier. Reverse oil is directed to the servo piston to apply the band (see fig. T13-4). To ensure that the rear band will hold the reaction carrier for the reverse gear ratio, line pressure is increased. No other oil pressures are present in the servo to resist the movement of the servo piston.

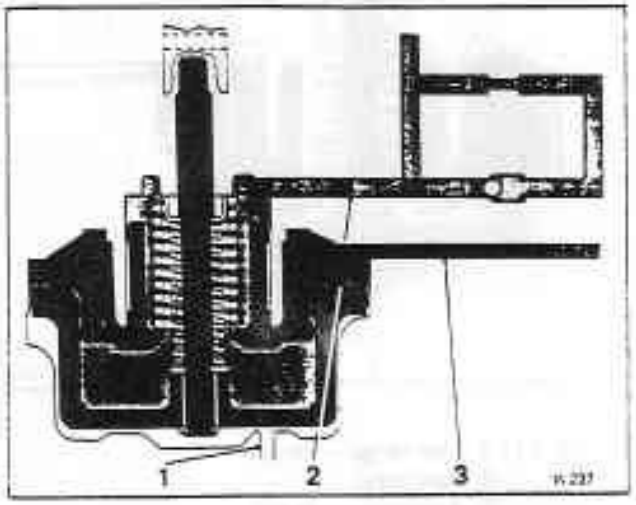

Fig. T13-1 Drive and Intermediate – 2nd gear
1 Reverse or low oil
2 Intermediate clutch oil
3 1-2 accumulator oil

Intermediate clutch oil

1-2 accumulator oil

Rear servo – To remove
The rear servo can be removed whether the transmission is fitted to the car or not.
1. Remove the sump (see Section T11).
2. Remove the control valve unit (see Section T12).
3. Remove the setscrews that secure the servo cover to the transmission casing.
4. Remove the cover and discard the gasket.
5. Remove the servo unit from the casing (see fig. T13-5).
6. Remove the servo accumulator spring.

To ensure that the rear band is correctly adjusted when the rear servo is fitted, the apply pin must be checked as follows.

Rear band apply pin – To select
1. Fit the band apply pin selector gauge (J-21370-6) onto the bottom face of the transmission casing. The gauge must fit over the rear servo bore with the hexagonal nut on the side of the gauge facing the parking linkage. The smaller diameter end of the gauge pin (J-21370-5) should be positioned in the servo pin bore (see fig. T13-6).
2. Secure the gauge with two suitable setscrews (e.g. rear servo cover screws) and torque tighten them to the figures quoted in Section T22.

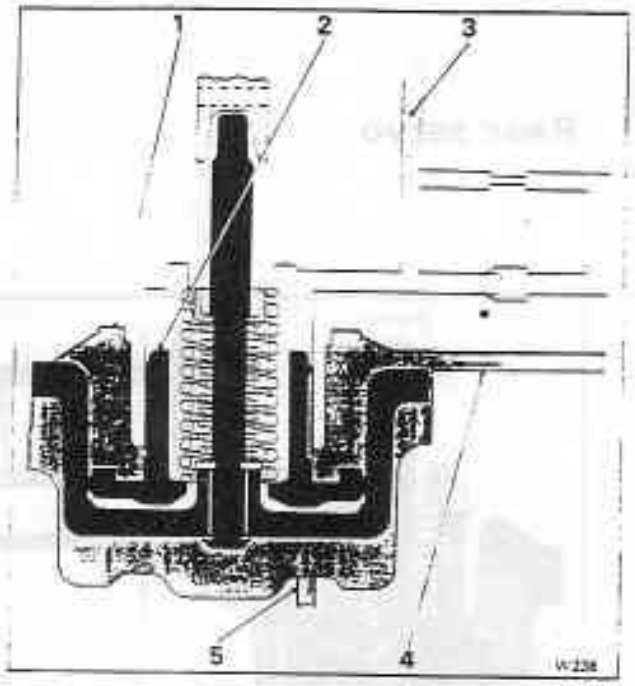

Fig. T13-2 Low range – 1st gear
1 Rear servo
2 Accumulator piston
3 Intermediate clutch passage
4 1-2 accumulator oil
5 Reverse or low oil

Low and 1-2 accumulator oil

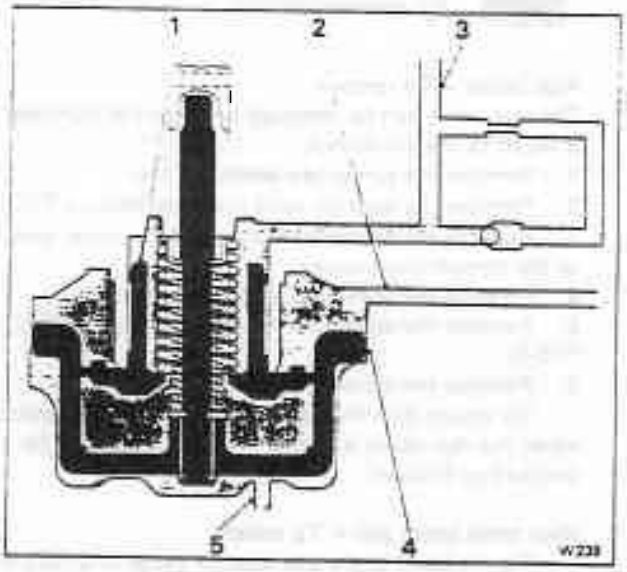

Fig. T13-3 Low range – 2nd gear
1 Accumulator piston
2 1-2 accumulator oil
3 Intermediate clutch oil
4 Servo piston
5 Reverse or low oil

Low, intermediate and 1-2 accumulator oil

3. Ensure that the stepped gauge pin moves freely in the tool and in the servo pin bore. The stepped side of the pin must face the front of the transmission case.
4. Band apply pins are available in three sizes as shown in the following chart.

Identification	Length
Three rings	Long
Two rings	Medium
One ring	Short

5. The identification ring is located on the band lug end of the pin. Selecting the correct pin is the equivalent of adjusting the rear band.
6. To determine the correct size pin to use, apply 34 Nm, 3,5 kgf m (25 lbf ft) to the hexagonal nut on the side of the gauge (see fig. T13-6). This will cause the lever on top of the gauge to depress the stepped gauge pin into the servo pin bore, simulating the actual operation of the servo.
7. Note the relationship between the steps on the gauge pin and the machined surface on the top of the gauge.
8. If the machined surface on top of the gauge is level with, or above the upper step on the gauge pin, a long (3 rings) pin is required.
9. If the machined surface on top of the gauge is between the upper and lower steps on the gauge pin, a medium pin (2 rings) is required.
10. If the machined surface on top of the gauge is

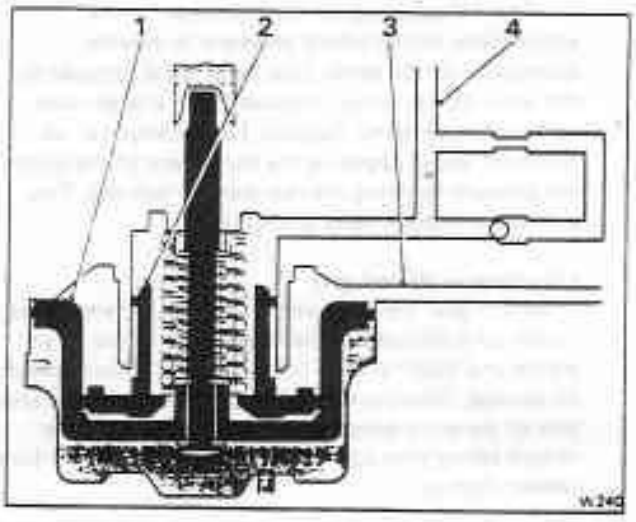

Fig. T13-4 Rear servo in reverse position
1 Servo piston
2 Accumulator piston
3 1-2 accumulator passage
4 Intermediate clutch passage

Reverse oil

level with, or below the lower step on the gauge pin, a short (1 ring) pin is required.

11. If a new pin is required, make a note of the size of the required pin, then remove the gauge from the transmission.

Rear servo – To dismantle

1. Remove the rear accumulator piston from the rear servo piston (see fig. T13-7).
2. Remove the 'E' ring which retains the rear servo piston on the band apply pin.
3. Remove the rear servo piston and the seal from the band apply pin.
4. Remove the washer, spring, and retainer.

Rear servo – To inspect

1. Check the fit of the oil sealing rings in the accumulator piston. The rings should be free to turn in the grooves.
2. Fit the accumulator piston lower oil sealing ring into its bore in the casing and check the ring-to-bore fit.
3. Check the fit of the band apply pin in each piston.
4. Examine the band apply pin for scores, cracks, or the opening of drilled passages.
5. Examine the accumulator piston for an open bleed passage.
6. Ensure that the pin is the correct size as determined by the check under the heading Rear band apply pin – To select.

Rear servo – To assemble

1. Fit the spring retainer, spring, and washer onto the band apply pin.
2. Fit the servo piston onto the pin and secure it with the 'E' ring.
3. If necessary, fit a new oil seal ring onto the servo piston.

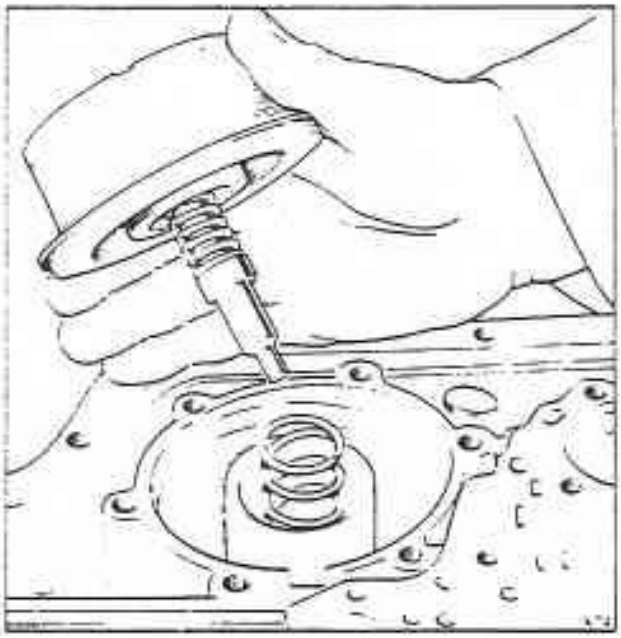

Fig. T13-5 Removing the rear servo

4. Fit the accumulator piston into the servo piston.

Do not remove the Teflon oil seal rings from the rear accumulator piston, unless they require replacement.

If the Teflon inner oil seal ring (small diameter)

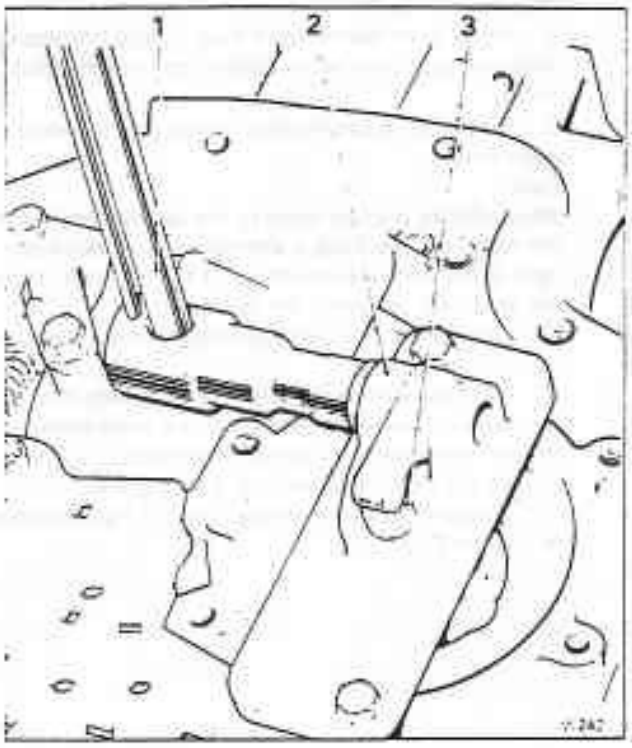

Fig. T13-6 Selecting the band apply pin
1 Torque spanner
2 Gauge
3 Gauge pin

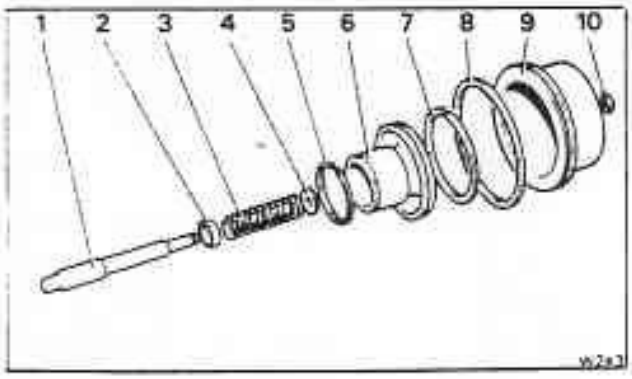

Fig. T13-7 Rear servo and accumulator
1 Servo pin
2 Spring retainer
3 Servo spring
4 Washer
5 Oil sealing ring
6 Accumulator piston
7 Oil sealing ring
8 Servo oil seal
9 Servo piston
10 'E' ring

requires replacement, use the aluminium oil seal ring.

The rear accumulator piston (large diameter) ring groove depth, is machined shallower to take the Teflon oil seal ring. Therefore, if replacement is necessary, use only the Teflon oil seal ring.

Rear servo — To fit

1. Using clean transmission fluid, lightly lubricate the inner and outer rear servo bores in the transmission casing.
2. Fit the servo accumulator spring into the servo inner bore.

Note

Before fitting the rear servo to the casing, ensure that the rear band apply lug is aligned with the servo pin bore in the transmission casing. If the lug is not aligned, the servo will not apply the rear band.

3. Position the rear servo assembly in the transmission casing.
4. Using hand pressure, push the servo into the transmission casing, ensuring that the servo piston sealing ring is correctly seated in the bore.
5. Fit the cover together with a new gasket.
6. Torque tighten the setscrews to the figures quoted in Section T22.

Detent solenoid, control valve spacer, and front servo

The detent solenoid is secured to the lower face of the transmission casing and is connected by a lead to a connector on the left-hand side of the transmission. When the solenoid receives a signal from a micro-switch at full throttle (kick-down button depressed), an exhaust port is opened. This allows oil at high pressure to be fed to the shift valves to oppose governor pressure (see Section T12).

The control valve spacer fits between the control valve unit and the transmission casing and forms part of the hydraulic system which contains restrictors and check balls.

The front servo is an assembly of pistons and springs, similar to the rear servo. It fits partly in the transmission casing and partly in the control valve unit. The servo applies the front band in Intermediate range (second gear) and Low range to provide engine braking. It is used also as an accumulator for the application of the direct clutch and in conjunction with the check balls and orifices, is part of the timing for the release of the direct clutch.

Front servo operation

Drive range — first gear

In Drive range, servo oil from the manual valve charges the accumulator by stroking both the accumulator piston and the servo piston against the accumulator spring. This prepares the accumulator for the controlled application of the direct clutch during the 2-3 up-change. The charging of the accumulator in Drive range (first gear) also makes it possible to have a controlled 1-3 let-up change as the accumulator is prepared in first gear for direct clutch application.

Servo oil and the servo release spring prevent the application of the band in second gear (Drive range) when intermediate clutch apply oil is directed between the servo and accumulator pistons. Servo oil is also present in Reverse and Neutral.

Drive range — second gear

In Drive range (first and second gears), the accumulator is charged with servo oil which strokes the servo and accumulator pistons down against the accumulator spring (see fig. T14-1). In second gear, intermediate clutch oil is fed between the servo and accumulator pistons but does not force them apart. This is because the force of the servo oil which holds the piston down is equal to the intermediate clutch oil attempting to stroke the piston up.

Drive range — third gear

When the direct clutch is applied, intermediate clutch oil pressure increases. This increased pressure, plus the

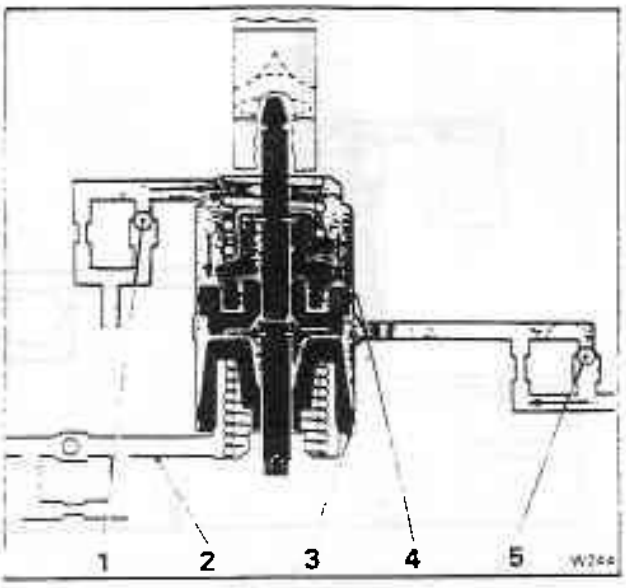

Fig. T14-1 Drive range — 2nd gear

1 Servo oil (check ball seated)
2 Direct clutch passage
3 Accumulator piston
4 Servo piston
5 Intermediate clutch oil (check ball seated)

Servo and intermediate clutch oil

accumulator spring, overcomes the servo oil pressure and the accumulator piston is moved until it reaches the stop on the pin (see fig. T14-2). As the accumulator piston moves, it abuts the servo piston which moves a corresponding distance, until it contacts a retainer ring on the servo pin. It will not however, move any further and the front band will not be applied.

As the accumulator piston moves, an amount of direct clutch oil is absorbed and this permits the direct clutch to apply at a controlled rate, for a smooth 2-3 up-change.

Drive range — 3-2

The release of the direct clutch is controlled by the front servo, two orifices and two check balls. This allows the driving load to be transferred smoothly to the intermediate sprag.

The controlled release pressure allows the engine to increase its rev/min to suit the lower gear ratio of second gear during detent down-changes, resulting in a smooth change with better acceleration.

During the stroking of the servo and accumulator

pistons, servo oil seats a check ball and the oil must pass through a restrictor. This slows down the stroking of the pistons (see fig. T14-3).

The exhausting oil from the accumulator and the direct clutch seats another check ball and the oil is forced to flow through an orifice. This controls the clutch pressure during direct clutch release.

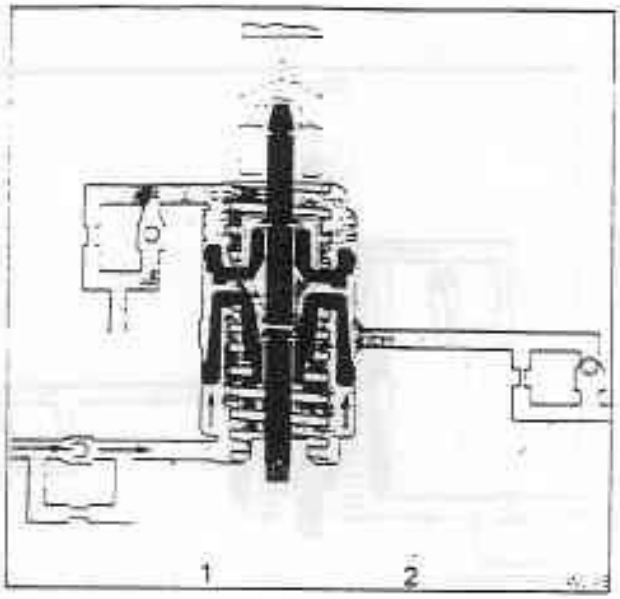

Fig. T14-2 Drive range – 3rd gear
1 Direct clutch oil
2 Intermediate clutch oil (check ball seated)

Direct clutch and intermediate clutch oil

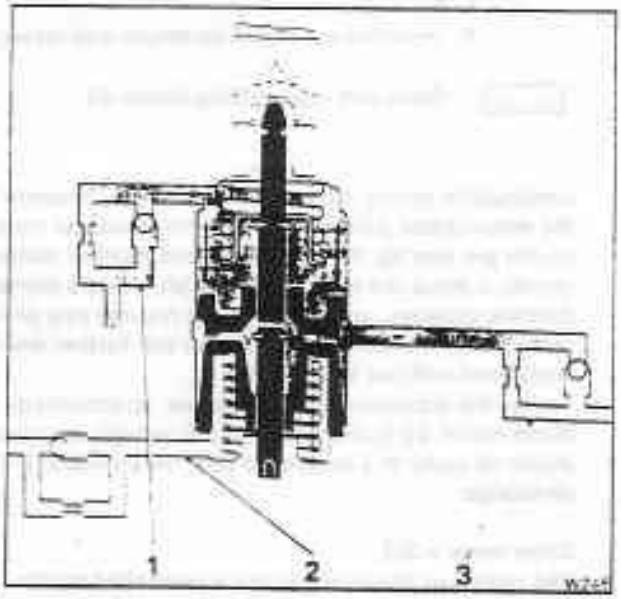

Fig. T14-3 Drive range – 3-2
1 Servo oil (check ball seated)
2 Direct clutch passage
3 Intermediate clutch oil (check ball seated)

Servo and intermediate clutch oil

Intermediate range – second gear

During a manual 3-2 down-change, intermediate clutch oil from the 1-2 shift valve seats a check ball and flows through an orifice to apply the front band (see fig. T14-4) The oil which applies the band is also controlled by the stroking of the accumulator piston which is resisted by the accumulator spring and the restricted exhaust of the direct clutch oil.

Detent solenoid, control valve spacer, and front servo – To remove

These units may be removed from the transmission whether or not the transmission is fitted to the car.

1. Drain the transmission fluid and remove the sump.
2. Remove the control valve unit and governor pipes (see Section T12).
3. Disconnect the leads from the connector terminals.
4. Remove the two setscrews that secure the detent solenoid.
5. Remove the solenoid.
6. Remove the control valve spacer plate and gasket.

Note

If the last operation is being carried out with the transmission in the car, lower the control valve spacer plate in a level plane so that the check balls do not fall out. Remove the check balls from the spacer plate.

7. Remove the six check balls from the cored passages in the transmission case (see fig. T14-5).
8. Lift the front servo piston, retaining ring, pin, retainer, and spring from the transmission case. An exploded view of the front servo is shown in figure T14-7.

Front servo – To inspect

1. Examine the servo pin for damage.

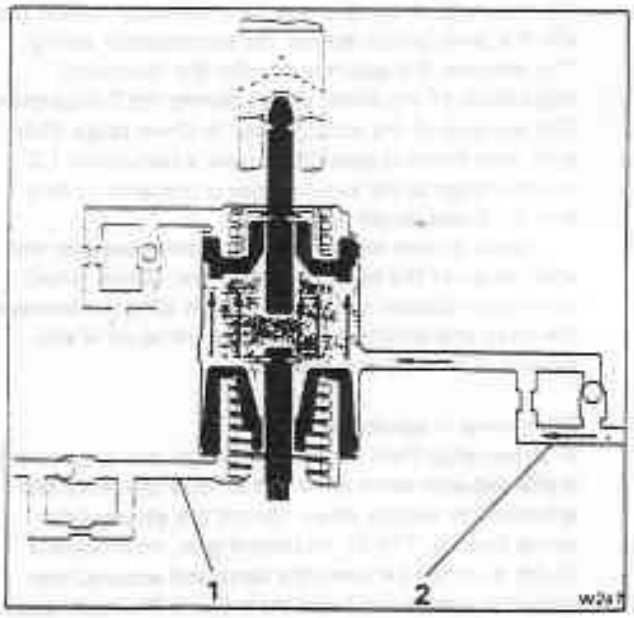

Fig. T14-4 Intermediate range – 2nd gear
1 Direct clutch passage
2 Intermediate clutch oil (check ball seated)

Intermediate clutch oil

2. Examine the oil seal ring groove in the piston for damage.
3. Ensure that the ring is free in the groove.
4. Examine the piston for cracks and other damage.
5. Check the fit of the servo pin in the piston.

Detent solenoid, control valve spacer, and front servo — To fit

When overhauling the front servo or front accumulator piston it will be noticed that the Teflon ring allows the piston to slide very freely in its bore. This is a normal characteristic of the ring and does not indicate leakage during operation.

When servicing pistons, the following points should be noted.

Only remove a Teflon oil sealing ring from a piston ring groove if the ring is to be renewed.

Only renew a Teflon oil sealing ring if it shows evidence of leaking during operation or visual damage.

When changing a front servo Teflon oil sealing ring, renew with an aluminium sealing ring.

1. Fit two guide bolts into the transmission case.
2. Place the six check balls into the ball seat pockets in the case.
3. If the transmission is in the car, place the check balls into the ball seat pockets in the spacer plate.

Note

One check ball is non-functional, therefore, on RC transmissions omit one ball as shown in figure T14-6.

4. Fit the control valve spacer plate to case gasket (gasket with extension for detent solenoid).
5. Fit the control valve spacer plate.
6. Fit the detent solenoid. Do not tighten the setscrews at this time.
7. Fit the front servo spring and retainer into the bore of the transmission case.
8. Fit the retainer ring onto the front servo pin and install the pin into the case so that the tapered end contacts the forward band. Ensure that the retainer ring is installed in the servo pin groove.

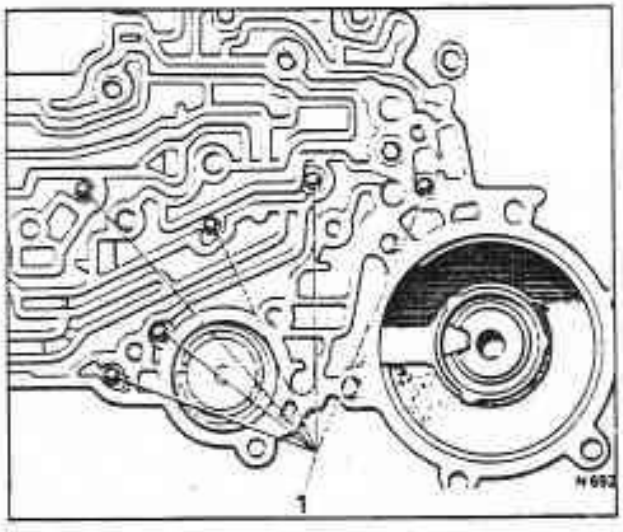

Fig. T14-5 Location of check balls — transmission case
1 Check balls

9. Fit a new piston sealing ring to the servo piston, if the ring has been removed.
10. Fit the servo piston onto the band apply pin with the flat side of the piston positioned towards the transmission sump.

If the transmission is in the car, the parts should be assembled as a group (see fig. T14-7) and fitted into the servo bore. A length of straight clean feeler gauge (approximately 0,51 mm (0.020 in)) should be used to hold the servo assembly temporarily in position as shown in

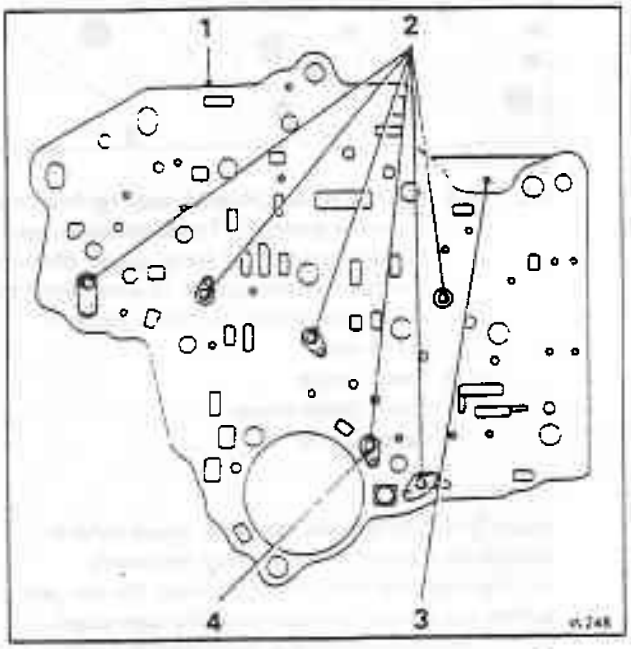

Fig. T14-6 Location of check balls — spacer plate
1 Spacer plate to case gasket
2 Check balls
3 Spacer plate
4 Non-functional ball (omit on RC transmissions)

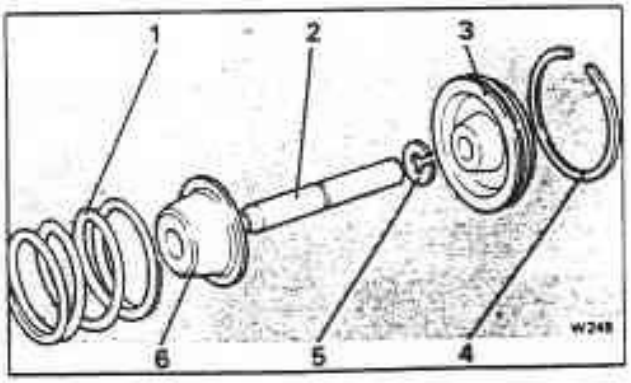

Fig. T14-7 Front servo
1 Spring
2 Pin
3 Piston
4 Oil seal ring
5 Retainer ring
6 Spring retainer

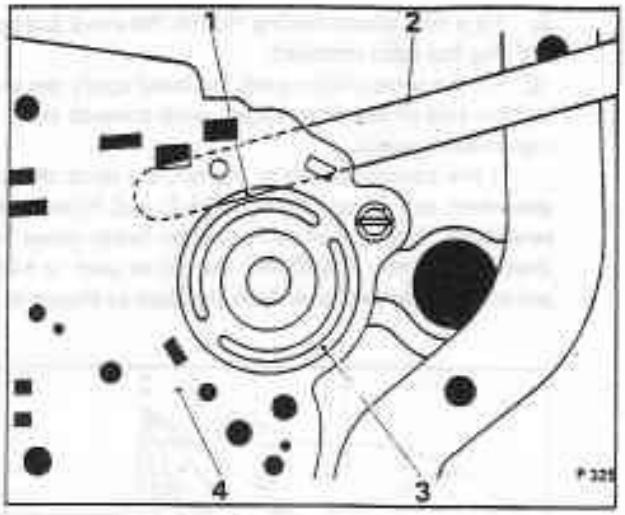

Fig. T14-8 Method of temporarily holding front servo piston in position (Transmission in car)

1 Correct position of feeler gauge, allowing the accumulator piston to enter the front servo bore before the feeler gauge is withdrawn
2 Feeler gauge
3 Front servo piston
4 Spacer plate

figure T14-8. Withdraw the feeler gauge before tightening the control valve body setscrews.
11. Connect the electrical leads from the top gear switch and detent solenoid onto the connector.
12. Fit the control valve as described in Section T12 then torque tighten the setscrews and the detent solenoid setscrews to the figures quoted in Section T22.

Rear extension

Rear extension – To remove

This section describes the procedure for removal of the rear extension when the transmission is fitted to the car.

The procedure is the same when the transmission is removed from the car except that the gearchange actuator and the propeller shaft will have been removed.

1. Remove the gearchange electric actuator as described in Section T5.
2. Remove the body crossmember and disconnect the propeller shaft at the gearbox end.
3. Place a drip tray beneath the rear extension.
4. Remove the coupling flange by withdrawing it from the output shaft.
5. Remove the setscrews that secure the rear extension to the transmission casing.
6. Slide the rear extension rearward and downward until it clears the output shaft.

Caution

Make certain that the output shaft splines do not damage the oil seal in the end of the rear extension.

7. Remove and discard the gasket from the rear extension.

Rear extension – To inspect

1. Examine the rear extension for cracks or damage.
2. Examine the bush for excessive wear or damage.
3. Examine the oil seal for damage.
4. If a new oil seal is to be fitted, push out the old seal using a suitable drift.
5. Ensure that the seal bore in the rear extension is clean and free from damage and that the seal drain-back port is not obstructed.
6. Lightly smear the outer edge of the new seal with Wellseal. Drive in the seal using tool RH 7953.

Note

The webbing on the seal installation tool RH 7953 must be undercut by approximately 3,17 mm (0.125 in) as shown in figure T15-1.

7. Fill the space between the seal lips with Shell Retinax A grease, ensuring that the lip edges are coated with grease.
8. Ensure that the rear face of the transmission casing and the front face of the extension are clean and free from burrs.

Rear extension – To fit

1. Fit a new gasket onto the extension housing.
2. Carefully fit the extension casing over the output shaft until the extension abuts the rear of the transmission casing.
3. Ensure that the splines on the output shaft do not touch the oil seal in the end of the extension casing otherwise the seal lip may be damaged.

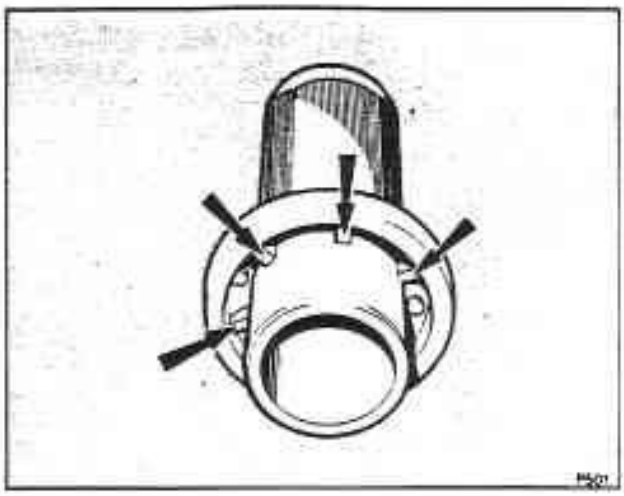

Fig. T15-1 Seal installation tool RH 7953

4. Fit the setscrews and torque tighten them to the figures quoted in Section T22.
5. Fit the coupling flange.
6. Connect the propeller shaft.
7. Fit the body crossmember.
8. Fit the gearchange electric actuator.

Oil pump

The oil pump is an internal/external gear type which is secured to the front face of the transmission casing. Contained within the oil pump cover is an oil pressure regulator valve train. The pump is mechanically connected to the engine flexplate and operates whenever the engine is running.

As the engine flexplate rotates it turns the torque converter pump which is keyed to the inner gear of the oil pump. The inner gear turns the outer gear which causes oil to be lifted from the transmission sump via an oil strainer.

As the gears turn, the oil is carried in pockets formed by the gear teeth, past a crescent shaped projection of the pump. Beyond the crescent, the gear teeth move closer together causing the oil to be forced out at pressure from between the teeth. At this point the oil is delivered through the pump outlet to the pressure system (see fig. T16-1).

The oil pressure is controlled by a pressure regulator valve. As the pressure builds up, the oil is

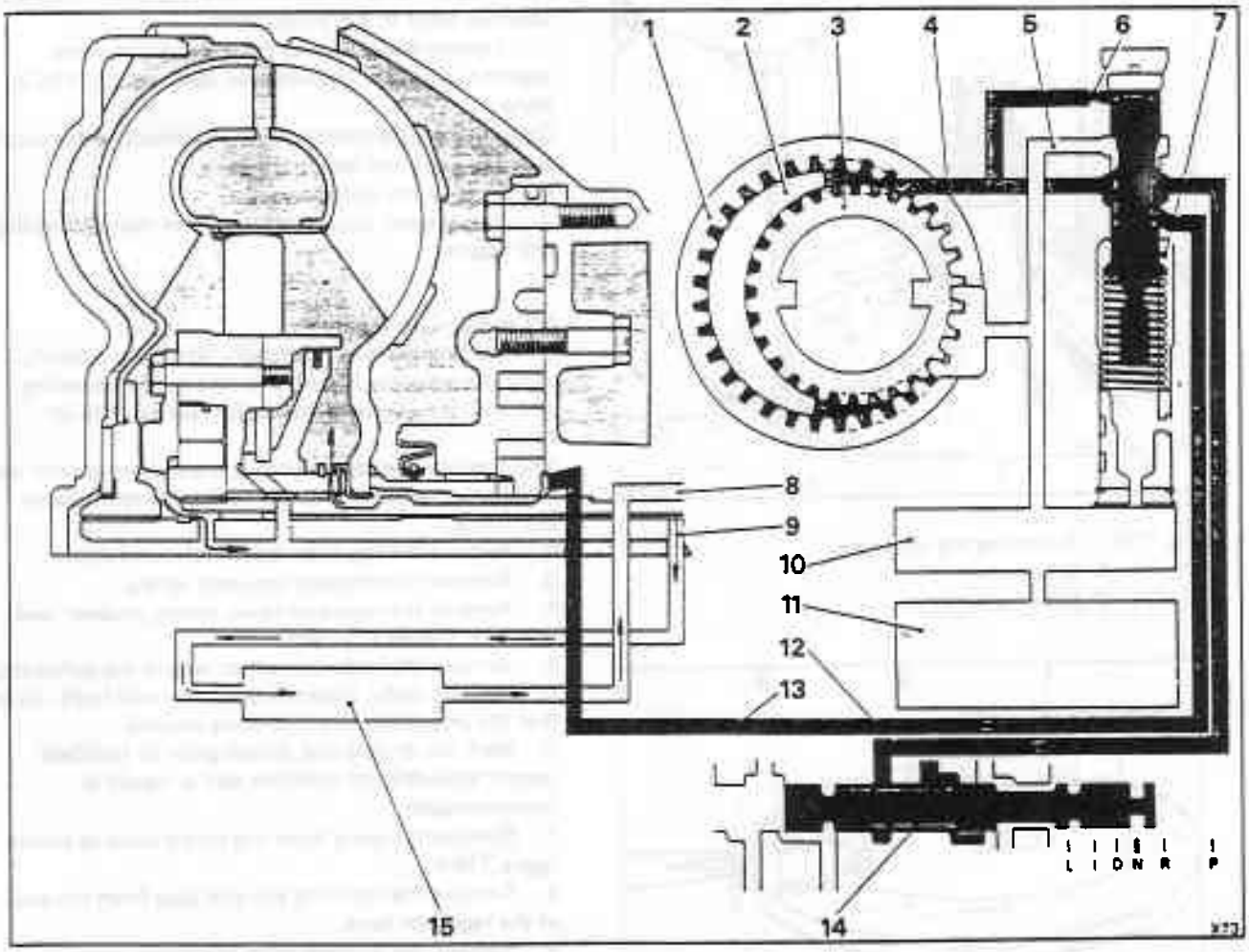

Fig. T16-1 Oil pump and pressure regulating system

1 Driven gear
2 Pump crescent
3 Driving gear
4 Pump outlet
5 Pump intake
6 Line pressure oil
7 Pressure regulator valve
8 Lubricating oil
9 Converter return
10 Strainer assembly
11 Transmission sump
12 Line pressure oil
13 Converter oil
14 Manual valve
15 Heat exchanger

Line oil

Intake and lubricating oil

directed through an orifice to the top of the pressure regulator valve. When the correct pressure is reached, the valve moves against spring pressure, opening a passage which feeds the torque converter.

When the torque converter is full, oil passes to the transmission heat exchanger by way of an external pipe. Upon leaving the heat exchanger, the oil is fed by way of a second external pipe to the transmission lubricating system.

As the pressure continues to increase from the pump, the pressure regulator valve moves further to expose a port which directs excess oil back to the suction side of the pump. The pressure regulator valve is spring balanced to regulate line pressure at approximately 4,8 bar (70 lbf/in^2).

Note
There are two types of regulator valves, therefore, reference should be made to Section T4.

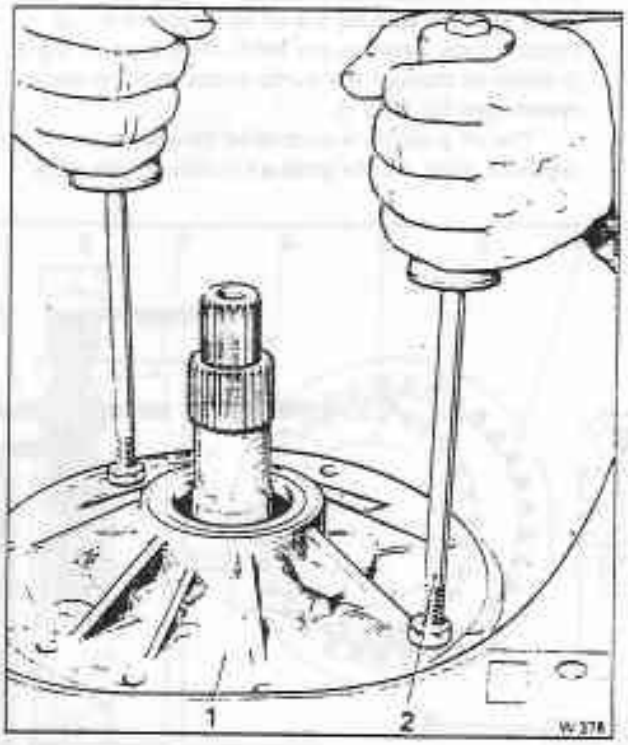

Fig. T16-2 Removing the oil pump
1 Oil pump
2 Slide hammer

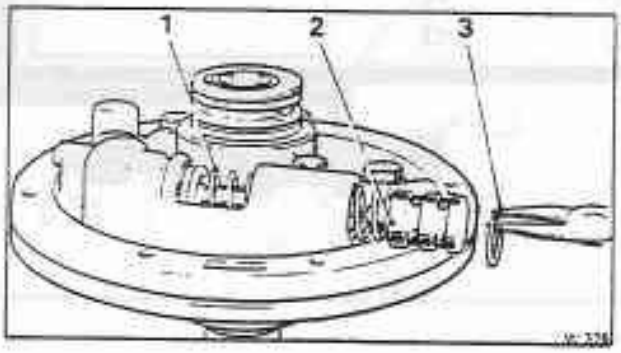

Fig. T16-3 Removing the regulator valve retaining circlip
1 Regulator valve spring
2 Boost valve sleeve
3 Circlip

Oil pump – To remove

1. Remove the transmission from the car (see Section T6).
2. Remove the retaining clamp RH 7952 and withdraw the converter.

Note
The converter and oil weigh approximately 23 kg (50 lb) and care should be taken when removing it to ensure it is not dropped or damaged.

3. Install the transmission in the holding fixture RH 7955 with the pump upwards.
4. Remove the pump attaching setscrews.
5. Fit the threaded slide hammers (J-7004) into the setscrew holes in the pump body.

Tighten the lock-nuts and remove the pump assembly from the transmission case (see fig. T16-2).

Note
Operate the slide hammers simultaneously otherwise the pump will tilt and jam in the case.

6. Remove the slide hammers.
7. Remove and discard the pump to case sealing ring and gasket.

Oil pump – To dismantle

1. Holding the pump assembly firmly on a bench, push the regulator boost valve sleeve, against spring pressure, then remove the circlip (see fig. T16-3).

Note
The pressure regulator spring is under pressure and care should be exercised when removing the boost valve and sleeve.

2. Remove the regulator boost valve and sleeve.
3. Remove the pressure regulator spring.
4. Remove the regulator valve, spring retainer, and spacer or spacers (if fitted).
5. Remove the setscrews which secure the pump cover to the pump body. Separate the cover and body, noting that the setscrews are of differing lengths.
6. Mark the driving and driven gears to facilitate correct assembly (an indelible pen or pencil is recommended).
7. Remove the gears from the pump body as shown in figure T16-4.
8. Remove the retaining pin and plug from the end of the regulator bore.
9. Remove the oil rings from the pump cover.
10. Remove the pump to forward clutch housing selective washer, noting the thickness to facilitate fitting of a new washer on assembly.

Oil pump – To inspect

Wash all parts in clean paraffin, then dry with compressed air.

1. Examine the pump body gear pocket and the crescent for scoring or other damage.
2. Fit the gears into the pump body, then check the end clearance as shown in figure T16-5. The clearance should be between 0,02 mm and 0,09 mm (0.0008 in and 0.0035 in).
3. Examine the face of the pump body for scores and burrs.
4. Examine the oil passages for blockages and porosity.
5. Examine the threads into which the cover securing setscrews fit.
6. Check the pump cover and body faces for overall flatness.
7. Examine the pressure regulator valve bore for score marks.
8. Ensure that the pressure regulator valve and the boost valve will move freely in their respective bores.

Oil pump – To assemble

1. Fit the oil pump driving and driven gears into the pump body with the alignment marks (made with an indelible pen or pencil) uppermost.

Note

If the pump driven gear has a rectangular or triangular identification mark on one tooth, the gear should be installed with the identification mark downwards.

Fit the drive gear with the drive tangs uppermost (see fig. T16-4).

2. Fit the pressure regulator spring retainer, spacer, or spacers (if fitted) and spring into the pressure regulator bore (see fig. T16-6).
3. Lightly lubricate the pressure regulator valve with clean transmission fluid, then fit the valve into the opposite end of the bore, stem end first.
4. Fit the pressure regulator valve end plug and retaining pin.
5. Lightly lubricate the boost valve and sleeve, then fit the valve into the sleeve (stem end out). Fit both parts into the bore in the pump cover by compressing the sleeve against the pressure regulator valve spring.
6. Retain the sleeve with the circlip.
7. Fit the two oil sealing rings to the pump cover.
8. Lubricate the pump gears with clean transmission fluid then fit the pump cover to the pump body.
9. Fit the cover securing setscrews into their original positions. Leave the setscrews finger tight.
10. Fit the pump body and cover alignment band (J-21368) around the pump assembly. Tighten the band to align the cover with the body (see fig. T16-7).
11. With the band in position, tighten the pump body to cover securing setscrews to the figures quoted in Section T22. Remove the alignment band.
12. Fit a new pump to case 'O' ring.
13. If necessary, fit a new front pump oil seal using the installing tool RH 7953.
14. Fit a new selective washer (pump to forward clutch housing), with a corresponding thickness to the one removed.

Oil pump – To fit

1. Fit a new gasket and guide pins into the transmission case.

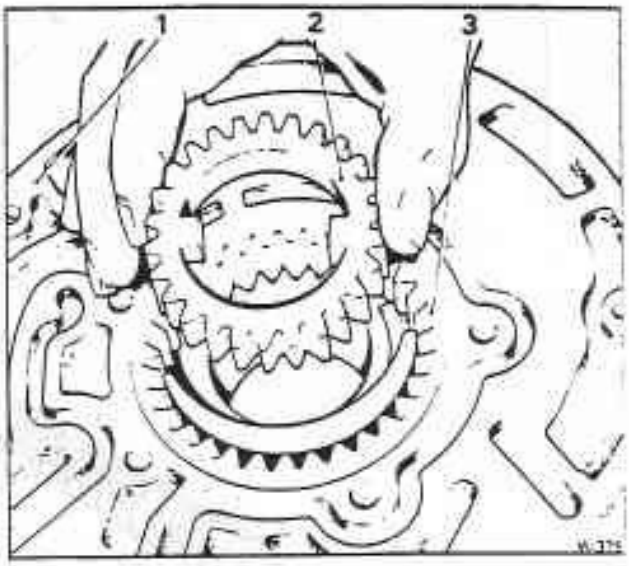

Fig. T16-4 Removing the pump gears
1 Pump body
2 Driving gear (tangs uppermost)
3 Driven gear

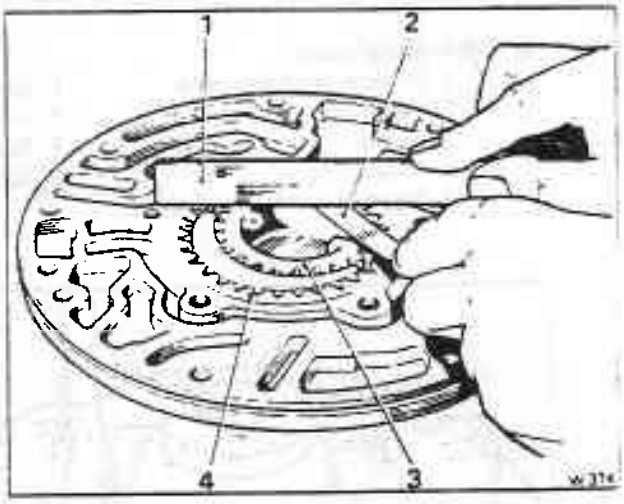

Fig. T16-5 Checking the gear end clearance
1 Straight edge
2 Feeler gauge
3 Inner (driving) gear
4 Outer (driven) gear

2. Lubricate the turbine shaft journals with clean transmission fluid. Smear the seal rings on the pump delivery sleeve with petroleum jelly, ensuring that the rings are correctly located.
3. Fit the pump assembly (see fig. T16-8). Ensure that new seals are fitted to the setscrews.

Do not remove the guide pins until all but two setscrews have been fitted. Leave one setscrew out to

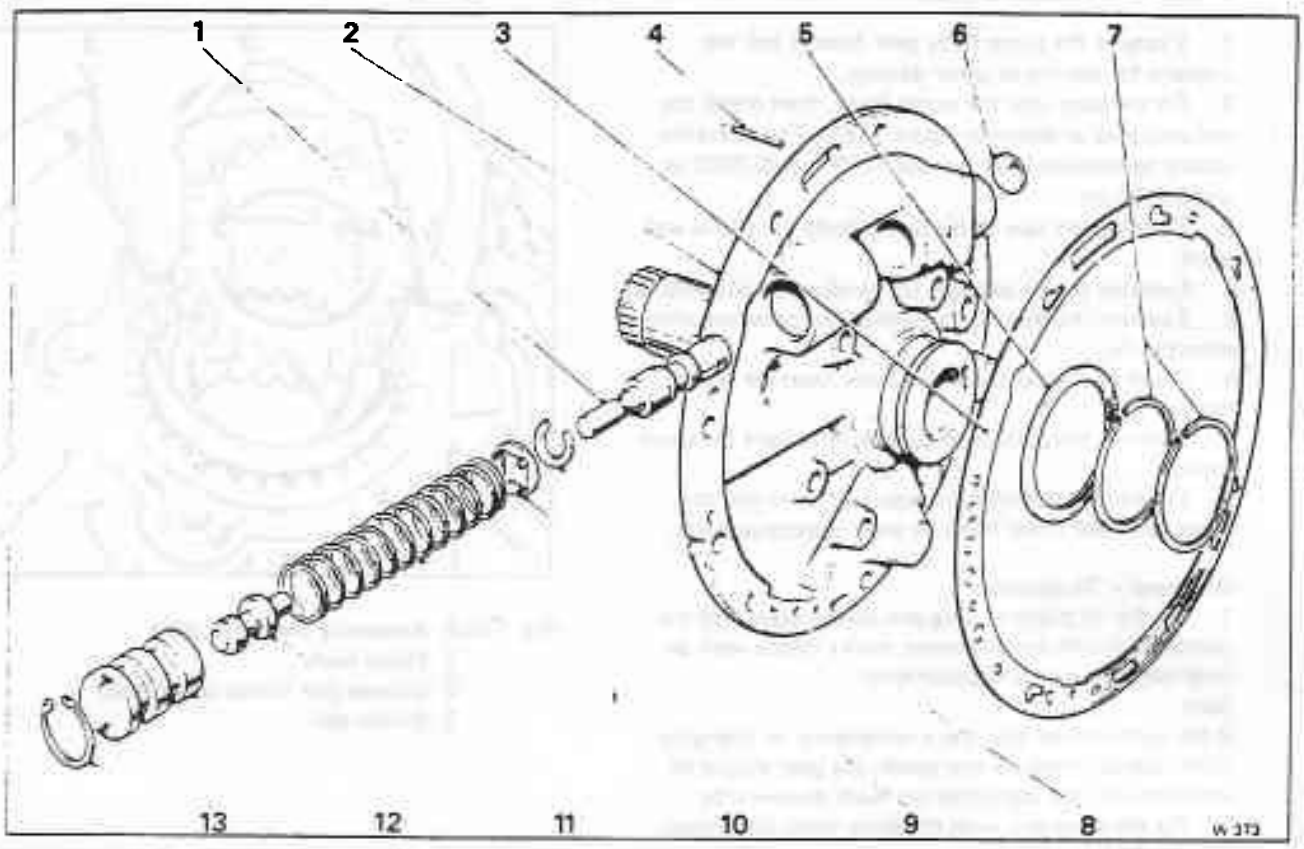

Fig. T16-6 Pump cover

1 Pressure regulator valve
2 Pump cover
3 Gasket
4 Retaining pin
5 Selective washer
6 Bore plug
7 Oil sealing rings
8 Spacer
9 Spring retainer
10 Pressure regulator spring
11 Boost valve
12 Sleeve
13 Circlip

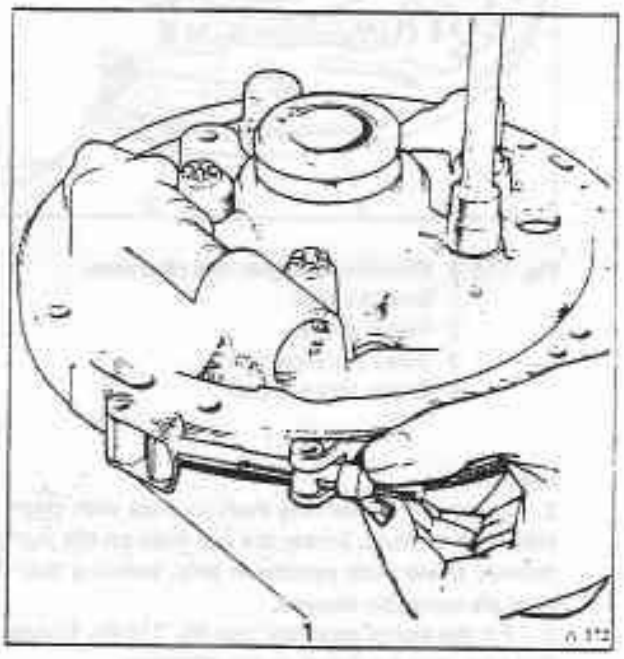

Fig. T16-7 Aligning pump cover with pump body

1 Alignment band

assist in checking the end-float.

4. Torque tighten the setscrews to the figures quoted in Section T22.

Note

If the turbine shaft cannot be rotated as the pump is being pulled into position, it is possible that either the forward or direct clutch housings have not been correctly indexed with all the clutch plates. This condition must be corrected before the pump is finally pulled into position.

5. Check the front unit end-float as follows (see fig. T16-9).

a. Fit a slide hammer bolt (J-7004) into the one remaining bolt hole.

b. Secure a dial test indicator on the slide hammer bolt. Adjust the indicator to register against the end of the turbine shaft.

c. Hold the output shaft forward whilst pushing the turbine shaft rearward to its stop.

d. Set the dial indicator to zero.

e. Pull the turbine shaft forward, noting the indicator reading (shaft travel).

The end-float should be between 0,08 mm and 0,61 mm (0.003 in and 0.024 in).

If the end-float is not within the limits, select a new

washer, referring to the following chart.

Thickness	Colour	Number
1,52 mm to 1,63 mm (0.060 in to 0.064 in)	Yellow	0
1,80 mm to 1,90 mm (0.071 in to 0.075 in)	Blue	1
2,08 mm to 2,18 mm (0.082 in to 0.086 in)	Red	2
2,36 mm to 2,46 mm (0.093 in to 0.097 in)	Brown	3
2,64 mm to 2,74 mm (0.104 in to 0.108 in)	Green	4
2,92 mm to 3,02 mm (0.115 in to 0.119 in)	Black	5
3,20 mm to 3,30 mm (0.126 in to 0.130 in)	Purple	6

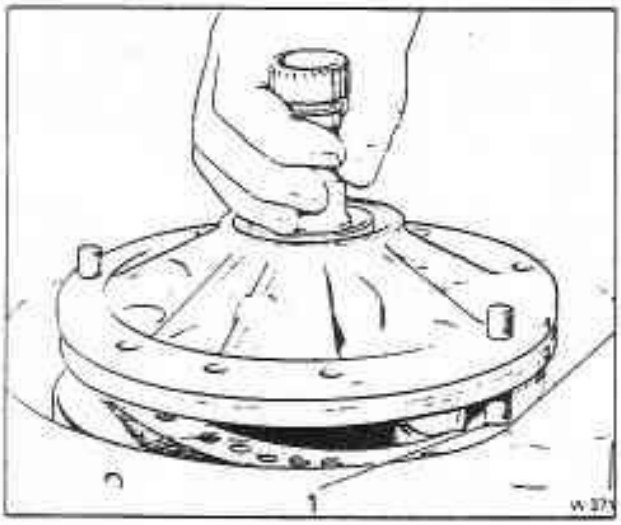

Fig. T16-8 Fitting the oil pump
1 Guide pin

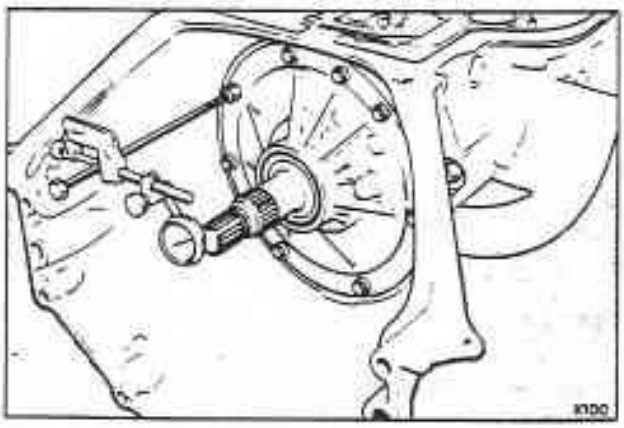

Fig. T16-9 Checking the front unit end-float

Note
An oil soaked washer may tend to discolour. Therefore, if necessary, measure the washer to ascertain the thickness.

6. Remove the dial test indicator and slide hammer bolt.
7. Fit the final pump securing setscrew and seal. Torque tighten the setscrew to the figures quoted in Section T22.

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Control rods, levers, and parking linkage

The control rods, levers, and parking linkage consist of an assembly of levers and rods which are operated by the electric gearchange actuator. The detent lever is connected to the manual control valve in the control valve unit and is retained in this position by a spring-loaded detent roller (see fig. T17-1).

The parking pawl actuating rod causes the parking pawl to engage the transmission whenever Park is selected. This provides a mechanical lock which will hold the car on the steepest of gradients.

When the gear range selector lever on the steering column is moved, with the ignition on, the electric actuator will move the gearchange operating lever to the required position via an adjustable rod. The gearchange operating lever is secured to the outer end of the manual shaft and the detent lever is secured to the inner end of the shaft. Therefore, the detent lever will move a corresponding distance, moving the manual control valve.

When the gear selector lever on the steering column is moved to Park, the parking pawl actuating rod which is secured to the detent lever causes the parking pawl to engage with a gear ring on the rear unit planet carrier. The rear unit planet carrier is mechanically connected to the transmission output shaft, therefore, the shaft is prevented from rotating.

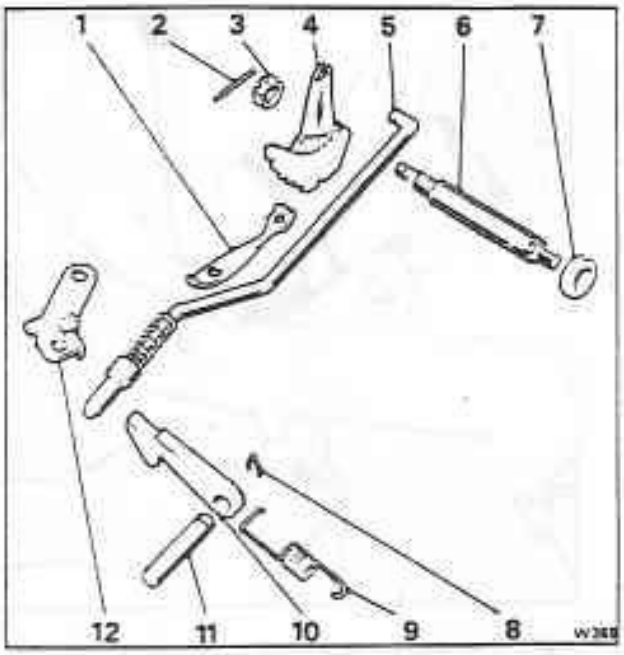


Fig. T17-1 Manual shaft and parking linkage
1 Detent roller and spring assembly
2 Retaining pin
3 Lock-nut
4 Detent lever
5 Parking pawl actuating rod
6 Manual shaft
7 Lip seal
8 Spring retainer
9 Pawl return spring
10 Parking pawl
11 Pawl shaft
12 Parking lock bracket

Control rods, levers, and parking linkage — To remove

1. The units may be removed from the transmission whether or not the transmission has been removed from the car.
2. If the transmission has not been removed, drain and remove the sump as described in Section T11.
3. If the gearchange electric actuator has not been removed, disconnect the gearchange operating rod by removing the split pin and clevis pin.
4. Remove the split pin and clevis pin from the opposite end of the gearchange operating rod; remove the rod.
5. Remove the lock-nut which retains the gearchange operating lever to the manual shaft; remove the lever.
6. Remove the setscrew that secures the detent spring and roller assembly to the control valve unit; remove the detent spring assembly.
7. Remove the pin which secures the manual shaft to the case.
8. Slacken the lock-nut securing the detent lever to the manual shaft.
9. Remove the detent lever from the manual shaft. Then remove the lock-nut completely.
10. Remove the parking pawl actuating rod, detent lever, and manual shaft from the case.

Note
Do not remove the manual shaft seal unless replacement is required.

11. Remove the setscrews securing the parking lock bracket; remove the bracket.
12. Remove the parking pawl return spring.

Note
The following operations are to be completed only if one or more of the parts involved requires replacement.

13. Remove the spring retainer from the parking pawl shaft. Remove the parking pawl shaft cup plug by placing a screwdriver between the parking pawl shaft and the casing; levering outwards (see fig. T17-2).
14. Remove the parking pawl and the shaft.

Control rods, levers, and parking linkage – To inspect

1. Wash all parts in clean paraffin, then dry them with compressed air.
2. Examine the parking pawl actuator rod for cracks or broken spring retainer lugs.
3. Examine the actuator spring for distortion or damage. Ensure the actuator fits freely on the actuator rod.

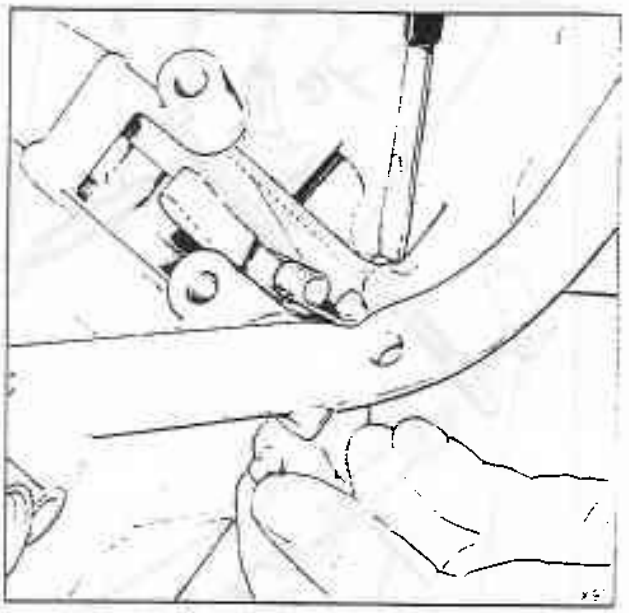


Fig. T17-2 Removing the cup plug

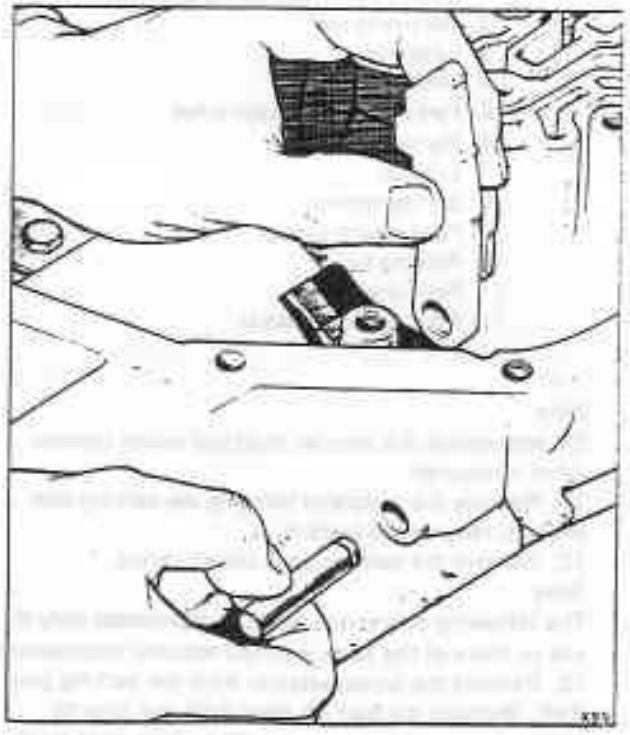


Fig. T17-3 Fitting the parking pawl and shaft

4. Examine the parking pawl for cracks or wear.
5. Examine the manual shaft for damaged threads or shaft roughness (oil seal surface).
6. Examine the detent lever for cracks or a loose pin.
7. Examine the parking pawl shaft for damage to the retainer groove.
8. Examine the parking pawl return spring for distortion or damaged ends.
9. Examine the parking lock bracket for cracks or wear.
10. Examine the detent spring and roller assembly for cracks or damage.
11. Examine the gearchange operating rod for signs of bending.
12. Examine the jaws of the operating rod for cracks or damage.

Control rods, levers, and parking linkage – To fit

1. Fit the parking pawl with the tooth towards the centre of the transmission, then fit the parking pawl shaft (see fig. T17-3).
2. Fit the parking pawl shaft retaining clip.
3. Fit the cup plug into the case, using a 9,52 mm (0.375 in) diameter steel rod, to drive the shaft and plug into the case until the shaft bottoms on the case rib.
4. Fit the parking pawl return spring with the squared end hooked around the pawl.
5. Fit the parking lock bracket with the guides over the parking pawl. Torque tighten the setscrews to the figures quoted in Section T22.
6. Fit the actuator rod plunger under the parking lock bracket and over the parking pawl.
7. Fit the opposite end of the actuator rod into the detent lever from the side opposite to the pin.
8. If necessary, fit a new manual shaft to case lip type seal into the case, using a 19,05 mm (0.750 in) diameter steel rod to seat the seal.
9. Lubricate the manual shaft with Shell Retinax A grease. Fit the shaft into the case and through the detent lever (see fig. T17-4).
10. Fit the lock-nut onto the manual shaft, then torque tighten the nut to the figures quoted in Section T22.
11. Fit the retaining pin into the transmission casing, aligning it with the groove in the manual shaft (see fig. T17-5).
12. Fit the detent spring and roller assembly. Torque tighten the setscrew to the figures quoted in Section T22.
13. Fit the gearchange operating lever to the manual shaft. Fit the lock-nut and torque tighten to the figures quoted in Section T22.
14. Fit the gearchange operating rod using the clevis pins. Lubricate the clevis pins with Rocol MTS 1000 grease, then fit new split pins.
15. Fit the sump (see Section T11).

Control linkage – To check

1. Remove the split pin and clevis pin from the gearchange operating rod, at the actuator end.
2. Select Park on the gearchange actuator. Push the lower end of the gearchange operating lever fully

forward (Park position).

3. Ensure that both jaws of the operating rod slide easily about the two levers and check the clevis pin will slide into the jaw and through the lever.

4. Select each of the gear positions in turn on the actuator. At each position, ensure that the clevis pin will slide easily into the jaw and lever.

5. Check that the pin will slide easily into the jaw when Low is selected after Park and conversely when Park is selected after Low.

6. If, in any position the pin will not pass through the jaw and lever, adjust the length of the rod.

7. Finally, lubricate the clevis pin with Rocol MTS 1000 grease. Fit the clevis pin and secure it with a new split pin.

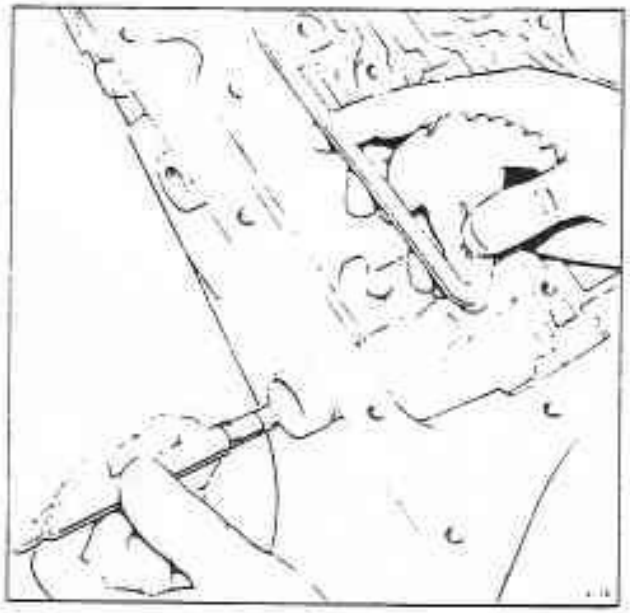


Fig. T17-4 Fitting the manual shaft

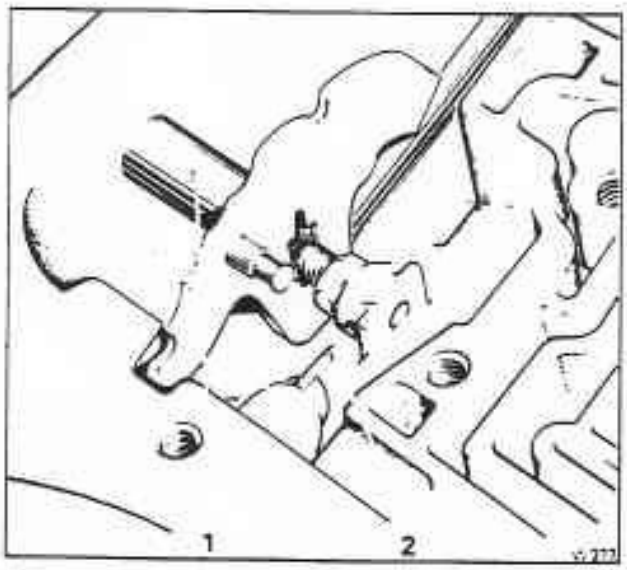


Fig. T17-5 Fitting the manual shaft retaining pin
1 Manual shaft
2 Retaining pin

Turbine shaft, forward and direct clutches, sun gear shaft, and front band

The turbine shaft is a splined shaft which connects the torque converter to the forward clutch.

The forward clutch comprises a housing, splined onto the turbine shaft; steel clutch driving plates, which are driven by the clutch housing; composition faced plates, which are splined onto a clutch hub; and a hydraulically operated clutch piston. The mainshaft is splined into the forward clutch hub.

The direct clutch is similar in construction to the forward clutch (see fig. T18-1).

The composition plates are splined to a hub which is integral with the forward clutch back plate. The steel plates are splined to a housing which in turn is splined to the sun gear shaft. The clutch is applied hydraulically by a piston housed in the direct clutch housing.

The front band is a lined steel band which is anchored to the transmission case at one end and is servo operated at the other end. The band fits around the direct clutch housing and when moved by the servo, holds the housing stationary.

Whenever the forward clutch is applied, the drive transmitted by the turbine is connected to the transmission mainshaft. When the forward clutch is released the clutch return springs push back the hydraulic piston, the plates are then released and the connection between the converter and the mainshaft is broken. As a result, the transmission is in Neutral.

Whenever the direct clutch is applied, drive from the forward clutch is divided and follows two different paths to the gear unit (see Section T19).

By following one path, the drive continues through the forward clutch to the mainshaft and the rear gear unit internal (annulus) gear. The other path is via the forward clutch back plate, through the direct clutch to the sun gear shaft.

As the direct clutch is applied, clockwise torque from the converter causes an intermediate inner sprag race to overrun the sprag clutch assembly.

A summary of the power flow through the transmission is given in Section T19.

Turbine shaft, forward and direct clutches, sun gear shaft, and front band — To remove

1. Remove the transmission from the car; withdraw the converter assembly.
2. Remove the oil pump.
3. Withdraw the turbine shaft and the forward clutch from the transmission (see fig. T18-2).
4. Remove the thrust washer from between the forward clutch hub and the direct clutch housing; the

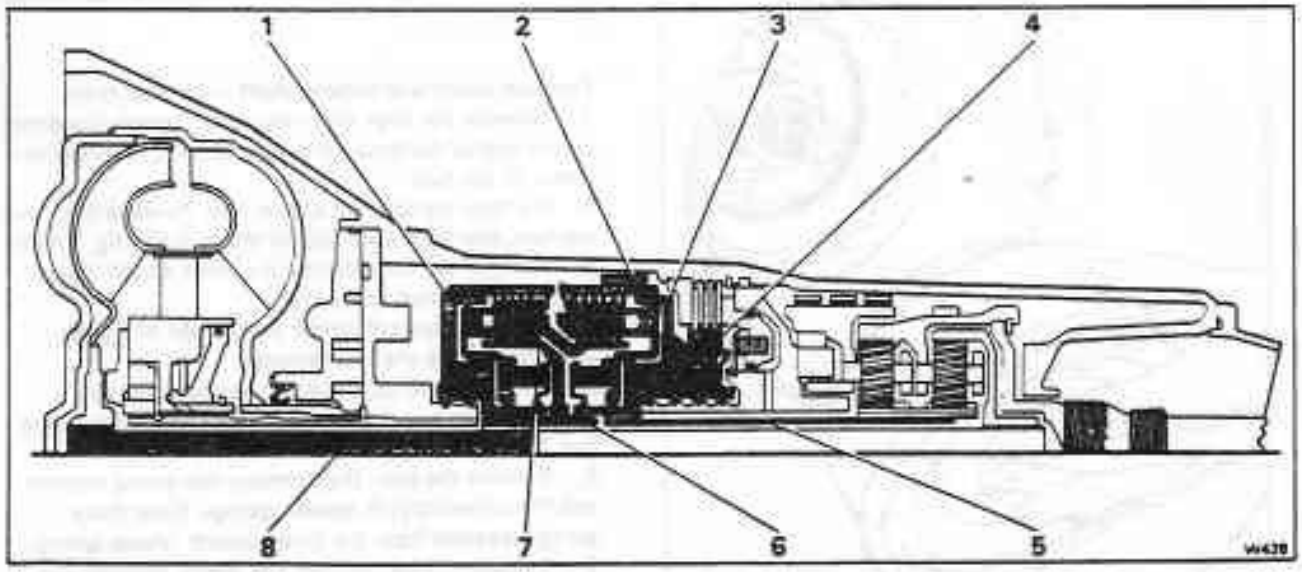


Fig. T18-1 Sectioned view of transmission showing forward and direct clutches

1 Forward clutch housing
2 Front band
3 Direct clutch housing
4 Intermediate sprag clutch
5 Sun gear shaft
6 Forward clutch hub
7 Direct clutch hub
8 Turbine shaft

Turbine shaft, forward and direct clutches, sun gear shaft, and front band

washer may have come out with the forward clutch.
5. Withdraw the direct clutch and intermediate sprag assembly (see fig. T18-3). The sun gear shaft may come out with the direct clutch assembly.
6. Remove the sun gear shaft if not previously removed.
7. Remove the front band.
8. Check the end-float of the rear unit; proceed as follows.

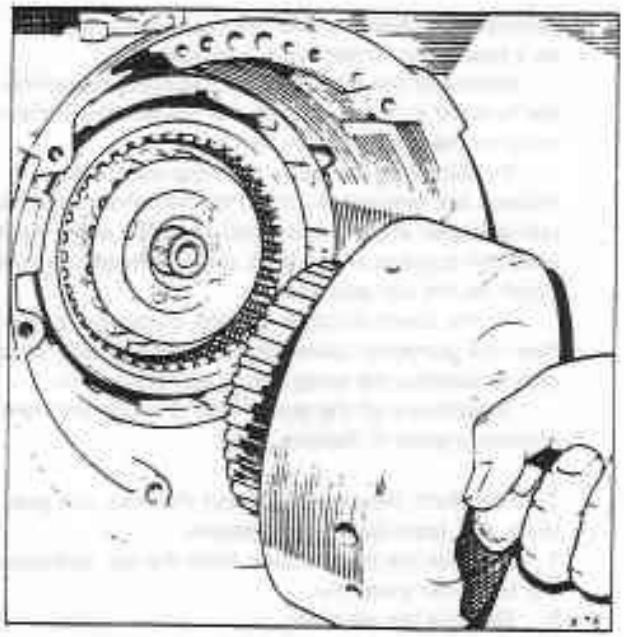


Fig. T18-2 Removing the forward clutch assembly

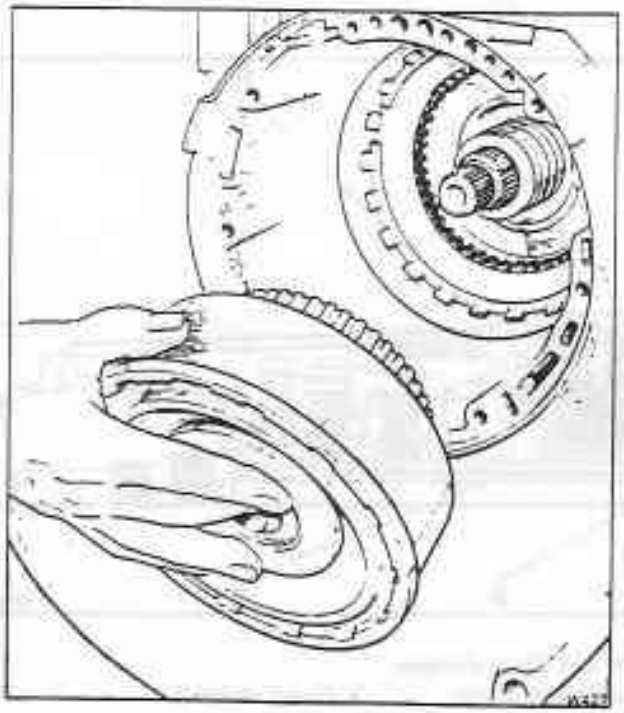


Fig. T18-3 Removing the direct clutch and intermediate sprag assembly

Rear unit end-float – To check
1. Remove the transmission rear extension housing.
2. Fit a slide hammer bolt (J-7004), or a similar suitable bolt into one of the holes in the end of the transmission case.
3. Mount a dial test indicator onto the bolt so that the indicator stem registers with the end of the output shaft (see fig. T18-4).
4. Set the dial indicator to zero.
5. Move the output shaft in and out, noting the indicator reading to enable the correct end-float adjusting washer to be used when the transmission is assembled. The end-float should be between 0,18 mm and 0,48 mm (0.007 in and 0.019 in).
6. The adjusting washer which controls this end-float is a steel washer with three tabs located between the thrust washer and the rear face of the transmission case.
7. If a different washer thickness is required to bring the end-float within the specified limits, it can be selected with the aid of the following chart.

Thickness	Number
0 mm to 0,41 mm (0 in to 0.016 in)	6
0,41 mm to 0,81 mm (0.016 in to 0.032 in)	5
0,81 mm to 1,22 mm (0.032 in to 0.048 in)	4
1,22 mm to 1,63 mm (0.048 in to 0.064 in)	3
1,63 mm to 2,03 mm (0.064 in to 0.080 in)	2
2,03 mm to 2,44 mm (0.080 in to 0.096 in)	1

Forward clutch and turbine shaft – To dismantle
1. Remove the large snap ring which retains the direct clutch hub to the forward clutch housing. Remove the direct clutch hub.
2. Remove the forward clutch hub. Remove the thrust washers, one from each side of the hub (see fig. T18-5).
3. Remove the composition and steel clutch plates. Remove the clutch apply ring.
4. Place the forward clutch on the bed of a press with the turbine shaft lowermost.
5. Compress the clutch return springs until the retaining snap ring is accessible. Remove the snap ring (see fig. T18-6).
6. Remove the tool, then remove the spring retainer and the sixteen clutch release springs. Keep these springs separate from the direct clutch release springs.
7. Remove the piston from the clutch housing (see fig. T18-7).

Note
The forward and direct clutch pistons are similar. Ensure that the forward clutch piston is identified during dismantling, so that it can be reassembled correctly into the forward clutch housing.

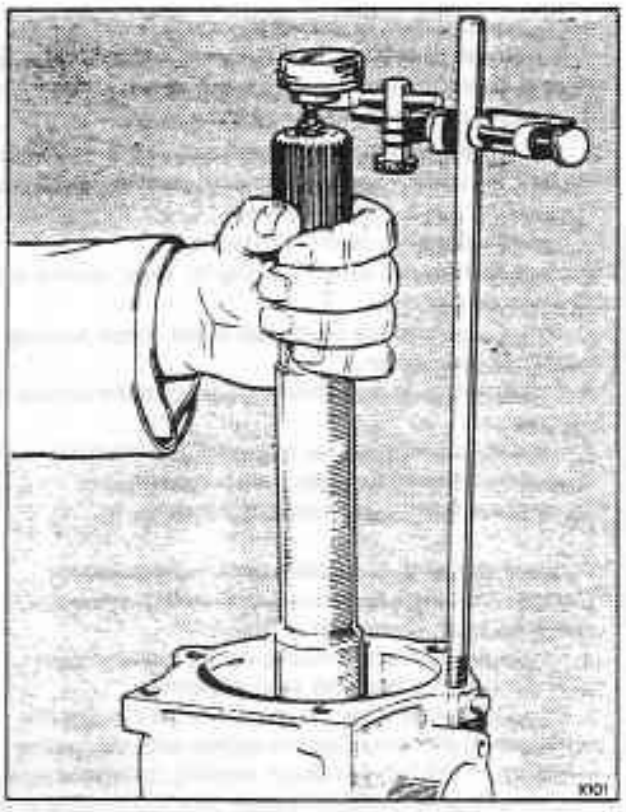


Fig. T18-4 Checking the rear unit end-float

8. Remove and discard the inner and outer seals from the clutch piston.
9. Remove and discard the piston centre seal from the forward clutch housing.
10. It is not necessary to remove the turbine shaft from the forward clutch housing unless either the shaft or the housing is damaged and requires renewal. Therefore, if renewal is required, proceed as follows.
11. Place the forward clutch housing on the bed of a press with the turbine shaft lowermost.
12. Using a drive extension 9,53 mm (0.375 in) in diameter and approximately 76,20 mm (3.00 in) long, or similar tool as a drive, press the turbine shaft out of the forward clutch housing.

Forward clutch and turbine shaft — To inspect

1. Wash all parts in clean paraffin, except the composition faced clutch plates. Dry all the parts with compressed air. The composition clutch plate surfaces should be examined for.
   a. Pitting and flaking.
   b. Wear.
   c. Glazing.
   d. Cracking.
   e. Charring.
   f. Metal particles embedded in the lining.

   If a composition plate exhibits any of the above conditions, fit new plates.
2. The steel plates should be checked for heat

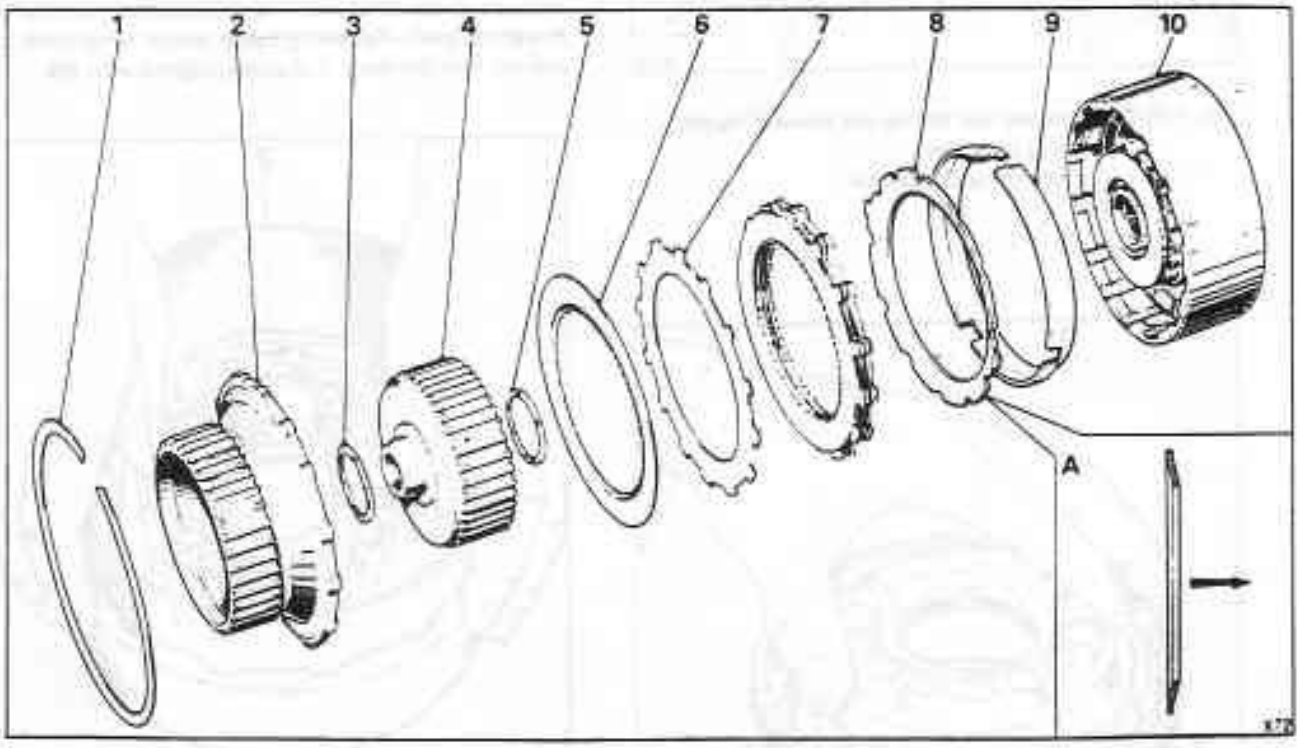


Fig. T18-5 Forward clutch assembly

1 Snap ring
2 Direct clutch hub
3 Thrust washer
4 Forward clutch hub
5 Thrust washer
6 Composition plate
7 Flat steel plate
8 Dished steel plate
9 Apply ring
10 Forward clutch assembly
A Direction of dished steel clutch plate into forward clutch housing

discolouration. If the surface is smooth and an even colour is indicated, the plates can be used again. If severe heat spot discolouration or surface scuffing is indicated, fit new plates.

3. Examine the sixteen clutch release springs for collapsed coils or signs of distortion. If any springs show these symptoms, fit sixteen new springs.

Extreme heat or burning in the area of the clutch may have caused the springs to take a heat set, if this condition is found, fit sixteen new springs.

4. Examine the clutch hubs for worn splines. Ensure that the lubrication holes are clear and that the thrust faces are not scored or damaged.
5. Examine the piston for cracks.
6. Examine the clutch housing for wear, scoring and open oil passages.
7. Ensure that the check ball in the clutch housing is free in its chamber.
8. Ensure that the lubrication holes in the turbine shaft are clear.
9. Examine the splines on the turbine shaft for damage and the shaft for cracks or distortion.
10. Examine the bush journals for damage.

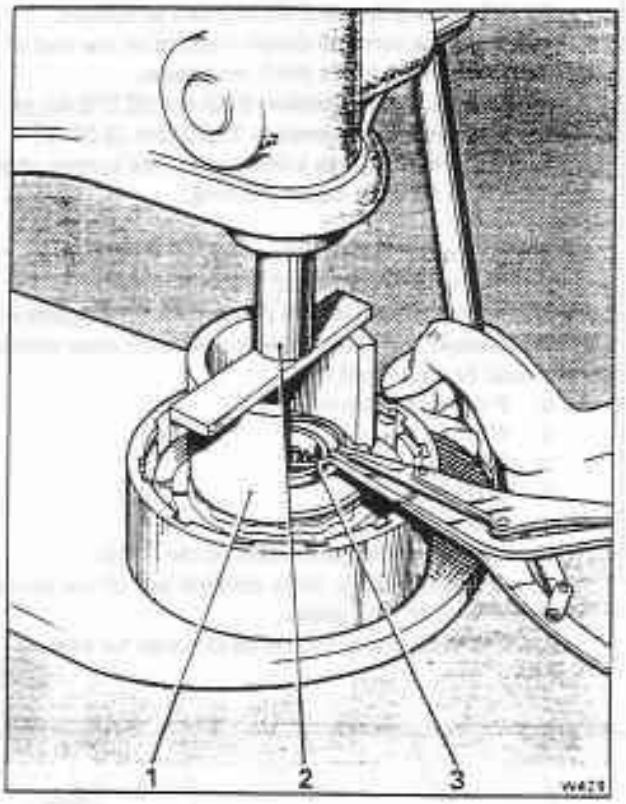


Fig. T18-6 Removing and fitting the forward clutch housing snap ring
1 Clutch spring compressor
2 Press ram
3 Snap ring

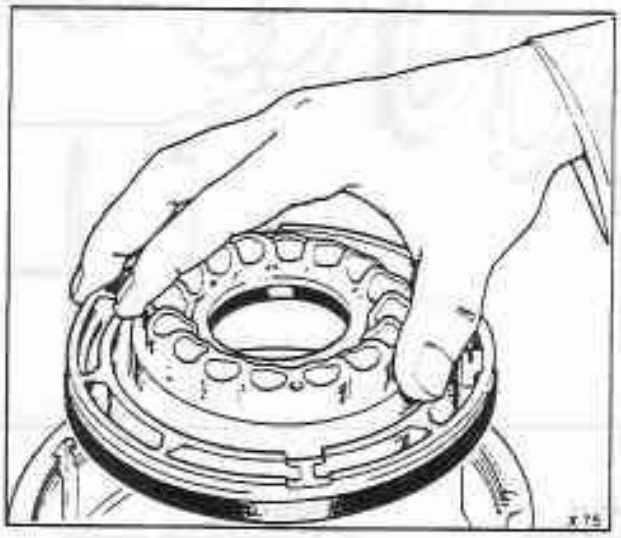


Fig. T18-7 Removing the forward clutch piston

Forward clutch and turbine shaft – To assemble

If the turbine shaft was removed from the forward clutch housing, proceed as follows.

1. Place the clutch housing on the bed of a press with the front face (flat side) uppermost.
2. Lightly lubricate the shorter splined end of the turbine shaft then, align the splines with the mating splines in the forward clutch housing. Using the press, carefully press the turbine shaft into the forward clutch housing until the shaft bottoms on the hub of the housing.

Note

The shaft should be started in the housing, then the pressure on the press arbor relaxed to allow the shaft to straighten itself. Repeat this step several times until it is evident that the shaft is squarely aligned with the

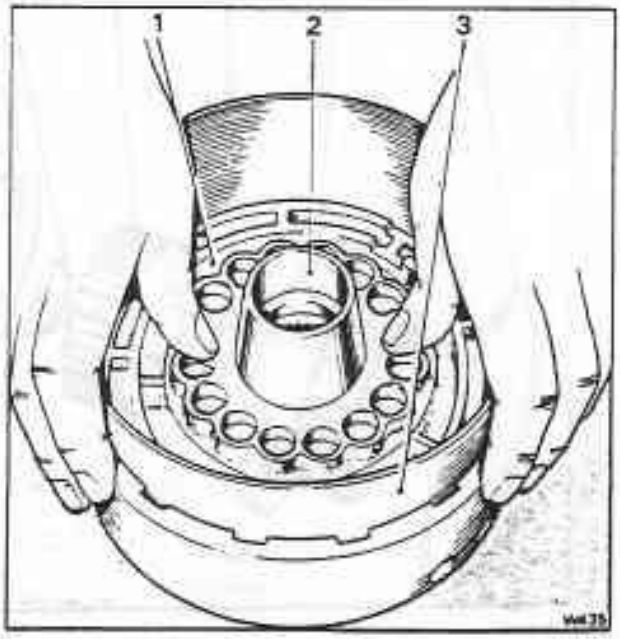


Fig. T18-8 Fitting the forward clutch piston
1 Forward clutch piston
2 Inner seal protector
3 Outer seal protector

housing. If the shaft is not started squarely, damage to the shaft or housing splines may occur.

3. Invert the forward clutch housing on the press so that the turbine shaft is downward.

4. Lubricate the new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in the piston with petroleum jelly then fit the seals with the seal lip facing away from the return spring pockets.

5. Lubricate a new piston centre seal with clean transmission fluid. Lubricate the seal groove in the forward clutch housing with petroleum jelly then fit the seal with the lip uppermost.

6. Fit the forward and direct clutch inner seal protector (J-21362) over the forward clutch hub.

7. Fit the clutch piston inside the forward and direct clutch piston seal protector (J-21409), then fit the assembly into the forward clutch housing (see fig. T18-8).

8. Fit the clutch piston by rotating it clockwise until it is seated in the housing.

9. Fit the sixteen clutch release springs into the spring pockets in the clutch piston.

10. Place the clutch housing on the bed of a press with the turbine shaft lowermost.

11. Position the spring retainer on the springs.

12. Compress the springs ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring then release the tension on the springs.

Note

Ensure that the release springs are not leaning. If necessary, push the springs into an upright position using a small screwdriver.

13. Fit the forward clutch apply ring into the clutch housing.

14. Fit the thrust washers on either side of the forward clutch hub. Retain the washers in position with petroleum jelly. Ensure the bronze washer is fitted to the side of the hub which faces the forward clutch housing.

15. Fit the forward clutch hub into the forward clutch housing.

16. Lubricate the five flat steel clutch plates, the five composition faced plates and the one dished steel clutch plate with clean transmission fluid.

17. Commence by fitting the dished steel plate with the concave side uppermost (away from the clutch piston), then alternate flat steel and composition plates (see fig. T18-5).

18. Fit the direct clutch hub into the forward clutch housing; fit the snap ring.

Direct clutch and intermediate sprag clutch assembly - To dismantle

1. Remove the snap ring which retains the sprag retainer.

2. Remove the retainer (see fig. T18-9).

3. Remove the sprag outer race, then withdraw the sprag clutch assembly from the outer race.

4. Turn the unit over then remove the large snap ring which retains the direct clutch back plate in the clutch housing; remove the back plate.

5. Remove the five composition plates, four steel plates, and one waved steel plate from the clutch housing. Remove the clutch apply ring.

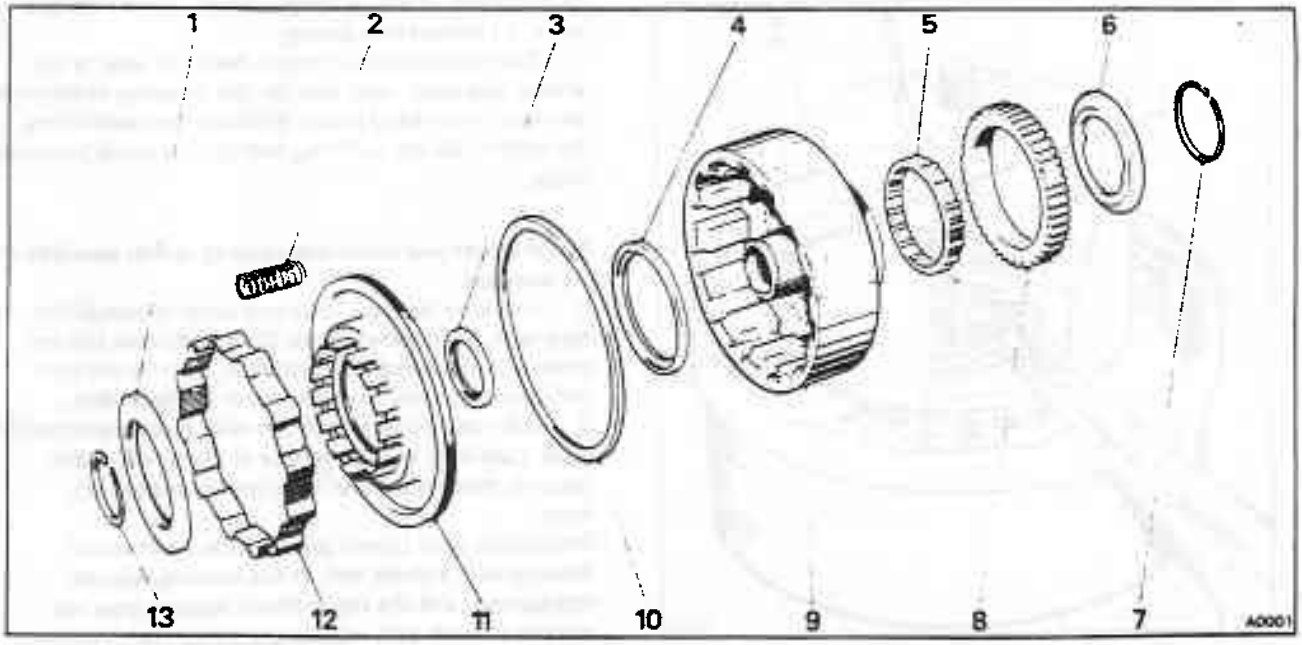


Fig. T18-9 Direct clutch and intermediate sprag assembly

1	Clutch spring retainer	6	Sprag clutch retainer	11	Direct clutch piston
2	Clutch release spring (14)	7	Snap ring	12	Apply ring
3	Piston inner seal	8	Intermediate clutch outer race	13	Snap ring
4	Piston centre seal	9	Direct clutch housing		
5	Sprag assembly	10	Piston outer seal		

On 1984 model year Mulsanne Turbo cars and onwards, remove six compostion plates, five flat steel plates, and one waved steel plate.

Note

The direct clutch assembly on the above cars has been uprated, therefore it should be kept together as an assembly. **Individual parts are not interchangeable with earlier models.**

6. Using the clutch spring compressor (J-2590), compress the clutch release springs and remove the snap ring (see fig. T18-10).
7. Remove the tool and lift off the spring retainer. Remove the fourteen clutch release springs. Keep these springs separate from the forward clutch release springs.
8. Withdraw the direct clutch piston from the clutch housing.

Note

The forward and direct clutch pistons are similar. Ensure that the direct clutch piston is identified during dismantling so that it can be reassembled correctly into the direct clutch housing.

9. Remove and discard the piston inner and outer seals.
10. Remove and discard the piston centre seal from the direct clutch housing.

Direct clutch, sun gear shaft, and intermediate sprag clutch assembly — To inspect

1. Wash all parts in clean paraffin, except the composition faced clutch plates. Dry all the parts with compressed air.
2. Examine the sprag assembly.

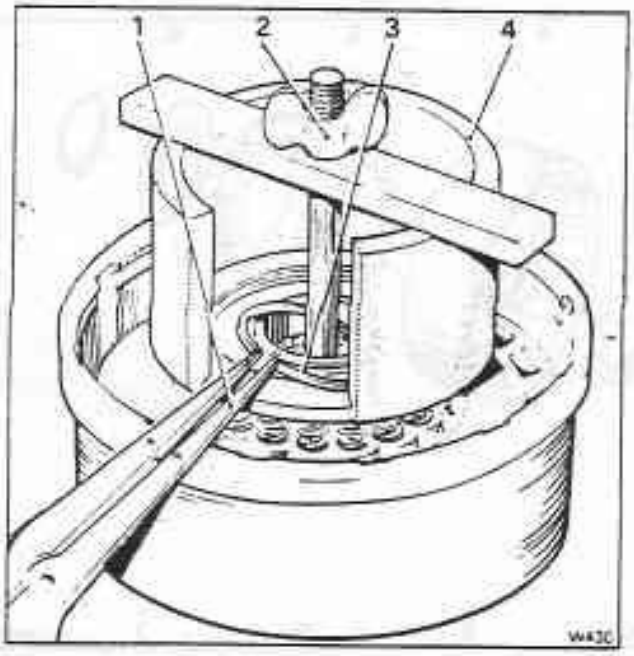


Fig. T18-10 Removing and fitting the direct clutch housing snap ring
1 Snap ring pliers
2 Spring compressor
3 Snap ring
4 Compressor adapter (seated on retainer)

3. Examine the inner cam and outer race for scratches or wear.
4. Examine the clutch housing for cracks. Ensure that the oil passages are clear and look for excessive wear on the clutch plate driving lugs.
5. Examine the composition faced and steel clutch plates.
6. Composition plates should be dried with compressed air and the composition surfaces inspected for.
   a. Pitting and flaking.
   b. Wear.
   c. Glazing.
   d. Cracking.
   e. Charring.
   f. Metal particles embedded in the lining.

   If a composition faced plate exhibits any of the above conditions, fit new plates.
7. Steel plates should be inspected for heat discolouration. If the surface is smooth and an even colour is indicated, the plates can be used again. If severe heat spot discolouration or surface scuffing is indicated, fit new plates.
8. Examine the back plate for scratches or other damage.
9. Examine the sun gear shaft for cracks. Examine the splines for damage, the bushes for scoring and the ground bush journals for damage. Ensure the oil feed hole is clear.
10. Examine the housing for free operation of the check ball.
11. Examine the piston for cracks.
12. Examine the fourteen springs for collapsed coils or distortion. If any of these springs requires replacement, fit sixteen new springs.
13. Examine the front friction band for wear at the anchor and apply lugs, also for the presence of metallic particles in the band lining. Examine the band lining for cracks, flaking, burning, and for the lining becoming loose.

Direct clutch and intermediate sprag clutch assembly — To assemble

1. Lubricate the new inner and outer clutch piston seals with clean transmission fluid. Lubricate the seal grooves in the direct clutch piston, then fit the seals with the lips facing away from the spring pockets.
2. Lubricate a new centre seal with clean transmission fluid. Lubricate the seal groove in the direct clutch housing, then fit the seal with the lip uppermost.

Note

Production built transmissions use a direct clutch housing with a check ball. If the housing requires replacement and the replacement housing does not contain a check ball, replace the direct clutch piston with the service piston which has a check ball. **Either the direct clutch housing and/or the piston must contain a check ball otherwise damage may occur to the direct clutch and related parts.**

3. Fit the inner seal protector (J-21362) over the direct clutch hub.
4. Fit the outer seal protector (J-21409) into the

clutch housing and fit the piston, turning it clockwise as it is pushed down. Remove the tools.

5. Fit the **fourteen** clutch release springs into the spring pockets in the clutch piston, leaving two pockets directly opposite one another with no springs. If replacement springs are to be fitted, fit all **sixteen**.
6. Position the spring retainer over the springs.
7. Using the clutch spring compressor (J-2590), compress the springs ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring, then remove the tool.

Note

Ensure that the clutch release springs are not leaning. If necessary, push the springs into an upright position using a small screwdriver.

8. Fit the direct clutch apply ring into the clutch housing.
9. Lubricate the four flat steel clutch plates, five composition faced plates and one waved steel plate with clean transmission fluid. Then fit the plates into the clutch housing (see fig. T18-11). Commence with the waved steel plate and then alternate composition and steel plates.

On 1984 model year Mulsanne Turbo cars and onwards, one waved steel plate, five flat steel plates, and six composition plates are fitted.

Note

Do not use radially grooved composition plates at this point of the assembly.

10. Fit the direct clutch backing plate over the clutch plates and fit the large snap ring.
11. Turn the clutch unit over and fit the sprag clutch assembly onto the intermediate clutch inner cam.
12. Fit the intermediate sprag outer race with a clockwise turning motion.

Note

When fitted, the outer race should not turn anti-clockwise.

13. Fit the sprag clutch retainer (cup side down) and fit the snap ring.

Turbine shaft, forward and direct clutches, sun gear shaft, and front band – To fit

1. Fit the front band so that the band anchor hole fits over the band anchor pin and the band apply lug faces the servo hole (see fig. T18-12).
2. Fit the sun gear shaft with the longer splined end innermost.
3. Fit the direct clutch housing and intermediate sprag assembly onto the centre support as follows.
4. Ensure that the ends of the oil sealing rings on the centre support are interlocked, and that the rings are lubricated.
5. Carefully slide the direct clutch housing onto the centre support sleeve, at the same time engage the housing internal splines with the splines on the sun gear shaft.
6. Ensure that the clutch housing hub bottoms on the

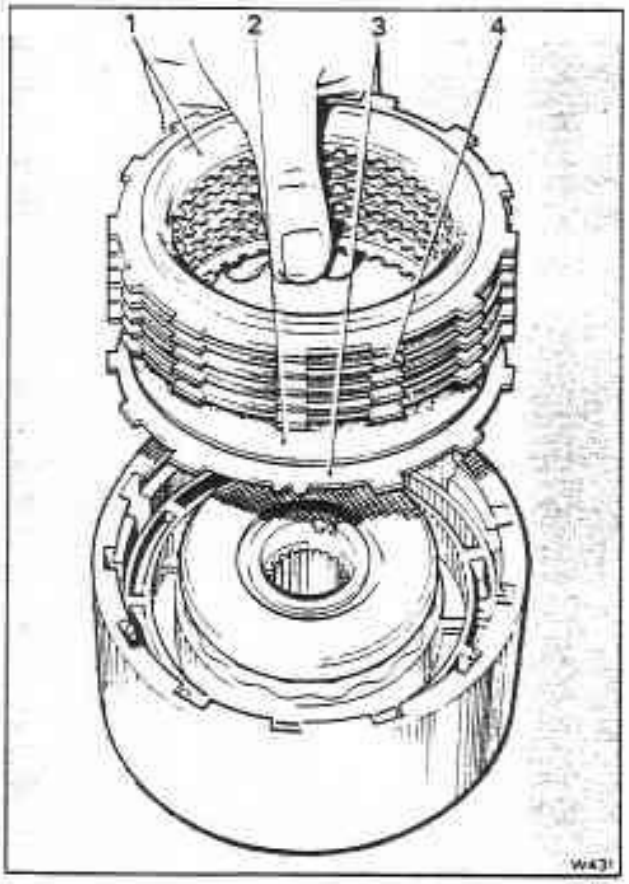


Fig. T18-11 Fitting the direct clutch plates
1 Backing plate
2 Composition plate
3 Waved steel plate
4 Flat steel plate

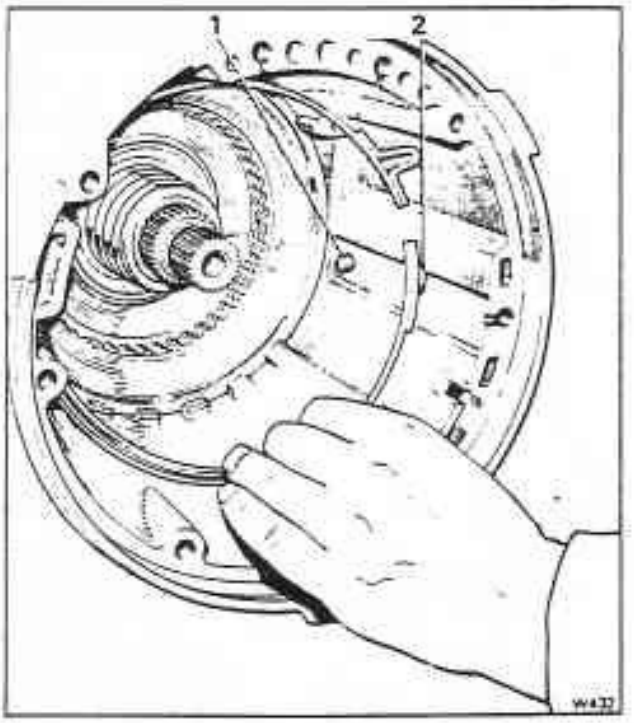


Fig. T18-12 Fitting the front band
1 Anchor pin
2 Front band location

sun gear shaft and that the splines on the forward end of the sun gear shaft are flush with the splines in the direct clutch housing.

Note

It will be necessary to rotate the clutch housing to allow the sprag outer race to line up with the intermediate clutch plates. If necessary, remove the direct clutch driving and driven plates to facilitate the handling of the housing.

7. Fit the bronze thrust washer onto the forward clutch hub; retain the washer in position with petroleum jelly.
8. Position the transmission horizontally in the transmission holding fixture, then fit the forward clutch assembly and the turbine shaft.
9. Ensure that the mainshaft bottoms on the end of the forward clutch hub.
10. It will be necessary to rotate the clutch housing to allow the direct clutch driving hub to line up with the clutch plates in the direct clutch.
11. When the forward clutch is correctly seated it should be approximately 31,75 mm (1.250 in) from the oil pump face in the transmission casing.

Note

The missing internal splines in the forward clutch hub are lubrication passages and do not have to be aligned with any particular splines on the mainshaft.

12. Fit the oil pump.

Intermediate clutch, gear unit, centre support, and reaction carrier

The intermediate clutch comprises three steel plates (1 waved and 2 flat), three composition plates and an apply piston.

On Mulsanne Turbo cars prior to 1984 model year, three flat steel plates were used together with heavy duty composition plates.

The steel plates are slotted directly into the transmission casing and the composition plates engage in splines machined in the intermediate clutch outer race.

The compound planetary gear unit consists of an internal gear, which is splined onto the mainshaft; an output planet carrier and pinions; an output shaft, which is mechanically connected to the output carrier; and a sun gear, which is splined onto the sun gear shaft (see fig. T19-1).

The centre support is keyed and bolted to the transmission casing and forms part of the reaction carrier roller assembly. The oil delivery sleeve, which supplies oil pressure to the direct clutch and the intermediate roller is an integral part of the centre support. The support also houses the piston that applies the intermediate clutch.

The reaction carrier comprises a housing, a set of planet pinions, and the outer race of the Low roller.

When the mainshaft rotates, the splined internal gear is driven clockwise. This causes the rear planet pinions to idle clockwise and drive the sun gear anti-clockwise.

The front and rear sun gears are integral so they turn as one. As a result, the front planet pinions also idle clockwise and drive the front internal gear clockwise.

The front internal gear is an integral part of the output carrier and is thus connected to the output shaft. This reacts with a force on the front pinions which are trying to drive the front internal gear clockwise. This reaction tends to rotate the front carrier assembly anti-clockwise instead of allowing the force to turn the internal gear and output shaft against the weight of the car.

To make the gear set effective in driving the car, a roller assembly is used to hold the carrier against anti-clockwise rotation. This roller assembly is in effect a one-way clutch which allows a rotating part to turn one way only.

The roller assembly is fitted in such a manner that its elements will lock and prevent the reaction carrier from rotating anti-clockwise. This provides the required reaction and causes the front planet pinions

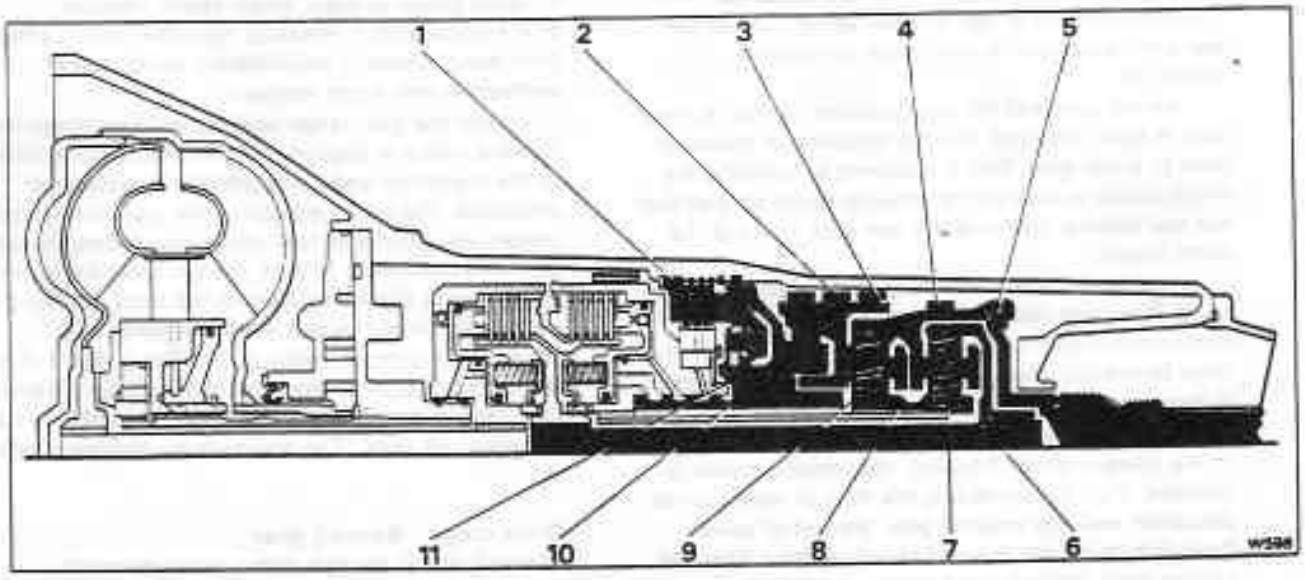


Fig. T19-1 Sectioned view of the transmission showing the intermediate clutch and gear unit

1 Intermediate clutch
2 Rear band
3 Reaction carrier
4 Output carrier
5 Output shaft driving flange
6 Mainshaft
7 Rear planet pinions
8 Sun gear
9 Front planet pinion
10 Roller clutch assembly
11 Centre support

Intermediate clutch, gear unit, centre support, and reaction carrier

to drive the front internal gear and output shaft in reduction at a ratio of approximately 2.5:1. This gear ratio, coupled with a maximum torque converter reduction of approximately 2.2:1 gives an overall ratio of almost 5.5:1 in first gear.

As the speed of the car increases, less torque multiplication is required so that the coupling will become more efficient, therefore, it is desirable to move to a lower ratio. This is accomplished with the aid of the intermediate sprag assembly, intermediate clutch, and sun gear shaft.

A sprag assembly is a device having irregular shaped members wedged between inner and outer races, similar to a roller assembly. It permits a part to rotate in one direction only.

When the intermediate clutch is applied, the drive plates become locked to the reaction plates and by doing so they lock the intermediate sprag outer race to the transmission case.

This, in effect, holds the clutch housing, sun gear shaft, and sun gear against anti-clockwise rotation. When the sun gear is stationary, the power flow is as follows.

Converter output is transmitted clockwise through the forward clutch to the mainshaft and rear internal gear. As the rear internal gear turns clockwise, the rear pinions rotate clockwise on their pins and 'walk around' the stationary sun gear. This moves the output carrier and output shaft clockwise in reduction at a ratio of approximately 1.5:1 (or second gear).

The front gear unit is not required for second gear operation. However, because the output carrier is integral with the front internal gear, the front internal gear runs clockwise in reduction. This causes the front planet pinions to run clockwise around the stationary sun gear, turning the reaction carrier clockwise. This clockwise rotation of the reaction carrier causes the rear roller assembly to overrun or to become ineffective.

As the speed of the car increases further, a lower ratio is again required. The transmission is moved to third or direct gear. This is achieved by applying the direct clutch as well as the forward clutch so that both the rear internal gear and the sun gear rotate at the same speed.

In order to obtain Reverse, a rear friction band is used. This band locks the reaction carrier against clockwise rotation which would cause the Low or rear roller to overrun. Power flow through the transmission in Reverse is as follows.

Turbine torque from the converter is transmitted to the forward clutch housing; the forward clutch is released, thus disconnecting the flow of power to the mainshaft and rear internal gear. Instead of power flowing through the forward clutch, it flows from the turbine shaft through the forward clutch housing and through the direct clutch hub to the direct clutch which is applied. This applies power to the sun gear shaft and sun gear, turning them clockwise. With the sun gear driving clockwise, the front pinions revolve anti-clockwise as idlers. This drives the front internal gear and output shaft anti-clockwise or in a reverse direction. The overall ratio in Reverse with maximum converter ratio and gear reduction is approximately 4.4:1.

In Intermediate range (second gear) with the accelerator pedal released, the car will slow down, using the engine as a brake. In this situation however, the rear wheels will drive the transmission through the output shaft and as a result, the intermediate sprag would attempt to overrun. To prevent this happening the front band is applied to the direct clutch housing, holding it stationary, thus keeping the transmission in second gear to provide effective engine braking.

For even greater engine braking, the transmission can be placed into Low range. At speeds below approximately 64km/h (40 mile/h) the transmission will move to first gear. When the car is in first gear and the throttle is closed, the Low roller tends to overrun. When the Low/Reverse band is applied, the reaction carrier is prevented from overrunning the roller and the transmission is retained in first gear.

The following is a summary of the flow of power through the transmission in various gears.

Summary of power flow

Neutral - Engine running

Forward clutch released, direct clutch released, intermediate clutch released, low roller clutch ineffective, front band released, intermediate sprag clutch ineffective, rear band released.

In Neutral, all clutches and bands are released; therefore, no power is transmitted from the torque converter turbine to the planetary gear train or output shaft.

Drive range - First gear

Forward clutch applied, direct clutch released, intermediate clutch released, low roller clutch effective, front band released, intermediate sprag clutch ineffective, rear band released.

With the gear range selector in Drive range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear clockwise. Clockwise motion of the rear internal gear causes the pinions to turn clockwise, driving the sun gear anti-clockwise. In turn, the sun gear drives the front pinions clockwise, driving the front internal gear, output carrier, and output shaft clockwise at a reduction of approximately 2.5:1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and roller clutch assembly to the transmission case. (The approximate stall ratio equals 5.5:1).

Drive range - Second gear

Forward clutch applied, direct clutch released, intermediate clutch applied, low roller clutch ineffective, front band released, intermediate sprag clutch effective, rear band released.

In second gear, the intermediate clutch is applied to allow the intermediate sprag clutch to hold the sun gear against anti-clockwise rotation. Turbine torque, through the forward clutch, is applied clockwise

through the mainshaft, to the rear internal gear. Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise at a reduction ratio of approximately 1.5:1.

Drive range - Third gear

Forward clutch applied, direct clutch applied, intermediate clutch applied, low roller clutch ineffective, front band released, intermediate sprag ineffective, rear band released.

In direct drive, engine torque is transmitted to the converter, then through the forward clutch to the mainshaft and the rear internal gear. Because the direct clutch is applied, equal power is transmitted also to the sun gear shaft and the sun gear. Since both the sun gear and the internal gears are now turning at the same speed, the planetary gear set is essentially locked and turns as one unit in direct drive at a ratio of 1:1.

Reverse

Forward clutch released, direct clutch applied, intermediate clutch released, low roller clutch ineffective, front band released, intermediate sprag clutch ineffective, rear band applied.

In reverse, the direct clutch is applied to transmit turbine torque from the forward clutch housing to the sun gear shaft and sun gear. The rear band is applied; this prevents the reaction carrier from turning clockwise. Clockwise torque to the sun gear causes the front pinions and front internal gear to turn anti-clockwise in reduction. The front internal gear is directly connected to the output shaft, thus providing the reverse output gear ratio of approximately 2:1. The reverse torque multiplication at stall (converter and gear ratios) is approximately 4.4:1.

Intermediate clutch, gear unit, centre support, and reaction carrier - To remove

Before the intermediate clutch, gear unit, and their associated parts can be removed, the transmission must be removed from the car.

Remove the following units.

1. Sump, strainer, and intake pipe assembly.
2. Control valve unit.
3. Rear servo.
4. Control valve spacer, check balls, and front servo.
5. Oil pump.
6. Turbine shaft, forward clutch, direct clutch, sun gear shaft, and front band.
7. Remove the centre support bolt from the transmission case. This is the socket-headed cap-screw located in the lower face of the transmission case at the rear of the control valve unit oil passages.
8. Remove the snap ring which secures the intermediate clutch back plate.
9. Remove the back plate then withdraw the three composition plates and the one waved and two flat steel plates (three flat steel plates on Mulsanne Turbo cars prior to 1984 model year).

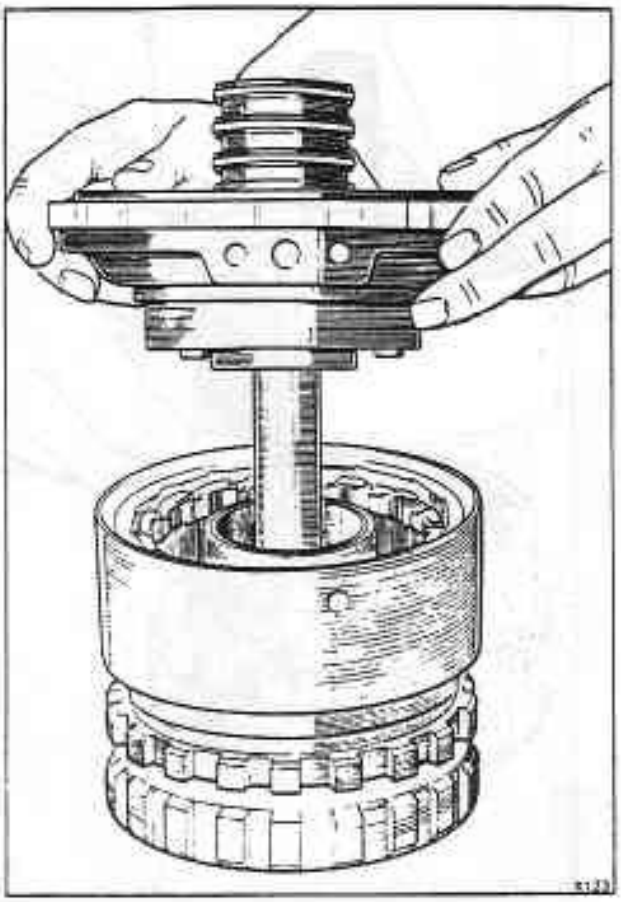


Fig. T19-2 Removing the centre support assembly

10. Remove the snap ring which retains the centre support in the case.
11. Remove the complete gear unit assembly by lifting with the removal tool (J-21795) and a slide hammer (J-7004).
12. Remove the output shaft thrust washer from either the output shaft or the case.
13. Hold the gear unit assembly with the output shaft pointing down (i.e. through a suitable hole in the work bench).
14. Remove the rear unit selective washer from the transmission case.
15. Remove the support to case spacer.
16. Remove the rear band assembly. To facilitate removal, rotate the band lugs away from the pins and pull the band assembly out of the transmission case.
17. Remove the centre support assembly from the reaction carrier (see fig. T19-2).
18. Withdraw the centre support to reaction carrier thrust washer.

Note

The thrust washer and the race may have adhered to the back of the centre support. If so, remove them from the centre support.

19. Remove the reaction carrier and roller clutch assembly from the output carrier (see fig. T19-3); remove the roller clutch assembly and spacer ring from the reaction carrier.

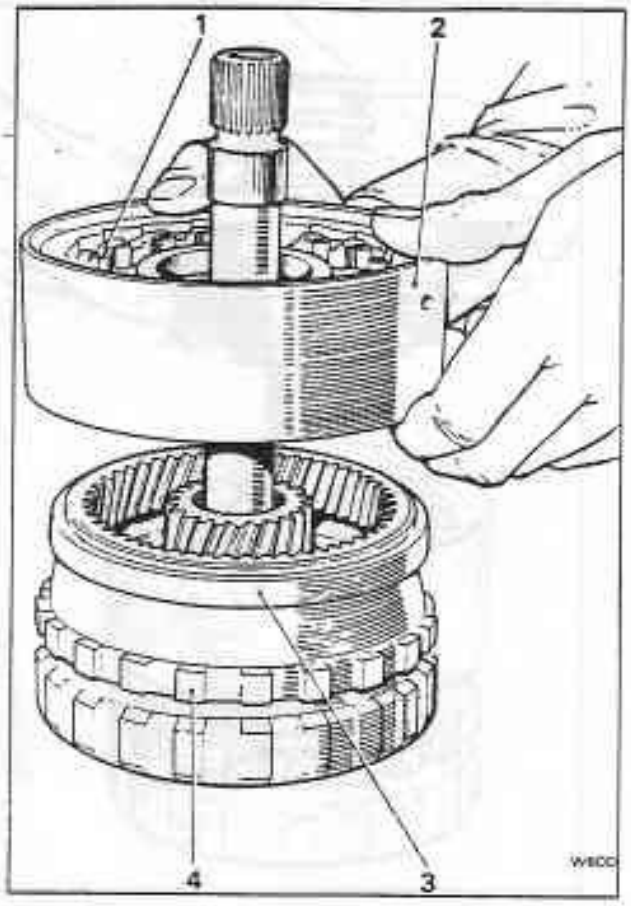


Fig. T19-3 Removing the reaction carrier assembly
1 Roller clutch assembly
2 Reaction carrier
3 Gear ring
4 Output carrier

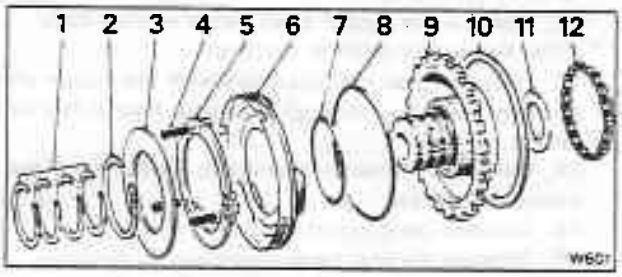


Fig. T19-4 Centre support assembly
1 Oil seal rings
2 Snap ring
3 Intermediate clutch spring retainer
4 Intermediate clutch release springs
5 Intermediate clutch spring guide
6 Intermediate clutch piston
7 Intermediate clutch inner seal
8 Intermediate clutch outer seal
9 Centre support assembly
10 Support to case spacer
11 Thrust washer
12 Roller clutch assembly

Centre support and intermediate clutch piston - To dismantle

1. Remove and discard the four oil seal rings from the centre support (see fig. T19-4).
2. Remove the snap ring (see fig. T19-5).
3. Remove the spring retainer and the clutch release springs.
4. Remove the intermediate clutch piston from the centre support.
5. Remove and discard the inner and outer seals from the clutch piston.

Note

Do not remove the three setscrews which secure the roller clutch inner race to the centre support.

Centre support and intermediate clutch piston - To inspect

1. Wash all parts in clean paraffin, then dry with compressed air.
2. Examine the roller clutch inner race for scratches and indentations. Ensure that the lubrication hole is clear.
3. Examine the bush for scoring or wear.

Note

Ensure that the **rear** spiral oil groove (looking from the front of the centre support) is in a clockwise direction (see fig. T19-6).

If replacement is necessary proceed as follows.

a. With the aid of the fitting/removal tools (J-21465-6 and J-8092), drive out the old bush.
b. **From the front of the centre support,** align the elongated slot in the bush with the drilled hole in the oil delivery sleeve (groove nearest to the intermediate piston).
c. Drive the bush squarely into the bore, until the bush is flush to 0,25 mm (0.010 in) below the top of the oil delivery sleeve.

4. Ensure that the oil ring grooves are clean and are not damaged.
5. Using compressed air check that the lubrication passages are clear and are not interconnected.
6. Examine the piston bore in the centre support for scratches or damage.
7. Examine the piston seal grooves for damage and ensure that they are clean.
8. Examine the piston for cracks or porosity.
9. Examine the springs for collapsed coils or signs of distortion. Check the spring length against that of a new spring before deciding whether to renew the complete set of springs.

Centre support and intermediate clutch piston - To assemble

1. Lubricate a new inner and a new outer seal with clean transmission fluid. Lubricate the seal grooves in the intermediate clutch piston and fit the seals with the lips facing away from the spring pockets.
2. Fit the intermediate clutch inner seal protector (J-21363) over the centre support hub.
3. Fit the intermediate clutch piston (see fig. T19-7). Ensure that it seats fully in the centre support.
4. Fit the spring guide and the three clutch release

springs into the pockets in the clutch piston.
5. Position the spring retainer centrally over the springs.
6. Compress the spring retainer, ensuring that the retainer does not catch in the snap ring groove. Fit the snap ring.
7. Fit four new oil sealing rings onto the centre support.

Gear unit - To dismantle (see fig. T19-8)

1. Remove the centre support to sun gear races and thrust bearing. The outer race may have been removed with the centre support.
2. Remove the sun gear from the output carrier assembly.
3. Remove the reaction carrier to output carrier thrust washer and front internal gear ring.
4. Invert the gear unit on the bench so that the mainshaft is pointing downwards.
5. Remove the snap ring which retains the output shaft in the output carrier; remove the output shaft.
6. Remove the thrust bearing and races from the rear internal gear.
7. Withdraw the rear internal gear and mainshaft from the output carrier; remove the thrust bearing and races from the inner face of the rear internal gear.
8. Remove the snap ring from the end of the mainshaft, then remove the rear internal gear.

Output shaft - To inspect

1. Wash the output shaft in clean paraffin, then dry with compressed air.
2. Examine the bushing for wear.
3. Examine the bearing and thrust washer faces for damage.
4. Examine the governor drive gear for rough or damaged teeth.
5. Examine the splines for damage.

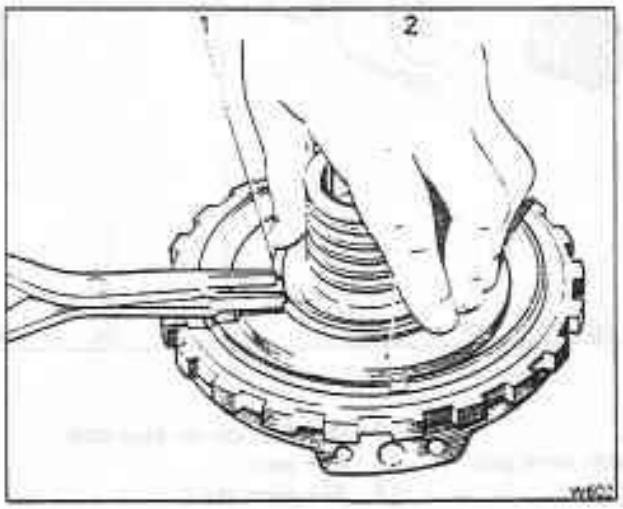


Fig. T19-5 Removing and fitting the intermediate clutch piston snap ring
1 Snap ring
2 Spring retainer

6. Examine the drive lugs for damage.
7. Examine the speedometer drive gear for rough or damaged teeth. If a gear is badly worn or damaged, it can be renewed as follows.

Speedometer drive gear - To remove

It should be noted that a nylon speedometer drive gear is installed **only** at the factory. All replacement drive gears are manufactured from steel.
1. If a **nylon gear** is fitted to the shaft, depress the retaining clip and slide the gear off the output shaft (see fig. T19-9).

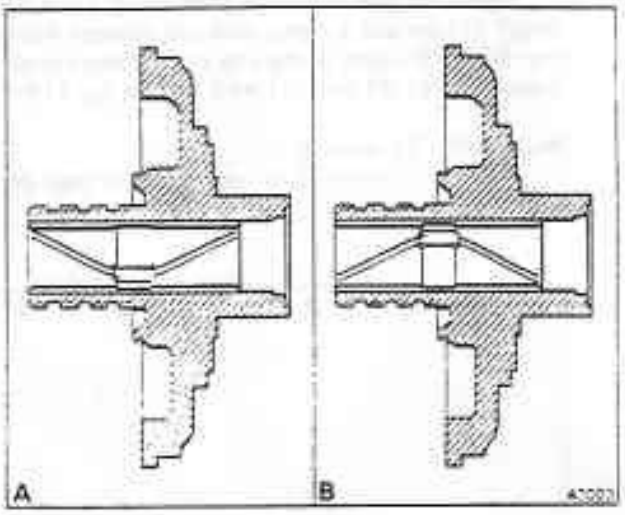


Fig. T19-6 Centre support bush
A Correctly fitted
B Incorrectly fitted

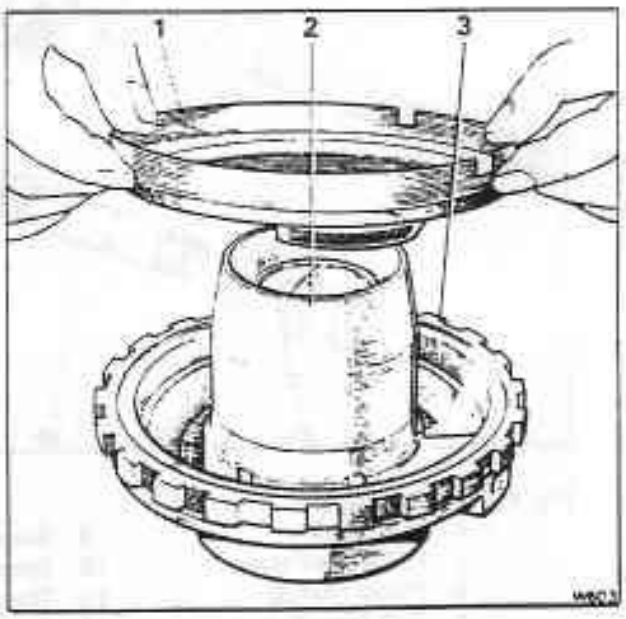


Fig. T19-7 Fitting the intermediate clutch piston
1 Intermediate clutch piston
2 Guide sleeve
3 Centre support

2. If a **steel gear** is fitted to the shaft, install the speedometer drive gear removal tools (J-21427 and J-9578) (see fig. T19-10).

Tighten the bolt on the puller until the gear is free on the shaft.

Remove the tools and the gear from the shaft.

Speedometer drive gear - To fit

1. To fit a **nylon gear**, align the slot in the speedometer drive gear with the hole in the output shaft, then install the retaining clip.
2. To fit a **steel gear**, lightly lubricate the bore of the gear, then fit the gear over the output shaft.

Press the gear down the shaft using a suitable length of tube and a press, until the distance from the rear face of the gear to the end of the output shaft measures 291,31 mm (11.469 in) (see fig. T19-11).

Mainshaft - To inspect

1. Wash the mainshaft in clean paraffin, then dry with compressed air.
2. Examine the shaft for cracks or distortion.
3. Examine the splines for damage.
4. Examine the ground journals for scratches or damage.
5. Examine the snap ring groove for damage.
6. Ensure the oil lubrication holes are clear.

Rear internal gear and sun gear - To inspect

1. Wash the rear internal gear and the sun gear in clean paraffin, then dry with compressed air.
2. Examine all the gear teeth for wear or damage.
3. Examine the splines for damage.
4. Examine the gears for cracks.

Output carrier assembly - To inspect

1. Wash the output carrier assembly in clean paraffin, then dry with compressed air.
2. Examine the front internal gear for damaged teeth.
3. Examine the pinion gears for damage, rough bearings, or excessive side movement.
4. Check the end-float of the pinions with the aid of

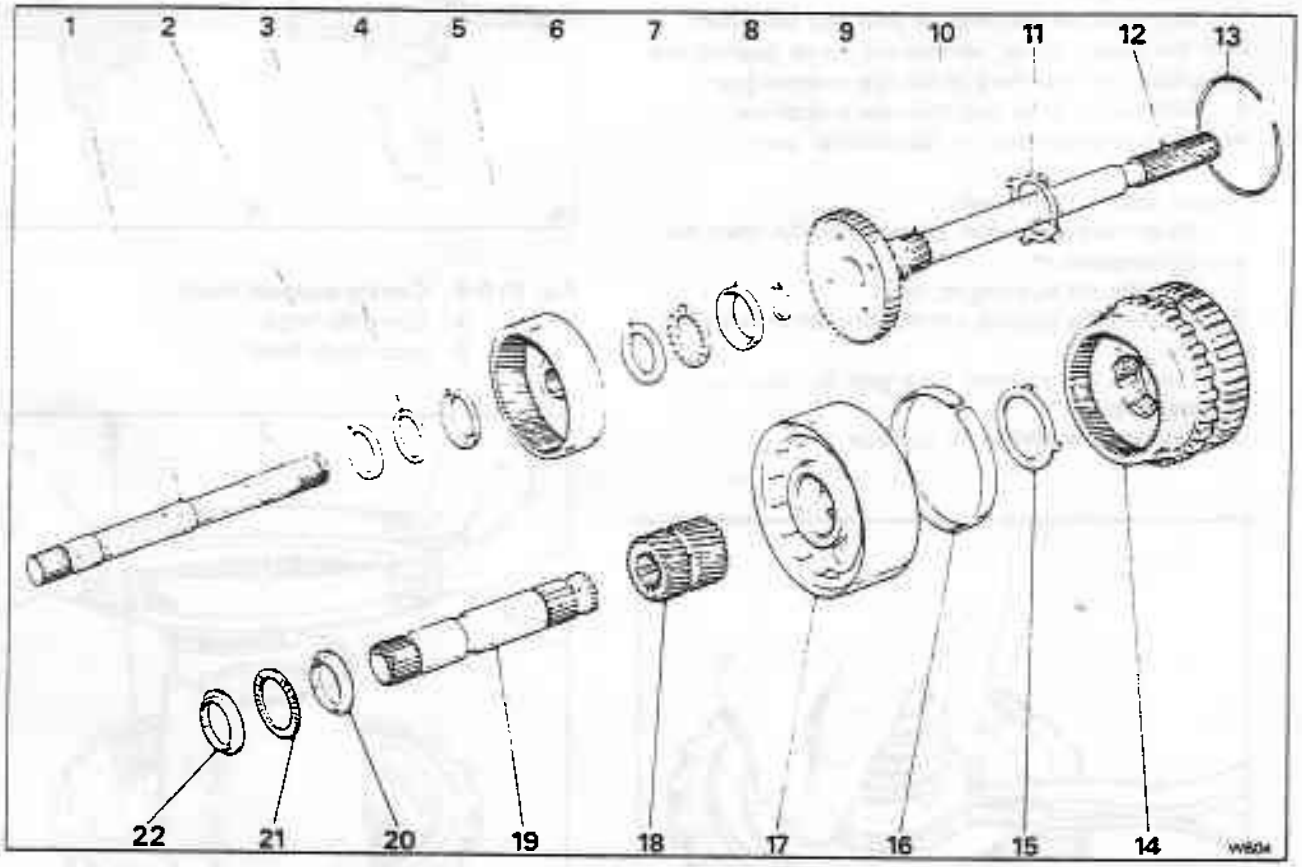


Fig. T19-8 Gear unit

1 Main shaft
2 I/D flanged race
3 Thrust bearing
4 O/D flanged race
5 Rear internal gear
6 I/D flanged race
7 Thrust bearing
8 O/D flanged race
9 Snap ring
10 Speedometer drive gear
11 Thrust washer
12 Output shaft
13 Snap ring
14 Output carrier assembly
15 Thrust washer
16 Front internal gear ring
17 Reaction carrier assembly
18 Sun gear
19 Sun gear shaft
20 I/D flanged race
21 Thrust bearing
22 I/D flanged race

a feeler gauge (see fig. T19-12). The end-float should be between 0,23 mm and 0,61 mm (0.009 in and 0.024 in).

5. Examine the parking pawl lugs for cracks or damage.
6. Examine the splines which drive the output shaft for damage.
7. Examine the front internal gear ring for flaking or cracks.

Reaction carrier assembly - To inspect

1. Examine the surface on which the rear band applies, for signs of burning or scoring.
2. Examine the roller outer race for scoring or wear.
3. Examine the thrust washer surfaces for signs of scoring or wear.
4. Examine the bush for damage. If the bush is damaged, the carrier must be renewed.
5. Examine the pinion gears for damage, rough bearings, or excessive side movement.
6. Check the pinion end-float. This should be between 0,23 mm and 0,61 mm (0.009 in and 0.024 in).

Pinion gears - To renew

1. Support the carrier assembly on its front face.
2. Using a 12,70 mm (0.50 in) diameter drill, remove the stake marks from the end of the pinion pins. Ensure that the drill does not remove any metal from the carrier as this will weaken the component and could result in a cracked carrier.

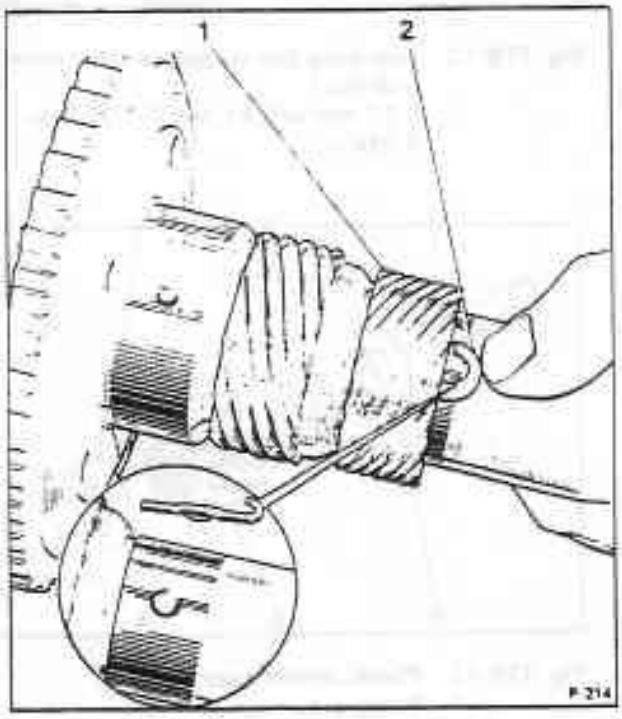


Fig. T19-9 Removing a nylon speedometer drive gear

1 Nylon gear
2 Retaining clip

3. Using a tapered punch, drive or press the pinions out of the carrier.
4. Remove the punch, gears, thrust washers, and needle roller bearings.
5. Examine the pinion thrust faces in the pinion gear pockets for burrs and stone off as necessary. Thoroughly wash the carrier in clean paraffin and dry with compressed air.
6. Ensure that the new gears are clean and free from burrs, then fit the eighteen needle bearings into each pinion gear. Use petroleum jelly to retain the bearings and use a pinion pin as a guide when fitting the bearings.
7. Fit a bronze and a steel thrust washer on each side of the pinion gear, with a steel washer next to the gear. Hold the washers in place with a smear of petroleum jelly.

On output carrier assemblies only, a steel and a bronze washer are always fitted on the thrust side, but two steel washers may be fitted on the non-thrust

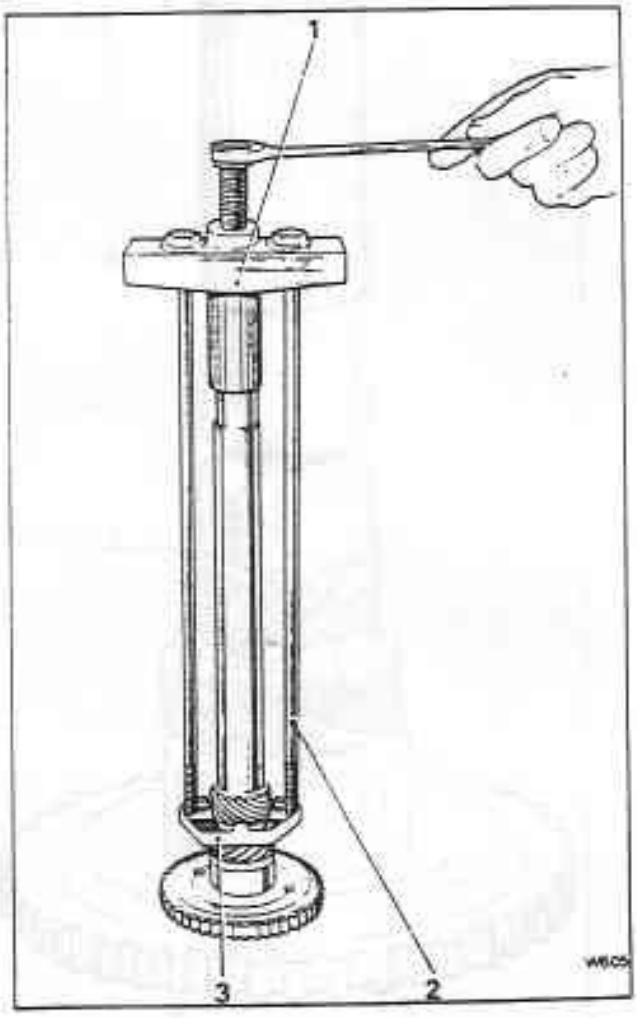


Fig. T19-10 Removing a steel speedometer drive gear

1 (J-9578)
2 Removal bolts
3 (J-21427)

side. However, if the pinion end-float is outside the tolerance given, the washers should be replaced with a steel and a bronze on both sides (see fig. T19-13). **This is essential on RT transmissions.**

8. Fit the pinion gear assembly into position in the carrier, then fit a pilot pin through the rear face of the assembly to centralize and hold the parts in position.
9. Drive a new pinion pin into position from the front, rotating the pinion whilst the pin is being driven in.
10. Ensure that the headed end of the pin is flush or below the face of the carrier.
11. Secure the punch to be used for staking the pins in a bench vice, so that it can be used as an anvil.
12. Support the carrier with the head of the pin resting on the punch. Then, using a chisel with a radiused end stake the opposite end of the pin in three places (see fig. T19-14).

Note
Both ends of the pin must lie below the face of the carrier, otherwise a foul may occur between the pin and the adjacent component.

13. Repeat the procedure for the remaining pins.

Roller clutch - To inspect

1. Wash the assembly in clean paraffin, then dry with compressed air.
2. Examine the roller clutch for damaged rollers or springs.
3. Examine the roller cage for damage.

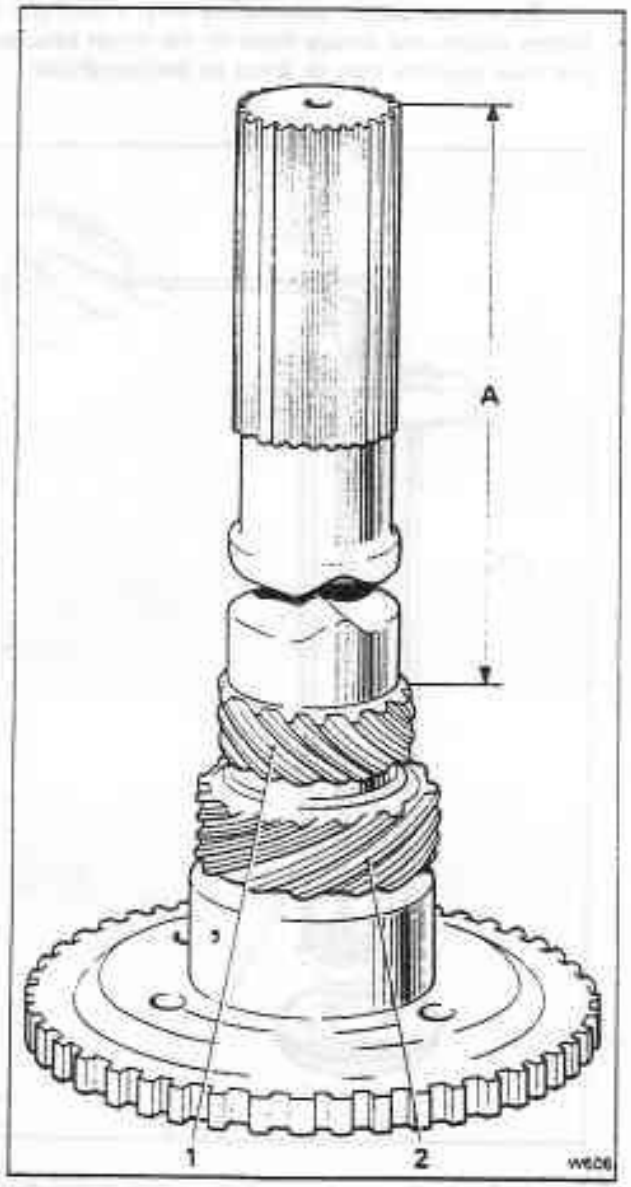


Fig. T19-11 Output shaft
1 Speedometer driving gear
2 Governor driving gear
A 291,30 mm (11.469 in)

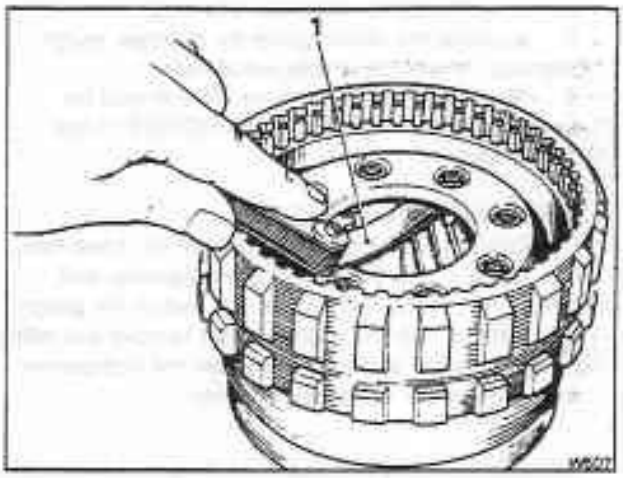


Fig. T19-12 Checking the output carrier pinion end-float
1 0,23 mm to 0,61 mm (0.009 in to 0.024 in)

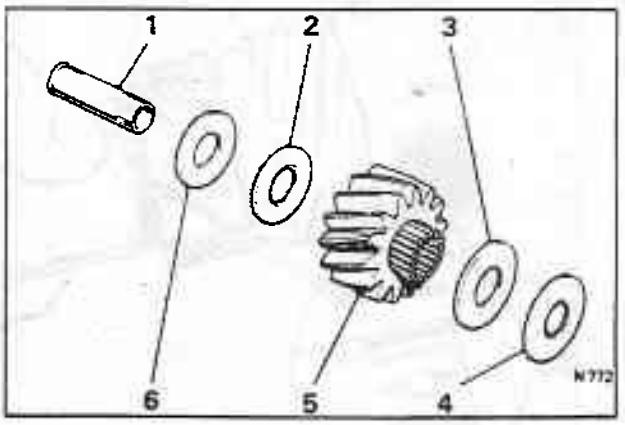


Fig. T19-13 Planet pinion gear
1 Pinion pin
2 Steel washer
3 Steel washer
4 Bronze washer
5 Planet pinion
6 Bronze washer

Intermediate clutch plates and rear band - To inspect

1. Examine the condition of the composition faced and steel plates. **Do not** diagnose a composition drive plate by colour.
2. Dry composition faced plates with compressed air and inspect the composition face for.
   a. Pitting and flaking.
   b. Wear.
   c. Glazing.
   d. Cracking.
   e. Charring.
   f. Metal particles embedded in the lining.

   If any of the above conditions are evident, replacement is required.
3. Wipe the steel plates dry and check for heat discolouration. If the surface is smooth and an even colour is indicated, the plates should be used again. If severe heat spot discolouration or surface scuffing is indicated, the plates must be replaced.
4. Examine the rear band for cracks or distortion.
5. Examine the ends of the band for damage at the anchor lugs and the apply lug.
6. Examine the lining for cracks, flaking, and burning.
7. Ensure that the lining is secured to the band.

Gear unit and centre support - To assemble

1. Ensure that all parts are clean. Lightly lubricate with clean transmission fluid all bushes, journals, gears, bearings, etc.
2. Fit the rear internal gear onto the mainshaft; fit the circlip.
3. Fit the races and thrust bearing onto the inner face of the rear internal gear, retaining them with a smear of petroleum jelly (see fig. T19-15).

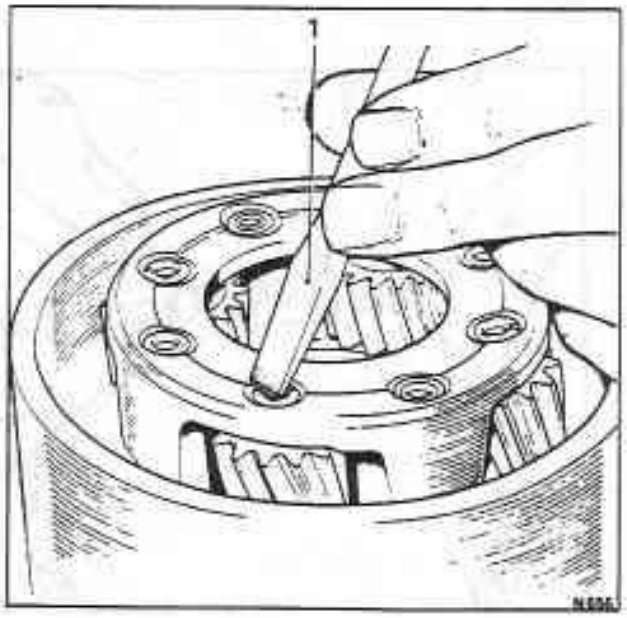


Fig. T19-14 Staking a pinion pin
1 Chisel

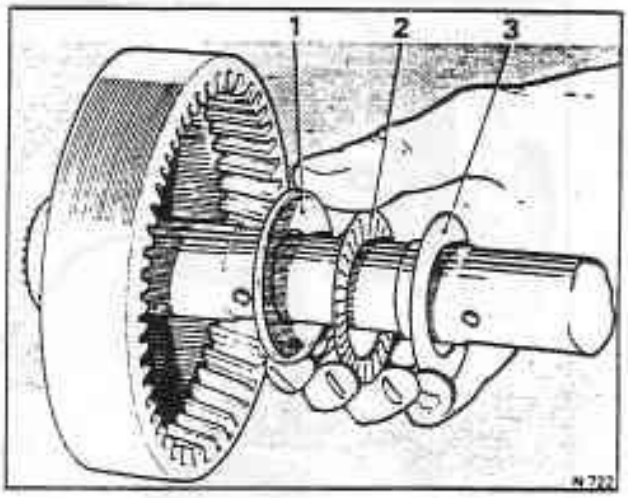


Fig. T19-15 Fitting the races and thrust bearing to the inner face of the rear internal gear
1 O/D flanged race
2 Thrust bearing
3 I/D flanged race

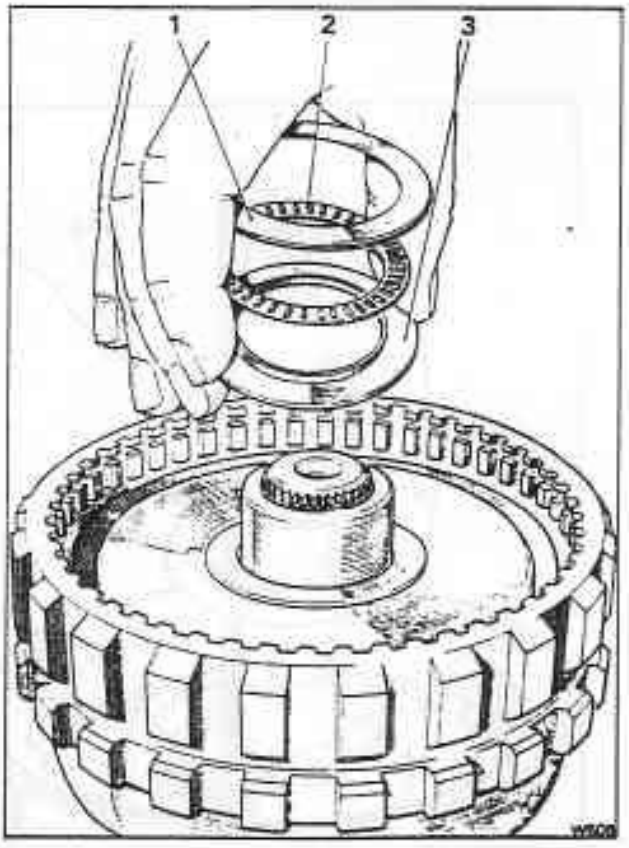


Fig. T19-16 Fitting the races and thrust bearing to the outer face of the rear internal gear
1 O/D flanged race
2 Thrust bearing
3 I/D flanged race

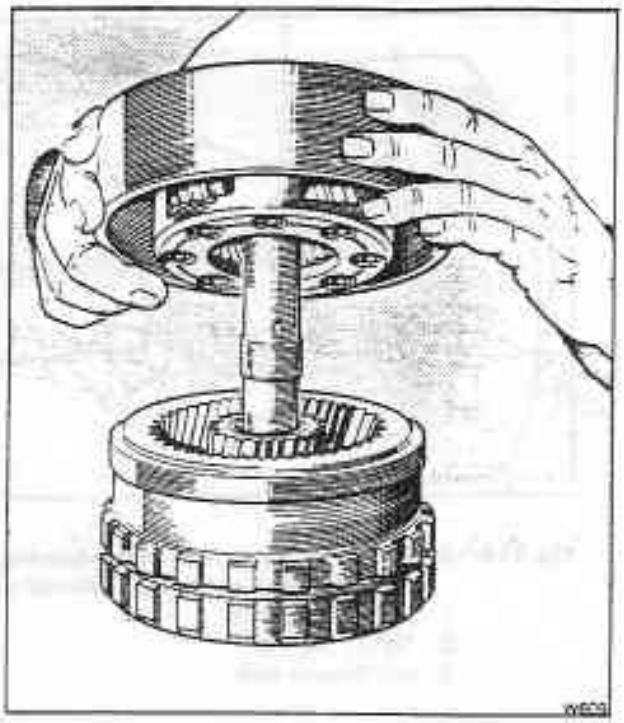


Fig. T19-17 Fitting the reaction carrier to the output carrier

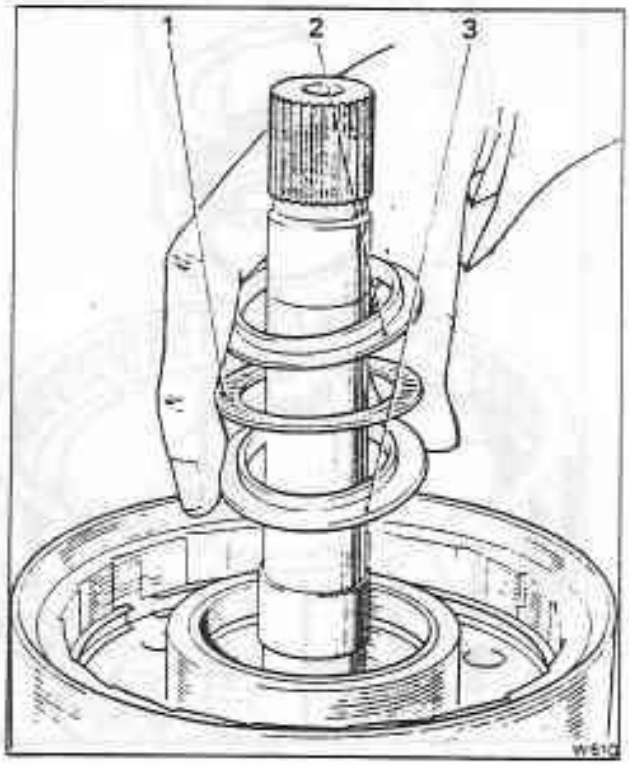


Fig. T19-18 Fitting the races and thrust bearing to the sun gear
1 Thrust bearing
2 I/D flanged race
3 I/D flanged race

4. Fit the large diameter race first with the outer flange uppermost.
5. Fit the thrust bearing into the race.
6. Fit the smaller diameter race over the bearing with the inner flange towards the bearing.
7. Ensure that the pinion gears are adequately lubricated then fit the output carrier onto the mainshaft so that the pinion gears mesh with the rear internal gear.
8. Position the assembly with the mainshaft pointing downwards through a hole in the bench. Take care not to damage the shaft.
9. Fit the races and thrust bearing onto the outer face of the rear internal gear, retaining them with a smear of petroleum jelly. The small diameter (flanged I/D) race must be fitted first with the flange uppermost (see fig. T19-16).
10. Fit the thrust bearing into the race.
11. Fit the large diameter (flanged O/D) race against the bearing with the flange cup over the bearing.
12. Fit the output shaft into the output carrier and fit the circlip.
13. Smear the output shaft to case metal thrust washer with petroleum jelly, then fit the washer into position.
14. Turn the assembly over so that the output shaft points downwards.
15. Smear the reaction carrier to output carrier thrust washer with petroleum jelly, then fit the washer into the output carrier so that the bent tabs engage in the tab pockets.

Note
The factory built transmissions use a non-metal washer, however, the service replacement thrust washer is metal.

16. Fit the sun gear; ensure that the end with the chamfered inside diameter faces downwards.
17. Fit the gear ring over the output carrier.
18. Fit the sun gear shaft with the longest splined end first.

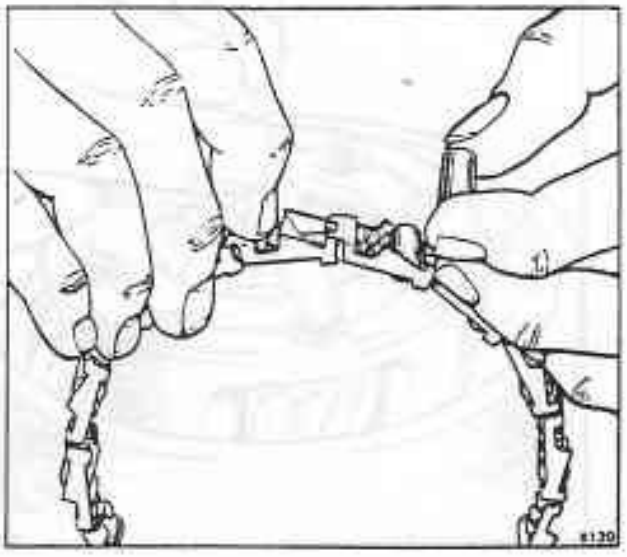


Fig. T19-19 Fitting a roller to the roller clutch cage

19. Ensure that the reaction carrier pinion gears are adequately lubricated, then fit the reaction carrier onto the output carrier as shown in figure T19-17. Mesh the pinion gears with the front internal gear.

Note

When a new output carrier and /or reaction carrier is being installed and the front internal gear ring prevents assembly of the carriers, replace the front internal gear ring with the service ring.

20. Smear the centre support to sun gear thrust races and bearing with petroleum jelly and fit as follows (see fig. T19-18).

a. The large outer diameter race, with the centre flange up, over the sun gear shaft.

b. The thrust bearing onto the large race.

c. The small diameter race, with the centre flange up.

21. Smear the centre support to reaction carrier thrust washer with petroleum jelly, then fit the washer into the recess in the centre support.

22. Fit the rollers that may have come out of the roller clutch cage, by compressing the energizing spring with the forefinger and inserting the roller from the outside (see fig. T19-19).

Note

Ensure that the energizing springs are not distorted and that the curved end leaf of the springs are positioned against the rollers.

23. Fit the spacer ring and roller clutch assembly into the reaction carrier.

24. Fit the centre support assembly into the roller clutch (see fig. T19-20).

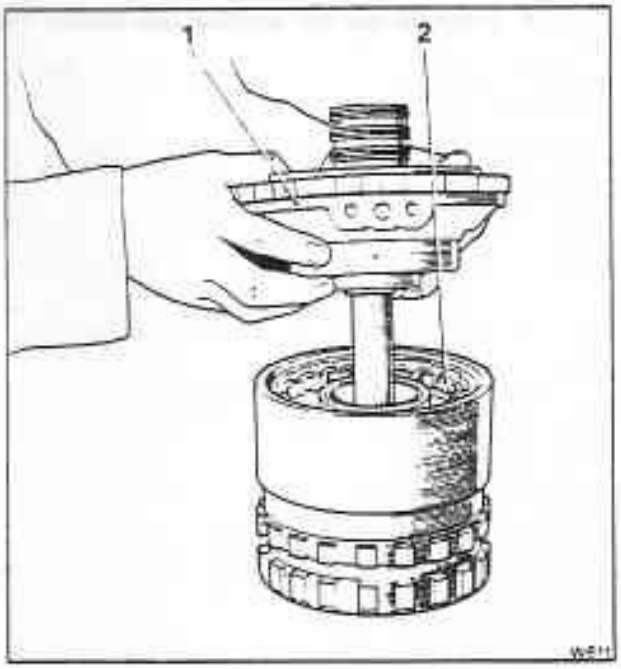


Fig. T19-20 Fitting the centre support into the reaction carrier (roller clutch)

1 Centre support
2 Roller clutch

Note

With the reaction carrier held, the centre support should turn **anti-clockwise only.**

Intermediate clutch, gear unit, centre support, and reaction carrier - To fit

1. Fit the rear band assembly into the transmission case so that the band lugs engage with the anchor pins (see fig. T19-21).

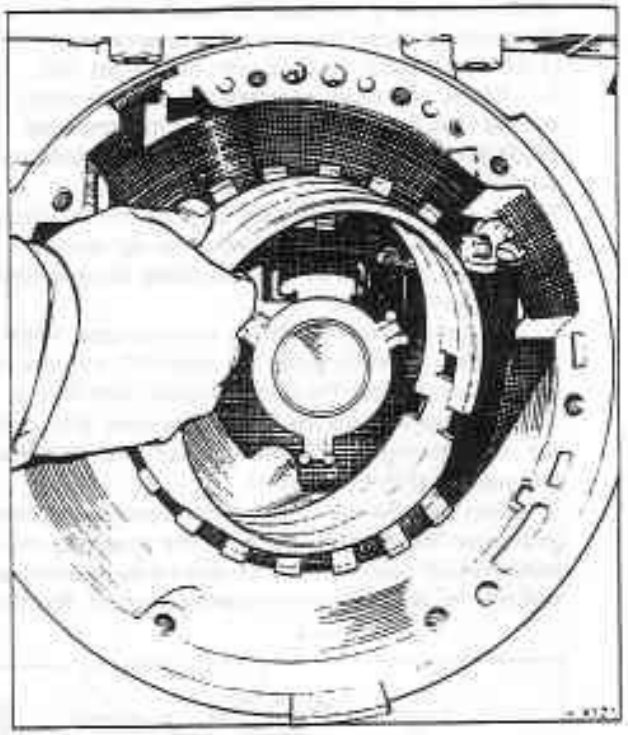


Fig. T19-21 Fitting the rear band

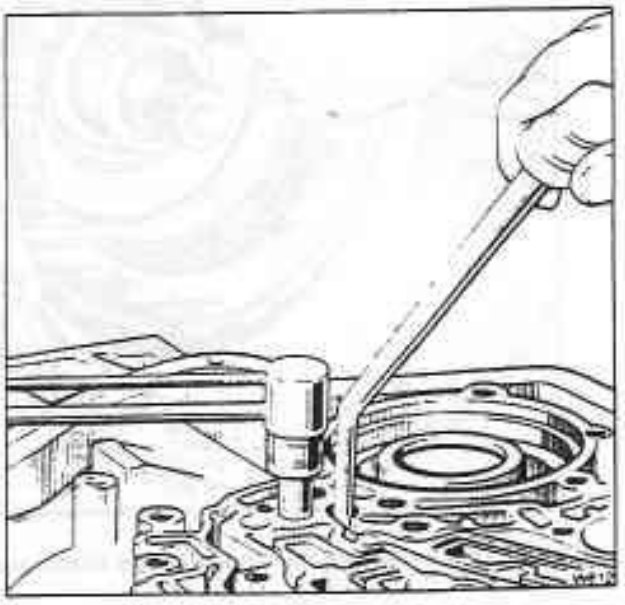


Fig. T19-22 Locating the centre support

2. Inspect the support to case spacer for burrs or raised edges. If necessary, remove the burrs, etc. with a stone or fine emery cloth. Ensure that the spacer is clean.
3. Fit the support to case spacer against the shoulder at the bottom of the case splines and the gap adjacent to the band anchor pin.

Note

Do not confuse this spacer [1,02 mm (0.040 in) thick and with both sides flat] with either the centre support to case snap ring (one side bevelled) or the intermediate clutch backing plate to case snap ring [2.36 mm (0.093 in) thick with both sides flat].

4. Fit the previously selected rear unit adjusting washer (see Section T18) into the slots provided inside the rear of the transmission case. Retain the washer with a smear of petroleum jelly.
5. Fit the transmission case into the holding fixture (if it has been removed). Do not over-tighten the fixture side pivot pin as this will cause binding when the gear unit is fitted.
6. Fit the gear unit assembly into the case. Align the slots. Then, carefully guide the assembly into the case, making certain that the centre support bolt hole is properly aligned with the hole in the case. Ensure that the tangs on the output shaft to case thrust washer are positioned in the pockets.
7. Lubricate the centre support retaining snap ring with clean transmission fluid. Fit the snap ring into the transmission case with the bevelled side uppermost and the flat side against the centre support. Position the location gap adjacent to the front band anchor pin.
8. Fit the case to centre support bolt by placing the centre support locating tool (J-23093) into the case direct clutch passage. Ensure that the handle of the tool is pointing to the right as viewed from the front of the transmission and parallel to the bell housing mounting face.
9. Apply pressure downward to the tool handle which will tend to rotate the centre support anti-clockwise as viewed from the front of the transmission.
10. While holding the centre support firmly anti-clockwise against the case splines, torque tighten the case to centre support bolt to the figures quoted in Section T22, using a ⅜ in UNC 12 point thin wall, deep socket (see fig. T19-22).

Note

When using the locating tool, take care not to create burrs on the case valve body mounting face.

11. Lubricate the one waved and two flat steel plates (three flat steel plates on Mulsanne Turbo cars prior to 1984 model year) also the three composition intermediate clutch plates with clean transmission fluid, then fit the clutch plates. Commence with the waved steel plate, then fit alternate composition and flat steel plates (see fig. T19-23).

On Mulsanne Turbo cars prior to 1984 model year, commence with a flat steel plate, then alternate composition and flat steel plates.

12. Fit the intermediate clutch back plate with the ridge uppermost.
13. Fit the intermediate clutch backing plate to case snap ring, ensuring that the ring gap is opposite the band anchor pin. Both sides of this snap ring are flat and it is 2.36 mm (0.093 in) thick.
14. Check the rear unit end-float (see Section T18).

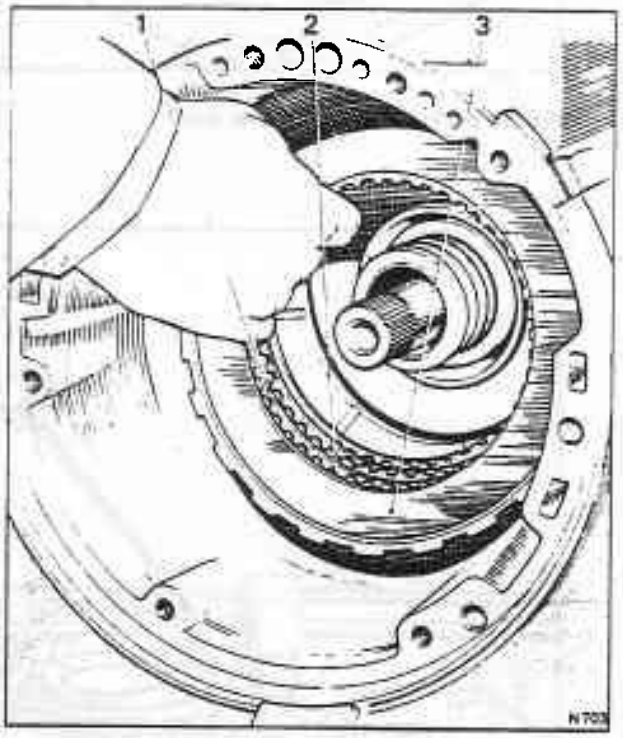


Fig. T19-23 Fitting the intermediate clutch plates
1 Steel plate
2 Composition plate
3 Back plate

Transmission case

The transmission case is an alloy die casting which houses the main transmission components. It also forms the bell housing which encloses the torque converter.

The lower inner face of the case forms part of the hydraulic passages onto which the control valve unit is fitted. The oil pump is fitted to a machined face at the front of the case. This machined face contains oil passages which convey transmission fluid from the pump to various points in the case (see fig. T20-1).

The bore in the rear of the case contains a bush in which the output shaft rotates.

Transmission case – To inspect

1. When the transmission has been completely dismantled, the case should be thoroughly washed in clean paraffin, then dried with compressed air.
2. Ensure that all the oil passages are flushed out.
3. Take care not to create burrs on the ends of the passages.

Note
If the case assembly requires replacement, ensure that the centre support to case spacer is removed from the old case and fitted in the new case.

4. Inspect the case assembly for cracks, internal porosity or cross channel leaks in the valve body face passages.
5. Check the retention of the band anchor pins.
6. Inspect all threaded holes for thread damage.

Note
Stripped threads in bolt holes are repairable with Heli-coil inserts (see fig. T20-3 and Heli-coil chart).

7. Inspect the intermediate clutch plate lugs for damage.
8. Inspect the snap ring grooves for damage.

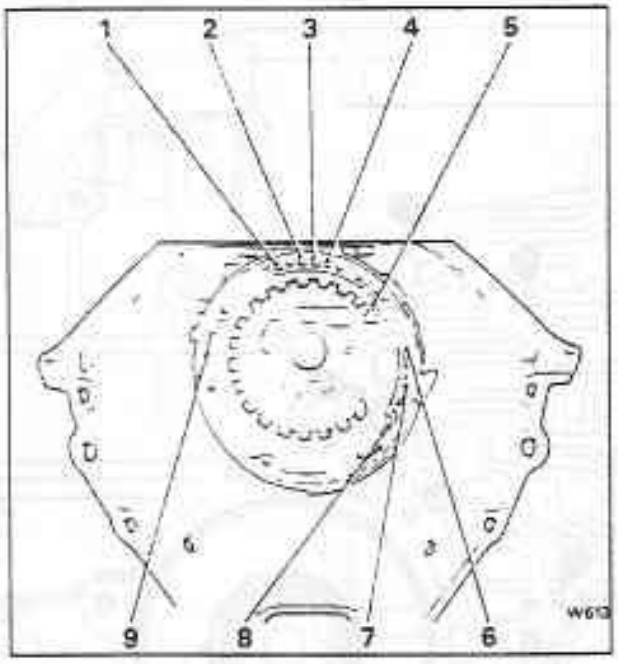


Fig. T20-1 Transmission case oil passages
1 Reverse
2 Line
3 Drive
4 Modulator
5 Intermediate clutch cup plug
6 To cooler
7 Cooler return
8 Vent
9 Pump intake

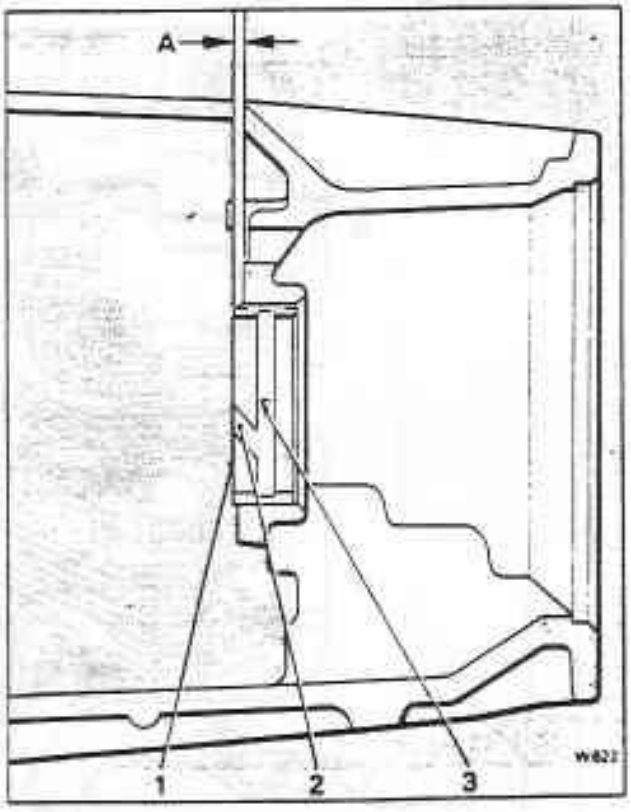


Fig. T20-2 Fitting a new case bush
1 Bush
2 Oil groove in direction shown
3 Stake mark
A 1,02 mm to 1,40 mm (0.040 in to 0.055 in)

9. Inspect the bore of the governor assembly for scratches or scoring.
10. Inspect the modulator valve bore for scoring or damage.
11. Inspect the intermediate clutch cup plug for retention and sealing. If necessary, fit a new plug.

External damage
External damage is usually caused by handling, road hazards, or the converter to flexplate setscrews becoming loose as a result of incorrect fitting. Therefore, when external damage is evident as previously described, fit a new case.

Internal damage
If internal damage is due to the incorrect installation of the spacer and/or the snap rings resulting in damage to the snap ring grooves, fit a new case and ensure that the snap rings are assembled correctly.

High oil pressure (faults usually located in the pressure regulator valve system) can also result in internal damage. If this is the cause, fit a new case and rectify the problem.

If the case bushing is found to be worn or scored, fit new bushing (see fig. T20-2).

Repair procedure for minor case porosity
1. Bring the transmission fluid up to the normal operating temperature approximately 82°C.
2. Locate the source of the oil leak.
3. Thoroughly clean the area to be repaired with cleaning solvent and a brush; dry the area with compressed air. A clean, dry soldering acid brush may be used to clean the area and also to apply the epoxy cement.
4. Following the manufacturer's instructions, mix a sufficient amount of epoxy cement, such as 3M Scotch Weld 2216 or equivalent, to carry out the necessary repair.

Note
Observe the manufacturer's precautions in handling.

5. While the transmission is still at operating temperature, apply the epoxy cement to the area under repair. Ensure that the area is completely covered.
6. If 3M Scotch Weld 2216 has been used, allow 1 hour to pass before starting the engine. Equivalent

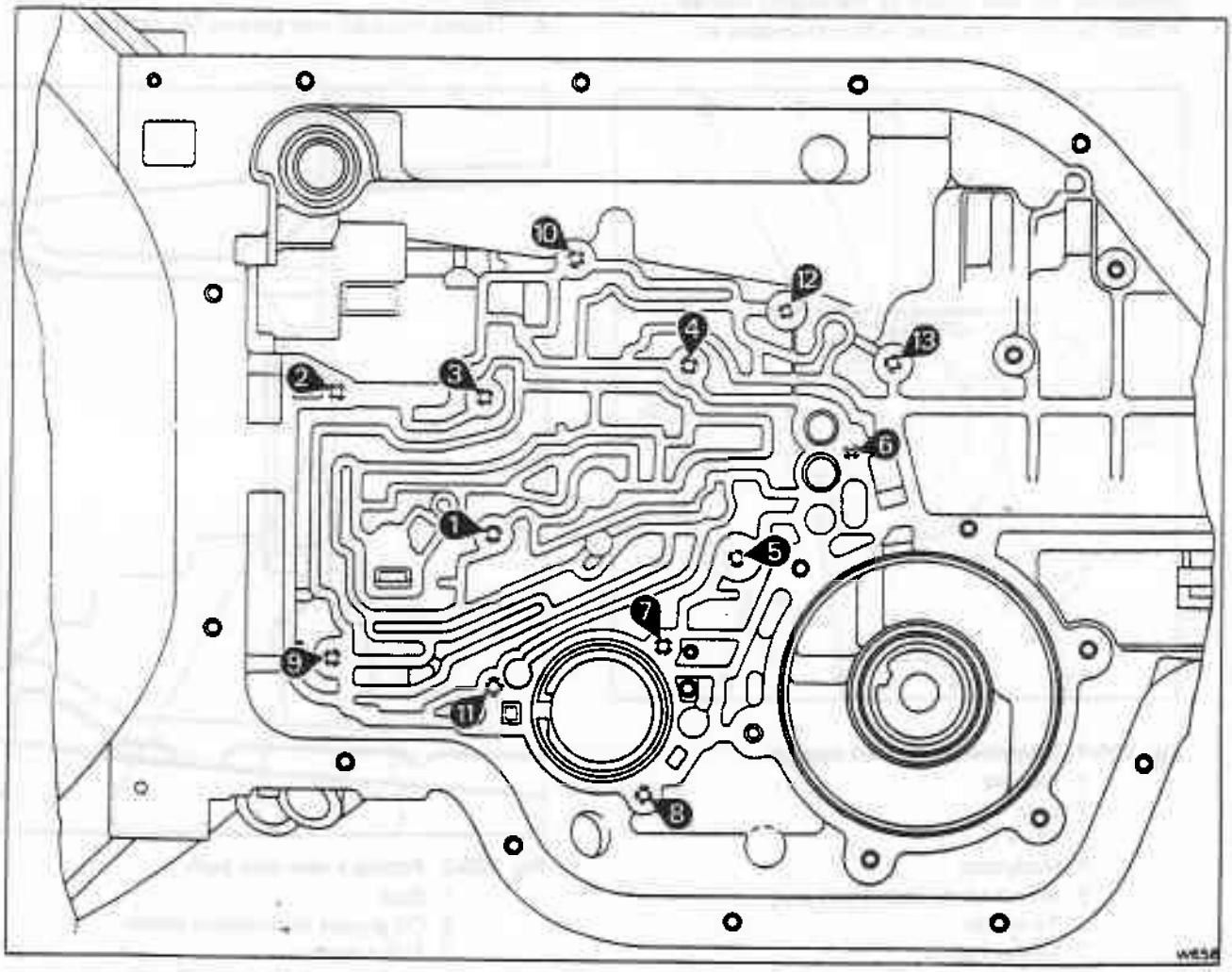


Fig. T20-3 Heli-coil identification — View of underside of transmission case

epoxy cements may take longer to cure, therefore, always check the manufacturer's instructions.

7. Finally, bring the transmission fluid up to the normal operating temperature of approximately 82°C and check the transmission for leaks.

Intermediate clutch cup plug — To fit

1. Place the transmission case in the holding fixture RH 7955 and position it with the front end facing upwards.
2. Ensure that the intermediate clutch cup plug hole

Heli-coil information for Torque Converter Transmission

Transmission out of car and partially or completely dismantled

Location	Hole number	Drill size	Tap size	Heli-coil size
Pump to case	All	8,33 mm (0.328 in)	5/16 - 18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	1 to 4 (see fig. T20-3)	8,33 mm (0.328 in)	5/16 - 18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	5 and 6 (see fig. T20-3)	6,76 mm (0.266 in)	¼ - 20 UNC-2B	¼ - 20 STI-NC
Converter to flexplate	All	10,30 mm (0.406 in)	M10 - 1.5	M10 - 1.5 x 1½D

Transmission in car and partially dismantled

Location	Hole number	Drill size	Tap size	Heli-coil size
Rear extension to case	All	9,93 mm (0.391 in)	3/8 - 16 UNC-2B	3/8 - 16 STI-NC
Governor cover to case	All	8,33 mm (0.328 in)	5/16 - 18 UNC-2B	5/16 - 18 STI-NC
Modulator retainer to case	–	8,33 mm (0.328 in)	5/16 - 18 UNC-2B	5/16 - 18 STI-NC
Speedometer driven gear assembly to case	–	6,20 mm (0.244 in)	M6 - 1.0	M6 - 1.0 x 2D
Oil sump to case	All	8,33 mm (0.328 in)	5/16 - 18 UNC-2B	5/16 - 18 STI-NC
Rear servo cover to case	All	8,33 mm (0.328 in)	5/16 - 18 UNC-2B	5/16 - 18 STI-NC
Parking lock bracket to case	All	8,33 mm (0.328 in)	5/16 - 18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	7 to 10 (see fig. T20-3)	8,33 mm (0.328 in)	5/16 - 18 UNC-2B	5/16 - 18 STI-NC
Valve body to case	11 (see fig. T20-3)	6,76 mm (0.266 in)	¼ - 20 UNC-2B	¼ - 20 STI-NC
Solenoid to case	12 and 13 (see fig. T20-3)	6,76 mm (0.266 in)	¼ - 20 UNC-2B	¼ - 20 STI-NC

is thoroughly clean and enter the intermediate clutch cup plug into the hole, open end out. Drive the plug into the case until it is flush or slightly below the top of the hole using a 9,52 mm (0.375 in) diameter rod, approximately 254 mm (10 in) long.

Note

Ensure that the diameter of the rod is large enough to locate on the lip edge of the plug and not the bottom of the plug.

3. Stake the plug securely in the case.

Case bushing – To remove

1. Support the case in the holding fixture and thread the extension handle (J-21465-13) into the bushing removal tool (J-21465-8). Using drive handle (J-8092) remove the bush.

Case bushing – To fit

1. Support the transmission case and using the adapter (J-21465-9), on the removal/fitting tool (J-21465-8), together with the drive handle (J-8092) and extension (J-21465-13), press or drive the bush into the case until between 1,02 mm and 1,40 mm (0.040 in and 0.055 in) above the selective thrust washer face (see fig. T20-2).

Note

Ensure that the bushing is fitted with the lubrication passage facing the front of the transmission case.

2. Stake the bushing in the oil groove using tool (J-21465-10).

Heli-coils

Always refer to figure T20-3 and the Heli-coil information chart, for the correct drill and tap sizes, before commencing any repair work.

1. Blank off the area around the hole to be heli-coiled (if possible), to contain any small particles of metal.
2. Drill out the old threads and clean any particles from the hole.

Note

Drill out only to the depth of the original hole. When drilling hole No.4 (see fig. T20-3), the drill may go through to the inside of the case; located just behind this hole are the intermediate clutch splines. Therefore, the burrs must be removed from the clutch splines.

3. Tap the hole with the Heli-coil tap.
4. Fit the standard insert (STI) Heli-coil.
5. Break off the tang from the bottom of the Heli-coil.
6. Remove any blanks etc. as described in Operation 1 and ensure that all particles of metal, etc. are removed.

Fault diagnosis

Accurate diagnosis of transmission problems begins with a thorough understanding of normal transmission operation. In particular it is essential to know which units are involved in the various gears and speeds, so that the specific unit or fluid flow can be isolated and investigated further.

The following sequence of tests may help to simplify the diagnosis of defects and should be performed first.

1. Check the fluid level.
2. Warm-up the engine and transmission.
3. Check the control linkage.
4. Check the kick-down micro-switch.
5. Check the vacuum lines and fittings.
6. Fit a pressure gauge and road test the car.

Note
If possible, test the car with the customer as a passenger. It is possible that the condition which the customer requires correcting is a normal function of the transmission, thus, unnecessary work can be avoided.

Symptom	Possible cause	Action
1. No drive in Drive range	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2). Check for external leaks or the vacuum modulator diaphragm leaking.
	2. Control linkage.	2. Check and adjust the control linkage (see Section T17).
	3. Low oil pressure.	3. (a) Check the vacuum modulator. (b) Check for a restricted intake strainer, a leak at the intake pipe, grommet, or the 'O' ring damaged or missing. (c) Check that the oil pump assembly pressure regulator is not sticking. Also check the pump drive gear tang has not been damaged by the converter. (d) Check the care for porosity around the intake bore. (e) Check the items listed on page T21-13.
	4. Control valve assembly.	4. Check for the manual valve being disconnected from the detent lever.
	5. Forward clutch.	5. (a) Check the forward clutch apply piston for cracks, the seals damaged or missing or the clutch plates burnt (see page T21-14). (b) Check the oil seal rings (missing or broken) on the pump cover. (c) Check for a leak in the feed circuit or the pump to case gasket mis-positioned or damaged. (d) Check the clutch housing check ball is not sticking or missing.
	6. Roller clutch assembly.	6. Check the clutch assembly for broken springs or damaged cage.

Symptom	Possible cause	Action
1. No drive in Drive range (continued)	7. Actuator inoperative.	7. (a) Check the thermal cut-out switch on the fuseboard. (b) Check the charge condition of the battery. (c) Check the operation of the actuator (see Section T5).
2. (a) No drive in Reverse range. (b) Slips in Reverse range	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Actuator inoperative.	2. (a) Check the thermal cut-out switch on the fuseboard. (b) Check the charge condition of the battery. (c) Check the operation of the actuator (see Section T5).
	3. Control linkage.	3. Check and adjust the control linkage (see Section T17).
	4. Oil pressure.	4. Check the items listed on page T21-13.
	5. Control valve assembly.	5. (a) Check that the valve body/spacer plate gaskets are not damaged or incorrectly fitted. (b) Check that the 2-3 valve train is not sticking open (this would also cause a 1-3 up-change in Drive range). (c) Low/Reverse check ball missing from the case (this will also cause no overrun braking in Low range).
	6. Rear servo and accumulator.	6. (a) Check for a damaged rear piston seal. (b) Check for a short band apply pin (this may also cause no overrun braking or slipping in overrun braking — Low range).
	7. Forward clutch.	7. Check that the clutch unit will release (if it does not release this will also cause drive in Neutral).
	8. Direct clutch.	8. (a) Check the outer seal for damage. (b) Check the clutch plates (if burnt, it may be caused by the check ball sticking in the piston). (c) Check the items listed on page T21-15.
	9. Rear band.	9. Check the band for burnt or loose linings, apply pin or anchor pins not engaged, or the band broken.
3. Drive in Neutral	1. Control linkage.	1. Check and adjust the control linkage (see Section T17).
	2. Forward clutch.	2. (a) Check that the clutch is releasing, if the clutch does not release it

Symptom	Possible cause	Action
3. Drive in Neutral (continued)		will also cause no Reverse. (b) Check the items listed on page T21-14.
	3. Pump assembly.	3. Transmission fluid pressure leaking into the forward clutch apply passage.
4. Will not hold in Park.	1. Control linkage.	1. Check and adjust the control linkage (see Section T17).
	2. Internal parking linkage.	2. (a) Check the parking brake lever and actuator assembly. (b) Check the chamfer on the actuator rod sleeve. (c) Check the parking pawl (broken or inoperative). (d) Check that the parking pawl return spring is not broken, missing, or incorrectly hooked.
5. No engine braking in Intermediate range — 1st gear	1. Control valve assembly.	1. Check the Low-Reverse check ball (missing from case).
	2. Rear servo.	2. (a) Check for a damaged oil seal ring, bore or piston. (b) Rear band apply pin short or improperly assembled.
	3. Rear band.	3. (a) Rear band broken or burnt (check for cause). (b) Check the rear band assembly engages correctly on the anchor pins and/or servo pin.
6. No engine braking in Intermediate range — 2nd gear	1. Front servo and accumulator.	1. (a) Check for leaking or broken oil sealing rings. (b) Check for scored bores. (c) Check for a sticking servo piston.
	2. Front band.	2. (a) Check to ensure that the front band is not burnt or broken. (b) Check to ensure that the front band is engaged correctly on the anchor pin and/or servo pin.
7. No detent down-changes Note Position the car on a ramp. Switch on ignition, but do not start engine.	1. Transmission case electrical plug.	1. (a) Disconnect the electrical connections. (b) Connect a test lamp to the detent solenoid terminal of the disconnected wiring loom. (c) Depress the accelerator fully, from the normal driving position. (d) Light off. Incorrectly adjusted or faulty, micro-switch. Faulty electrical circuit. (e) Light on. Check the operation of the detent solenoid. If the solenoid cannot be heard to operate this may be due to.

Symptom	Possible cause	Action
7. No detent down-changes (continued)		(i) Faulty electrical connection. (ii) Sticking detent valve train. (iii) Restricted oil passage.
	2. Control valve assembly.	2. (a) 3-2 valve sticking, spring missing or broken. (b) Detent valve train sticking.
8. Transmission noisy	1. Noise in Park, Neutral, and all Drive ranges.	1. (a) Check for pump cavitation. (i) Transmission fluid level low or high, top-up etc. as necessary (see Section T2). (ii) Restricted or incorrect strainer assembly. (iii) Intake 'O' ring damaged or intake pipe split. (iv) Porosity at pump face intake port. (v) Pump to transmission case gasket incorrectly fitted. (vi) Coolant in the transmission fluid. (b) Check pump assembly for. (i) Defective or damaged gears. (ii) Drive gear incorrectly assembled. (iii) Crescent interference. (iv) Seal rings damaged or worn. (c) Check converter for. (i) Damage. (ii) Loose bolts, converter to flywheel. (iii) Cracked or broken flexplate.
	2. Noise in First, Second, and Reverse.	2. (a) Check that the transmission does not contact the body. (b) Check planetary gear train for. (i) Gears or thrust bearings damaged. Thoroughly clean thrust bearings and thrust races. Closely inspect needles and surfaces for pitting and roughness. (ii) Front internal gear ring damaged.
	3. Noise during acceleration in any gear.	3. (a) Check that the transmission fluid lines to and from the cooler are not fouling. (b) Check that the engine mounts are not loose or broken.
	4. Squeak at low vehicle speeds.	4. Check the speedometer driven gear shaft seal (lubricate or replace).
	5. Slight creaking noise, when accelerating gently from the stationary position.	5. Check for the converter pilot spigot fretting in the crankshaft tail bore (lubricate the spigot liberally with Retinax A grease).

Symptom	Possible cause	Action
8. Transmission noisy (continued)	6. Clutch application during. (a) Neutral to Drive and/or Park to Drive. (b) 1-2 up-change in Intermediate and Drive ranges. (c) 2-3 up-change in Drive range, Neutral to Reverse and Park to Reverse.	6. (a) Check the condition of the forward clutch plates. (b) Check the condition of the intermediate clutch plates. (c) Check the condition of the direct clutch plates.
	7. Converter noise in Reverse, Drive, Intermediate and Low ranges. The noise level is generally lower in Park and Neutral.	7. Check for damaged needle bearings in the converter.
9. 1st and 2nd ranges only (no 2-3 up-change)	1. Incorrect vacuum.	1. Check the items listed on page T21-14, (Incorrect vacuum at modulator).
	2. Governor system.	2. Check line pressure.
	3. Control valve assembly.	3. (a) Check for the 2-3 shift valve train sticking (valves should fall under their own weight). (b) Check for damaged, leaking or incorrectly fitted gaskets between the control valve unit, oil spacer plate and case.
	4. Direct clutch burnt.	4. (a) Check the modulator bellows. (b) Check the centre support for the oil seal rings missing or broken. (c) Check that the direct clutch piston seals are not missing, cut, or incorrectly assembled. (d) Check that the piston check ball is not sticking or missing.
	5. Kick-down micro-switch.	5. Check that the micro-switch is not sticking closed, causing the solenoid to be activated all the time.
	6. Detent solenoid.	6. Check that the solenoid is not sticking open.
10. (a) No 1-2 up-change. (b) Delayed up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Kick-down micro-switch.	2. Check that the micro-switch is not sticking closed, causing the solenoid to be activated all the time.
	3. Detent solenoid.	3. Check that the solenoid is not sticking open.

Symptom	Possible cause	Action
10. (a) No 1-2 up-change. (b) Delayed up-change (continued)	4. Governor assembly.	4. (a) Check for the governor valve sticking. (b) Check that the driven gear is not loose, damaged, or worn (also check the output shaft drive gear, if the driven gear shows damage). (c) Check that the driven gear securing pin is not loose, broken, or missing.
	5. Control valve assembly.	5. (a) Check that the 1-2 shift valve train is not sticking closed. (b) Check that the governor feed channels are not blocked, leaking, or the pipes out of position. (c) Check that the valve body spacer plate gaskets are not leaking, damaged or incorrectly fitted.
	6. Case.	6. (a) Check for the intermediate clutch plug leaking or blown out. (b) Check for porosity between channels. (c) Check that the governor feed channel is not blocked, the governor bore scored or worn allowing a cross pressure leak.
	7. Intermediate clutch.	7. (a) Check that the clutch piston seals are not cut, improperly fitted, or missing. (b) Check that the centre support oil rings are not missing or broken. (c) Check that the orifice cup plug is fitted.
11. Rough 1-2 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Vacuum modulator.	2. (a) Check for loose fittings, restrictions in line, or the modulator assembly inoperative. (b) Check that the modulator valve is not sticking.
	3. Oil pressure.	3. (a) Check that the oil pump regulator or boost valve has not jammed. (b) Check for the pump to case gasket being incorrectly fitted or damaged.
	4. Check condition of engine.	4. Tune the engine.
	5. Control valve assembly.	5. (a) Check that the 1-2 accumulator valve train is not sticking. (b) Check that the valve body to case bolts are not loose. (c) Check that the valve body spacer plate gaskets are not damaged, incorrectly fitted, or the wrong gasket fitted.

Symptom	Possible cause	Action
11. Rough 1-2 up-change (continued)	6. Case.	6. (a) Check the intermediate clutch ball (missing or not sealing). (b) Check for porosity between channels.
	7. Rear servo accumulator assembly.	7. (a) Check the oil seal rings for damage. (b) Check that the piston has not jammed. (c) Check that the spring is not broken or missing. (d) Check that the servo bore is not damaged.
	8. Intermediate clutch.	8. (a) Check that only one waved plate has been fitted (not applicable to Turbocharged cars). (b) Check that the clutch plates are not burnt.
12. Slipping 1-2 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Check condition of engine.	2. Tune the engine.
	3. Vacuum line and components.	3. Check the vacuum system for response at the modulator.
	4. Line pressure.	4. (a) Check the oil pressure (it should vary and respond rapidly to quick changes in throttle openings). (b) Check the vacuum modulator for possible failure. (c) Check that the modulator valve is not sticking.
	5. Control valve assembly.	5. (a) Check for the 1-2 accumulator valve train sticking. (b) Check for porosity in the valve body or case. (c) Check the valve body attaching bolts for tightness.
	6. Front accumulator.	6. Check the oil seal ring (damaged or missing).
	7. Rear accumulator.	7. Check the oil seal ring (damaged or missing) or the case bore damaged.
	8. Oil pump.	8. (a) Check that the pump to case gasket is not mispositioned or damaged. (b) Check that the pressure regulator valve is not sticking.
	9. Case.	9. (a) Check that the intermediate clutch plug is not leaking excessively. (b) Check for porosity between channels.
	10. Intermediate clutch.	10. (a) Check the piston seals (damaged or missing). Also check for burnt clutch plates.

Symptom	Possible cause	Action
12. Slipping 1-2 up-change		(b) Check the centre support for leaks in the feed circuit (oil rings or grooves damaged). Also, for an excessive leak between the tower and the bush, or the orifice bleed hole blocked. (c) Check that the centre support bolt has seated properly in the case. (d) Check that only one waved plate has been fitted.
13. Rough 2-3 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Check condition of engine.	2. Tune the engine.
	3. Oil pressure – High.	3. (a) Check the vacuum modulator assembly. (b) Check that the modulator valve is not sticking. (c) Check that the oil pump regulator valve and boost valve are operating correctly.
	4. Front servo accumulator or assembly.	4. (a) Check that the accumulator spring is not missing or broken. (b) Check that the accumulator piston is not sticking.
	5. Direct clutch.	5. (a) Check that only one waved clutch plate has been fitted. (b) Check the direct clutch for leakage to the outer area of the clutch piston. (c) Check the centre support for damage.
14. Slipping 2-3 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Check condition of engine.	2. Tune the engine.
	3. Oil pressure – Low.	3. (a) Check the vacuum modulator assembly. (b) Check the modulator valve. (c) Check the oil pump pressure regulator valve and/or the boost valve for operation. (d) Check the oil pump to case gasket for damage or incorrect location.
	4. Control valve assembly.	4. (a) Check the front accumulator piston pin for a leak at the swaged end. (b) Check for sticking valves. (c) Check for damage or leaking oil passages. (d) Check the spacer plate for damage, blocked direct clutch feed orifice or mispositioned gasket.

Symptom	Possible cause	Action
14. Slipping 2-3 up-change (continued)	5. Case.	5. Check the case for porosity cross leaks etc.
	6. Direct clutch.	6. (a) Check the piston seals and check ball for leaks. (b) Check the centre support oil seal rings for damage and for an excessive leak between the tower and bush. (c) Check that only one waved plate has been fitted.
	7. Front servo.	7. (a) Check for a broken or missing front servo spring. (b) Check for a leak at the servo pin.
15. (a) Delayed up-changes. (b) No up-changes	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Kick-down micro-switch.	2. Disconnect the white/green wire from the connector on the side of the transmission case. Test the up-changes. (a) If the up-changes occur, the problem is in the micro-switch or wiring. (b) If the fault persists continue to Operation 3.
	3. Incorrect modulator vacuum.	3. Connect a gauge to the lower end of the modulator vacuum pipe and check for normal vacuum. (a) If the vacuum is low or not present, check for leaks and restrictions. (b) If the fault persists continue to Operation 4.
	4. Incorrect line pressure.	4. Connect a gauge to the transmission adapter and check the line pressure in Drive range with an engine speed of 1000 rev/min. Normal pressure is between 4,5 bar and 5,2 bar (65 lbf/in^2 and 75 lbf/in^2). Note Normal line pressure in Drive range with the car stationary should vary from approximately 4,5 bar (65 lbf/in^2) at idle speed to 10,3 bar (150 lbf/in^2) at full throttle. The pressure increases as the engine vacuum decreases.
	5. Line pressure between 6,6 bar and 7,6 bar (95 lbf/in^2 and 110 lbf/in^2).	5. Check the complete detent system.
	6. Line pressure between 9,3 bar and 10,3 bar (135 lbf/in^2 and 150 lbf/in^2).	6. With the correct vacuum at the modulator, check. (a) Modulator valve. (b) Pressure regulator components.

Symptom	Possible cause	Action
15. (a) Delayed up-changes. (b) No up-changes (continued)	7. Normal line pressure between 4,5 bar and 5,2 bar (65 lbf/in^2 and 75 lbf/in^2).	7. Remove the governor assembly; check for freedom of operation and presence of dirt, etc. Clean if necessary.
	8. Detent system.	8. (a) Check that the detent solenoid is not loose or defective. (b) Check that the solenoid feed orifice is not blocked.
16. 1-2 Up-change — Full throttle only	1. Kick-down micro-switch.	1. Check that the micro-switch is not sticking.
	2. Detent solenoid.	2. (a) Check that the solenoid securing bolts are torque tightened. (b) Check that the solenoid is not sticking open.
	3. Control valve assembly.	3. (a) Check the valve body spacer plate gasket for. (i) Leaks. (ii) Damage. (iii) Incorrectly fitted. (b) Check that the detent valve train has not jammed. (c) Check that the 3-2 valve has not jammed.
	4. Case.	4. Check the case for porosity.
17. Slips in all ranges	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Oil pressure.	2. (a) Check that the vacuum modulator valve is not sticking. (b) Check that the oil strainer assembly is not blocked or leaking, or the grommet or 'O' ring missing or damaged. (c) Check the oil pump assembly for the regulator or boost valve sticking, or for a cross leak. (d) Check that the oil pump to case gasket is not damaged or incorrectly fitted.
	3. Case.	3. Check the case for cross leaks or porosity.
	4. Forward and direct clutches slipping.	4. (a) If the clutches appear burnt, look for the cause in 'Burnt clutch plates' on page T21-14. (b) Check the oil pump sealing rings on the pump cover for wear or damage.
18. No part throttle down-changes	1. Oil pressure.	1. Check the vacuum modulator assembly, modulator valve, and pressure

Symptom	Possible cause	Action
18. No part throttle down-changes (continued)		regulator valve, etc., for leaks, sticking valves and restrictions.
	2. Control valve assembly.	2. Check that the 3-2 valve is not sticking, or the spring missing or broken.
19. Low or High up-changes	1. Oil pressure.	1. (a) Check the engine vacuum at the transmission end of the modulator pipe. (b) Check for loose vacuum connections at the engine and transmission. Also, check the modulator valve, pressure regulator valve train, etc., for leaks, sticking valves and restrictions.
	2. Governor.	2. (a) Check that the governor valve is not sticking. (b) Check the feed holes, lines, etc., for leaks or restrictions, or the pipes damaged or mispositioned.
	3. Detent solenoid.	3. Check that the solenoid is not sticking open, or become loose, etc., as this will cause late up-changes.
	4. Control valve assembly.	4. (a) Check the detent valve train for free movement or restrictions. (b) Check the 3-2 valve train. (c) Check the 1-2 valve train, if the 1-2 regulator valve is sticking this would cause a constant 1-2 shift point, regardless of throttle opening. (d) Check that the valve body spacer plate gaskets are not mispositioned, or the spacer plate holes missing or blocked.
	5. Case.	5. Check the case for porosity, intermediate plug leaking or missing.
20. Torque converter leaks	1. Converter welding.	1. Check the converter welding and if at all suspect, fit a new converter.
	2. Damaged or worn converter hub.	2. Inspect the converter hub for wear, also, scoring that can damage the seal.
21. Torque converter vibrations	1. Converter/flexplate out of balance, or cracked.	1. (a) Isolate the cause of the vibration. (b) Alter the position of the converter on the flexplate 120° at a time until the out of balance condition is corrected. (c) Replace the converter/flexplate.
	2. Converter balance weight.	2. Check the converter for the loss of balance weight(s), change the converter if a balance weight is lost.
	3. Crankshaft pilot.	3. (a) Check to ensure that the converter

Symptom	Possible cause	Action
21. Torque converter vibrations (continued)		to crankshaft pilot is not broken. (b) Change the converter if the pilot is broken.
22. Torque converter slipping or noisy. (Most converter noise occurs under light throttle in Drive range with the brakes applied)	1. Loose flexplate to converter set-screws.	1. (a) Check the flexplate and converter for damage. (b) If no damage is apparent, tighten the bolts. (c) If damage is apparent replace the components.
	2. Cracked flexplate.	2. (a) Check for a cracked flexplate (engine to case dowel pins missing can result in a cracked flexplate). (b) Replace the damaged components.
	3. Items listed under Operation 21 — Torque converter vibrations.	3. See items listed under Operation 21 — Torque converter vibrations.
	4. Fretting of the converter pilot spigot in the crankshaft tail bore.	4. Apply a liberal coating of Shell Retinax A grease all over the spigot.
	5. Converter balance weights lifting (spot welds breaking and one end lifting up and catching on the case).	5. (a) Check for welds breaking on the balance weights. (b) Change the converter if the balance weights have broken away.
	6. Internal damage to converter.	6. (a) Check the thrust roller bearing, thrust races and roller clutch for damage. Fit a new converter if damage is apparent.
	7. Converter fluid.	7. (a) Check the colour of the fluid, if it has the appearance of aluminium paint, the converter is damaged internally. (b) Check that anti-freeze has not contaminated the converter fluid. (c) Fit a new converter.
	Note It is not necessary to change the converter if a failure in some other part of the transmission has resulted in the converter containing dark discoloured fluid. The full flow strainer used in the transmission will remove all harmful residue from	

Symptom	Possible cause	Action
22. Torque converter slipping or noisy. (continued)	failures (other than converter to pump failures) before the oil is pumped into the converter.	Correct the transmission problem, then change the intake strainer and fluid.

High line pressure

If either the idle or full throttle pressure check is high, the cause may be as follows.

1. Vacuum leak
a. Full leak (vacuum line disconnected).
b. Partial leak in the line from the engine to the modulator.
c. Incorrect engine vacuum.
d. Leak in vacuum operated accessories.

2. Damaged modulator
a. Sticking valve.
b. Water in modulator.
c. Incorrect operation of modulator.

3. Detent system
a. Kick-down switch actuated (plunger sticking) or shorted.
b. Detent wiring shorted.
c. Detent solenoid sticking open.
d. Detent feed orifice in spacer plate blocked.
e. Detent solenoid loose.

4. Pump
a. Pressure regulator and/or boost valve sticking.
b. Incorrect pressure regulator spring.
c. Excessive number of pressure regulator valve spacers.
d. Faulty pump casting.
e. Pressure boost valve installed incorrectly or otherwise defective.
f. Aluminium bore plug defective.
g. Pressure boost bush defective.

5. Control valve assembly
a. Spacer plate-to-case gasket incorrectly fitted.
b. Incorrect plate-to-case gasket.

Low line pressure

If either the idle or full throttle pressure checks are low, the cause may be as follows.

1. Transmission oil level low

2. Modulator assembly

3. Intake strainer
a. Blocked or restricted.
b. 'O' ring on intake pipe omitted or damaged.
c. Incorrect strainer fitted.

4. Split or leaking intake pipe

5. Pump
a. Pressure regulator or boost valve sticking.
b. Gear clearance, damaged or worn (pump will become damaged if the drive gear is installed the wrong way or if the converter pilot does not enter the crankshaft freely).
c. Pressure regulator spring weak.
d. Insufficient spacers in pressure regulator.
e. Pump to case gasket incorrectly positioned.
f. Defective pump body and/or cover.

6. Leaks in the internal circuit
a. Forward clutch leak (pressure normal in Neutral and Reverse — pressure low in Drive).
(i) Check pump rings.
(ii) Check forward clutch seals.
b. Direct clutch leak (pressure normal in Neutral, Low, Intermediate and Drive — pressure low in Reverse).
(i) Check centre support oil seal rings.
(ii) Check direct clutch outer seal for damage.
(iii) Check rear servo and front accumulator pistons and rings for damage or missing.

7. Case assembly
a. Porosity in intake bore area.
b. Check case for intermediate clutch plug; leak or blown out.
c. Low — Reverse check ball incorrectly positioned or missing (this condition will cause no Reverse and no overrun braking in Low range).

Note
When checking item 3 — Intake strainer, it should be noted that there is no approved method for either checking or cleaning the strainer. If the performance of the strainer is suspect a new strainer must be fitted.

Incorrect vacuum at modulator

1. **Engine**
a. Requires tune-up.
b. Loose vacuum fittings.
c. Vacuum operated accessory leak.

2. **Vacuum line to modulator**
a. Leak.
b. Loose fitting.
c. Restricted orifice, or incorrect orifice size.
d. Carbon build-up at modulator vacuum fitting.
e. Pinched line.
f. Grease or varnish material in pipe (no or delayed up-change – cold).

Oil leaks

1. **Transmission oil sump leaks**
a. Securing bolts not correctly torque tightened.
b. Improperly installed or damaged sump gasket.
c. Oil sump gasket mounting face not flat.

2. **Case extension leak**
a. Securing bolts not correctly torque tightened.
b. Rear seal assembly damaged or incorrectly installed.
c. Gasket (extension to case) damaged or incorrectly installed.
d. Porous casting.

3. **Case leak**
a. Modulator assembly 'O' ring damaged or incorrectly installed.
b. Electrical connector 'O' ring damaged or incorrectly installed.
c. Governor cover, gasket, and bolts damaged or loose; case face leak.
d. Damage or porosity. Leak at speedometer driven gear housing or seal.
e. Manual shaft seal damaged or incorrectly installed.
f. Line pressure tap plug stripped.
g. Vent pipe (refer to item 5).
h. Porous case or crack at pressure plug boss.

4. **Front end leak**
a. Front seal damaged (check converter neck for score marks, etc., also for pump bushing moved forward), garter spring missing.
b. Pump securing bolts and seals damaged; bolts missing or loose.
c. Converter (leak in weld).
d. Pump 'O' ring seal damaged. (Also check pump oil ring groove and case bore).
e. Porous casting (pump or case).
f. Pump drain back hole not open.

5. **Oil comes out of vent pipe**
a. Transmission over-filled.
b. Water in oil.
c. Strainer 'O' ring damaged or incorrectly assembled causing oil to foam.
d. Foreign material between pump and case or between pump cover and body.
e. Case porous, pump face incorrectly machined.
f. Pump porous.
g. Pump to case gasket mispositioned.
h. Pump breather hole blocked or missing.
i. Hole in intake pipe.
j. Check ball in forward clutch missing or sticking.

6. **Modulator assembly**
a. Diaphragm defective.

Control valve assembly — Governor line pressure check

1. Install a line pressure gauge.
2. Install a tachometer.
3. Disconnect the vacuum line to the modulator.
4. With the car on a ramp (rear wheels off the ground), foot off the brake, in Drive, check line pressure at 1000 rev/min.
5. Slowly increase the engine revolutions to 3000 rev/min and determine if a line drop occurs of 0,7 bar (10 lbf/in^2) or more.
6. If a pressure drop of 0,7 bar (10 lbf/in^2) or more occurs, dismantle, clean, and inspect the control valve assembly.
7. If the pressure drop is less than 0,7 bar (10 lbf/in^2).
a. Inspect the governor.
   (i) Sticking valve.
   (ii) Weight freeness.
   (iii) Restricted orifice in governor valve.
b. Governor feed system.
   (i) Check screen in governor feed pipe hole in case assembly.
   (ii) Check for restrictions in governor pipe.

Burnt clutch plates

Burnt clutch plates can be caused by incorrect usage of clutch plates. Also, anti-freeze in transmission fluid can cause severe damage, such as large pieces of composition clutch plate material peeling off.

1. **Forward clutch**
a. Check the ball in the clutch housing for damage, sticking, or missing.
b. Clutch piston cracked, seals damaged or missing.
c. Low line pressure.
d. Manual valve mispositioned.
e. Restricted oil feed to forward clutch. (Clutch housing to inner and outer areas not drilled, restricted or porosity in pump).
f. Pump cover oil seal rings missing, broken or undersize; ring groove oversize.
g. Case valve body face not flat or porosity between channels.
h. Manual valve bent and centre land not ground properly.

2. **Intermediate clutch**
a. Rear accumulator piston oil ring, damaged or missing.

b. 1-2 accumulator valve sticking in control valve assembly.
c. Intermediate clutch piston seals damaged or missing.
d. Centre support bolt loose.
e. Low line pressure.
f. Intermediate clutch plug in case missing.
g. Case valve body face not flat or porosity between channels.
h. Manual valve bent and centre land not ground properly.

3. Direct clutch
a. Restricted orifice in vacuum line to modulator (poor vacuum response).
b. Check ball in direct clutch piston damaged, sticking, or missing.
c. Defective modulator bellows.
d. Centre support bolt loose (bolt may be tight in support but not holding support tight to case).
e. Centre support oil rings or grooves damaged or missing.
f. Clutch piston seals damaged or missing.
g. Front and rear servo pistons and seals damaged.
h. Manual valve bent and centre land not cleaned up.
i. Case valve body face not flat or porosity between channels.
j. Intermediate sprag clutch installed backwards.
k. 3-2 valve, 3-2 springs, or 3-2 spacer pin installed in wrong location in 3-2 valve bore.

Note
If direct clutch plates and front band are burnt, check manual linkage.

Vacuum modulator assembly

The following procedure is recommended for checking modulator assemblies in service before replacement is undertaken.

1. Vacuum diaphragm leak check
Check with a vacuum pump or insert a pipe cleaner into the vacuum connector pipe as far as possible and check for the presence of transmission oil. If oil is found, replace the modulator.

Note
Petrol or water vapour may settle in the vacuum side of the modulator. If this is found without the presence of oil, the modulator should not be changed.

2. Atmospheric leak check
Apply a liberal coating of soap bubble solution to the vacuum connector pipe seam and the crimped upper to lower housing seam. Using a short piece of rubber tubing, apply air pressure to the vacuum pipe by blowing into the tube and observe for leak bubbles. If bubbles appear, replace the modulator.

Note
Do not use any method other than human lung power to apply air pressure, as pressures over 0,4 bar (6 lbf/in^2) may damage the modulator.

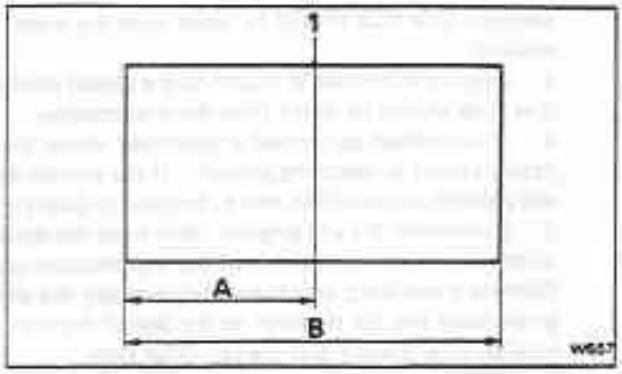


Fig. T21-1 Comparison gauge
1 Scribed centre line
A 12,70 mm (0.50 in)
B 25,40 mm (1.0 in)
Note
Round bar between 9,52 mm and 10,32 mm (0.375 in and 0.406 in) diameter.
Ends to be square within 0,39 mm (0.015 in).

3. Bellows comparison check
Make a comparison gauge (see fig. T21-1), and compare the load of a known good modulator with the assembly in question.
a. Install the modulator that is known to be acceptable on either end of the gauge.
b. Install the modulator in question on the opposite end of the gauge.
c. Holding the modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the centre of the gauge. The gap between the opposite modulator sleeve end and the gauge line should not be greater than 1,59 mm (0.062 in). If the distance is greater than this amount the modulator in question should be replaced.

4. Sleeve alignment check
Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity to the body. If the sleeve is concentric and the plunger is free, the modulator is acceptable. Once the modulator assembly passes all of the above tests, it is an acceptable part and should be fitted again.

Detent (down-change) solenoid circuit — To check

Before checking the detent solenoid circuit, make certain that the transmission kick-down switch is properly adjusted as described in Operation 5.

1. With the transmission gear range selector lever in Park, turn the ignition switch to the RUN position but do not start the engine. Leave the ignition switch in the RUN position throughout the checking procedure.
2. Working under the car, slowly advance the throttle

position. One click should be heard from the transmission.
3. Allow the throttle to return to the closed position. One click should be heard from the transmission.
4. If the system performed as described above, the detent circuit is operating properly. If the system does not perform as described above, proceed to Operation 5.
5. Disconnect the white/green cable from the detent solenoid terminal on the side of the transmission case. Connect a test lamp into the circuit between the white/green cable and the terminal on the side of the transmission case. Ensure that the test lamp bulb illuminates when the throttle linkage is in the full throttle position, operated from the normal driving position. The bulb should be extinguished when the throttle is released.
a. If the system operates as described above, but did not perform properly during Operations 1 to 3 inclusive, replace the solenoid after first checking to see that the internal wiring is operational.
b. If the test lamp bulb fails to illuminate with the throttle in the wide open position, the circuit is open, proceed to Operation 6.
c. If the test lamp bulb illuminates, with the throttle closed, the circuit is shorted, proceed to Operation 9.
6. Remove the white/green cable from the transmission kick-down switch. Connect the test lamp between the switch terminal and a good earth; at full throttle ensure that the bulb of the test lamp illuminates.
a. If the test lamp bulb illuminates, reconnect the white/green cable to the switch. Re-check the system.
b. If the test lamp fails to illuminate, proceed to Operation 7.
7. Check the white feed cable at the transmission kick-down switch, with the test lamp connected between the white cable and a good earth.
a. If the test lamp bulb illuminates, replace the transmission kick-down switch. Re-check the system.
b. If the test lamp fails to illuminate, proceed to Operation 8.
8. Check the transmission thermal cut-out on the fuseboard.
a. If it is necessary to reset or replace the cut-out, re-check the system.
b. If the cut-out is correct it will be necessary to locate the fault in the wiring. Test for circuit continuity from the white feed cable at the kick-down switch to fuse No.27 at the fuseboard.
9. Remove the white/green cable at the transmission kick-down switch. Connect the test lamp between the exposed terminal at the switch and a good earth, with the throttles closed.
a. If the test lamp bulb does not illuminate the system is correct.
b. If the test lamp bulb illuminates, proceed to Operation 10.
10. With the throttle in the closed position, connect the test lamp between the white feed cable at the transmission kick-down switch and a good earth.
a. If the test lamp bulb illuminates, replace the transmission kick-down switch. Re-check the system.
b. If the test lamp bulb fails to illuminate, it will be necessary to locate the short in the wiring. Test the circuit between the white feed cable from the kick-down switch and fuse No. 27 at the fuseboard.

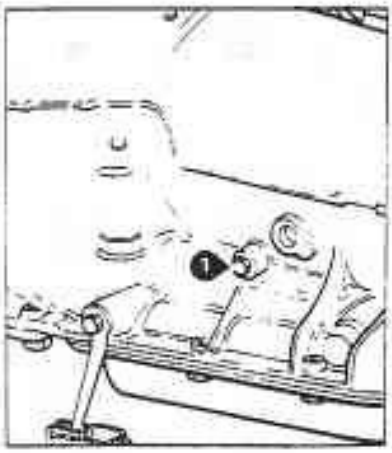
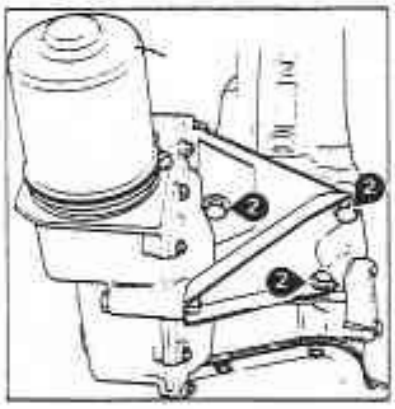
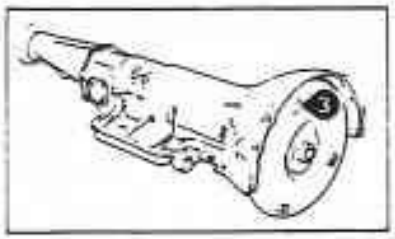
Special torque tightening figures

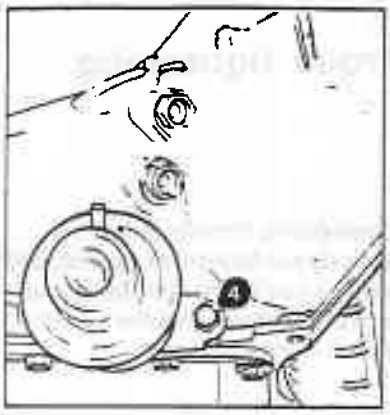
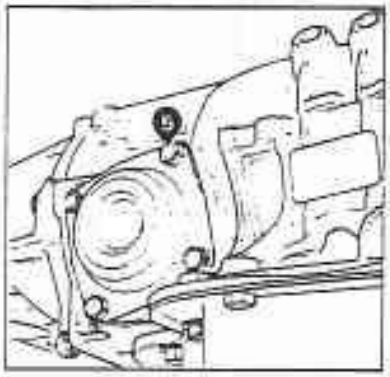
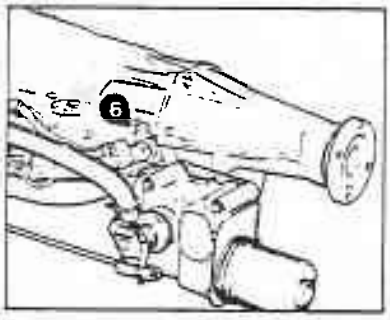
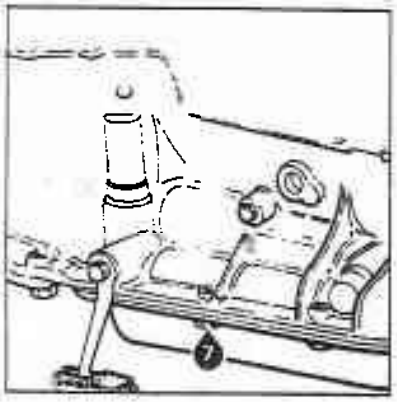
Introduction

This section contains the special torque tightening figures applicable to Chapter T.

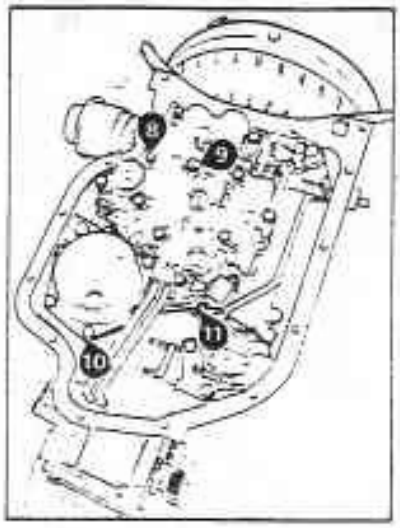
For standard torque tightening figures refer to Chapter P.

Components used during manufacture of the vehicle have different thread formations (Metric, UNF, UNC, etc.). Therefore, when fitting nuts, bolts, and setscrews it is important to ensure that the correct type and size of thread formation is used.

Section T3	Ref.	Component	Nm	kgf m	lbf ft
	1	Line pressure plug	21	2.1	15
Section T5					
	2	Setscrew – Actuator mounting bracket to rear extension	52	5.3	38
Section T6					
	3	Setscrew – Engine flexplate to torque converter	41	4.1	30

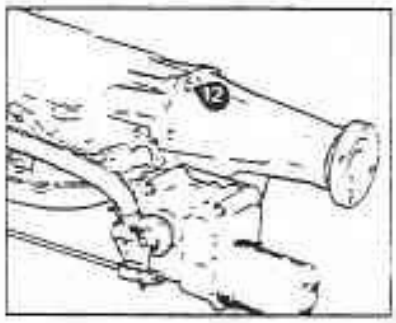
Section T8	Ref	Component	Nm	kgf m	lbf ft
	4	Setscrew – Vacuum modulator retainer to case	25	2.5	18
Section T9					
	5	Setscrew – Governor to case	25	2.5	18
Section T10					
	6	Setscrew – Speedometer drive to case retainer	17	1.7	13
Section T11					
	7	Setscrew – Sump to case	17	1.7	12

Sections T12, T13, and T14



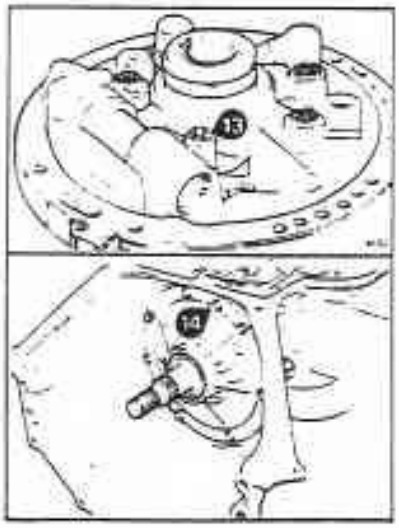
Ref	Component	Nm	kgf m	lbf ft
8	Setscrew (¼ UNC) – Control valve unit to case	11	1.1	8
9	Setscrew (⁵⁄₁₆ UNC) – Control valve unit to case	11	1.1	8
10	Setscrew – Rear servo cover to case	25	2.5	18
11	Setscrew – Solenoid to case	11	1.1	8

Section T15

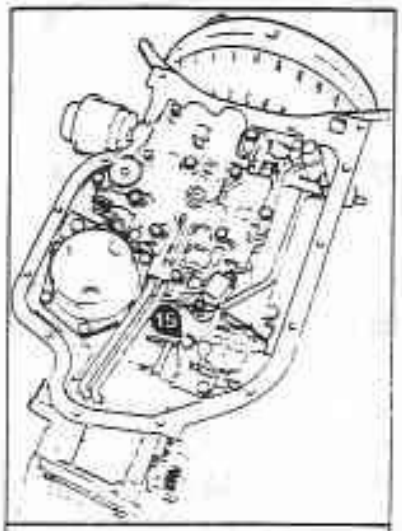
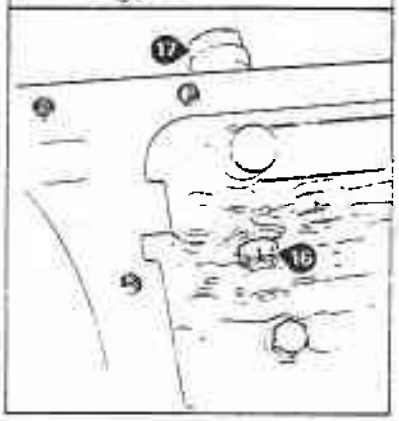


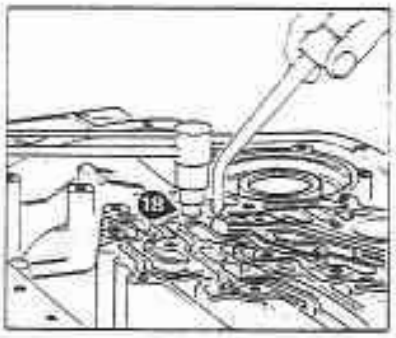
Ref	Component	Nm	kgf m	lbf ft
12	Setscrew – Rear extension to case	32	3.2	23

Section T16



Ref	Component	Nm	kgf m	lbf ft
13	Setscrew – Pump body to cover	25	2.5	18
14	Setscrew – Pump to case	25	2.5	18

Section T17	Ref	Component	Nm	kgf m	lbf ft
	15	Setscrew – Parking lock bracket to case	25	2.5	18
	16	Nut – Manual shaft to detent lever	25	2.5	18
	17	Nut – Gearchange lever to manual shaft	28	2.8	20

Section T19	Ref	Component	Nm	kgf m	lbf ft
	18	Setscrew – Case to centre support	30	3.0	22

Workshop tools

Workshop tools with either R or RH prefix letters are obtainable from the Parts Distribution Centre at Crewe. However, certain other tools prefixed with the letter 'J' may be obtained from the Kent-Moore or General Motors Organisation.

R 5244	Oil pressure gauge
R 5280	Adapter – air checking
RH 7674	Circlip and snap ring pliers
RH 7794	Universal handle – case bush
RH 7914	Adapter – oil pressure tapping
RH 7952	Retaining clamp – converter
RH 7953	Insertion tool – oil pump and rear extension housing oil seals
RH 7955	Holding fixture – transmission
RH 7956	Base – holding fixture (used with RH 7955)
(J-2590)	Spring compressor – forward and direct clutches
(J-7004)	Slide hammers
(J-9578)	Removal tool – steel speedometer gear (used with J-21427)
(J-21362)	Inner seal protector – forward and direct clutches
(J-21363)	Inner seal protector – intermediate clutch
(J-21368)	Alignment band – oil pump body and cover
(J-21370-5)	Selector pin – rear servo (used with J-21370-6)
(J-21370-6)	Band apply pin selector gauge – rear servo (used with J-21370-5)
(J-21409)	Outer seal protector – forward and direct clutches
(J-21427)	Removal tool – steel speedometer gear (used with J-9578)
(J-21465-8)	Removal tool – case bush (used with J-21465-13 and RH 7794)
(J-21465-9)	Adapter – fitting case bush (used with J-21465-8 and J-21465-13)
(J-21465-10)	Staking tool – case bushing
(J-21465-13)	Extension – case bushing
(J-21795)	Removal tool – gear unit assembly
(J-21885)	Fitting and removal tool – control valve accumulator piston
(J-23093)	Locating tool – centre support to case