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September 1971

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Section T10
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. T169*).

The converter cover is welded to the pump to seal all three members in an oil filled housing. An engine driven flexplate bolts directly onto the converter cover 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, toward 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 slowly 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

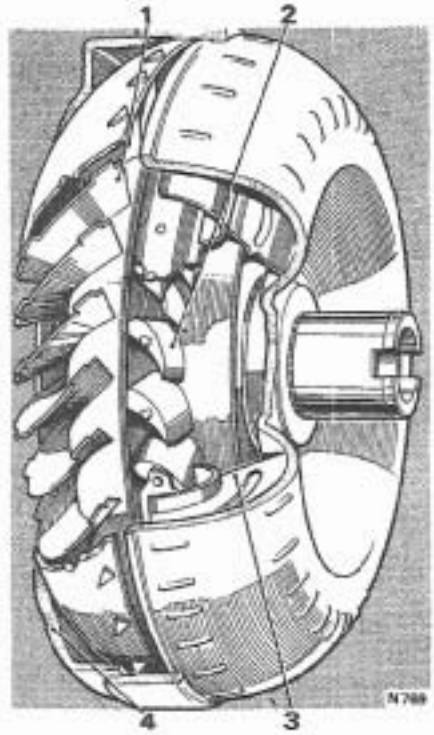

FIG. T169 TORQUE CONVERTER—CUT-AWAY VIEW

1 Turbine
2 Variable angle stator (early cars)
3 Pump
4 Converter cover

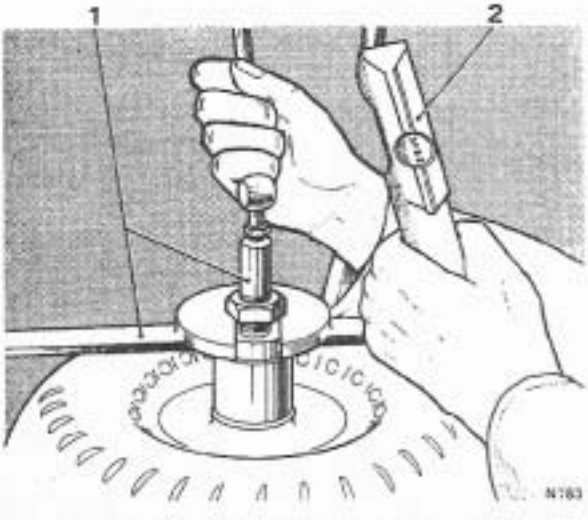

FIG. T170 TORQUE CONVERTER—LEAK TESTING FIXTURE

1 Converter leak test fixture
2 Pressure gauge

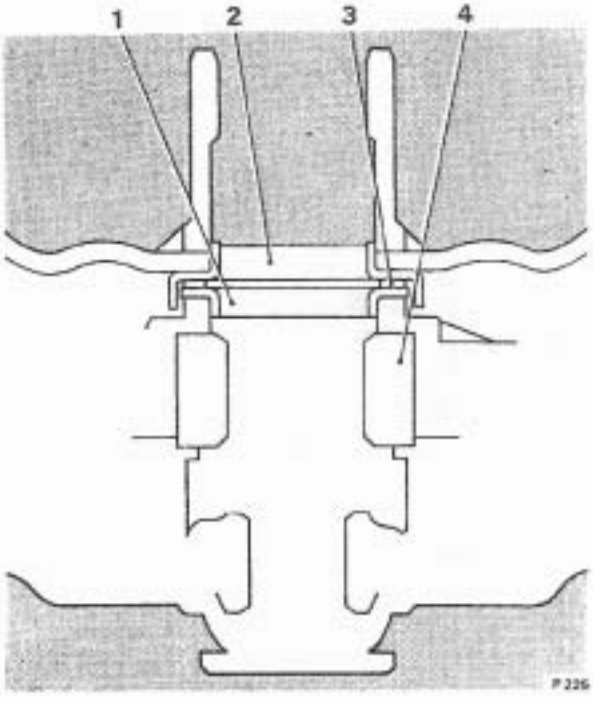

FIG. T171 TORQUE CONVERTER—INTERNAL BEARING ARRANGEMENTS

1 Thrust race L
2 Thrust race Z
3 Thrust roller bearing
4 Roller clutch stator race

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 (*see Fig. T169*); 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 oil flowing from the turbine to the stator blades tends to rotate the stator anti-clockwise, but 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 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 T9 — Transmission — To remove and fit.

Note Do **not** forget to fit the Convert Holding Clamp RH 7952 (J-21366) 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 50 lb. (22,7 kg.) and care should be taken when removing it to ensure that it is not dropped or damaged.

Torque converter—To fit

1. If the torque converter has been leak tested, ensure that all traces of water have been removed.
2. Fit the converter to the transmission, ensuring that the driving slots engage with the tangs in the transmission oil pump.
3. Fit the converter holding clamp RH 7952 (J-21366).

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.

Printed in Great Britain

September 1971

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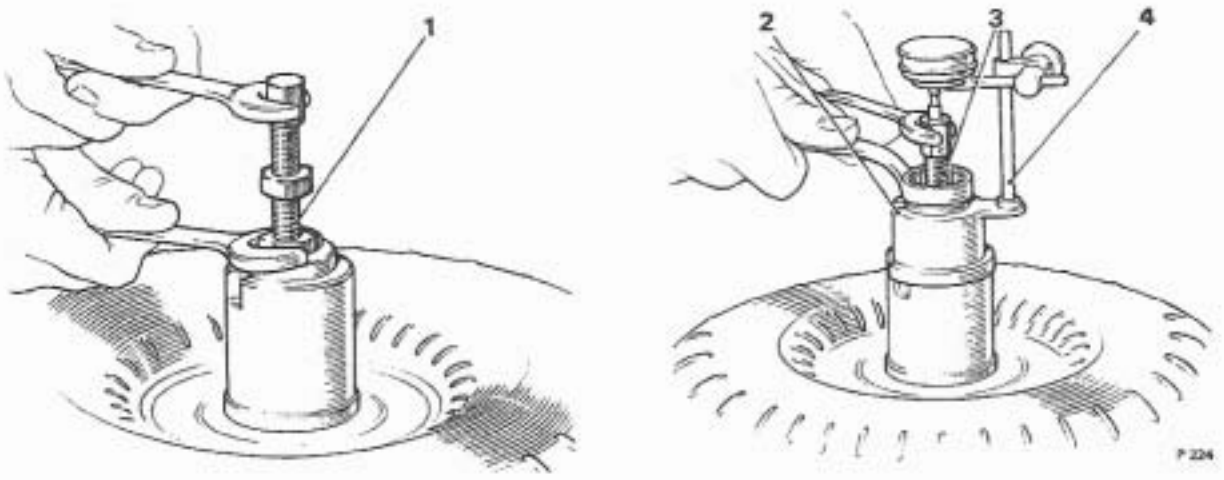

FIG. T172 CHECKING CONVERTER END CLEARANCE

1 Tool J-21371-8
2 Tool J-21371-3
3 Tool J-21371-8
4 Tool J.8001

For a more detailed procedure of inspection refer to 'Torque Converter' in the 'Fault Diagnosis Chart' on Page T175.

Torque converter—To leak Test

Fit Workshop Tool RH 7954 (J-21369) to the torque converter as follows.

1. Fit the valve portion of the fixture into the neck of the converter; unscrew the large hexagonal nut.
2. Fit the fixture band crosswise onto the converter so that the slotted plate fits around the valve and under the nut (*see Fig. T170*).
3. Tighten the nut to expand the 'O' ring so that a good seal is obtained.
4. Apply compressed air to the valve in the top of the tool at 80 lb/sq.in. (5,6 kg/sq.cm.).
5. Immerse the converter in water, noting any sign of bubbles which would indicate a leak.
6. Remove the converter from the water.
7. Renew the converter if a leak is evident.
8. Depress the valve stem to release the air pressure; remove the leak test fixture.

Caution Ensure that the pressure is released before removing the fixture, otherwise the valve may blow out during removal.

Converter end clearance—To check

1. Fully release collet end of Tool J-21371-8.
2. Install collet end of Tool J-21371-8 into converter hub until it bottoms (*see Fig. T172*); then tighten its cap nut to 5 lb. ft. (0,691 kg.m.).
3. Install tool J-21371-3 and tighten hexagon nut to 3 lb. ft. (0,415 kg.m.) (*see Fig. T172*).
4. Install Dial Indicator J-8001 and set it at 'Zero', while its plunger rests on the cap nut of Tool J-21371-8.
5. Loosen the hexagon nut while holding the cap nut stationary. With the hexagon nut loosened and holding tool J-21371-3 firmly against converter hub, the reading obtained on the Dial Indicator will be the converter end clearance. End clearance should be less than 0·050 in. (1,27 mm.). If the end clearance is 0·050 in. (1,27 mm.) or more replace the converter.

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September 1971

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Section T11
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.

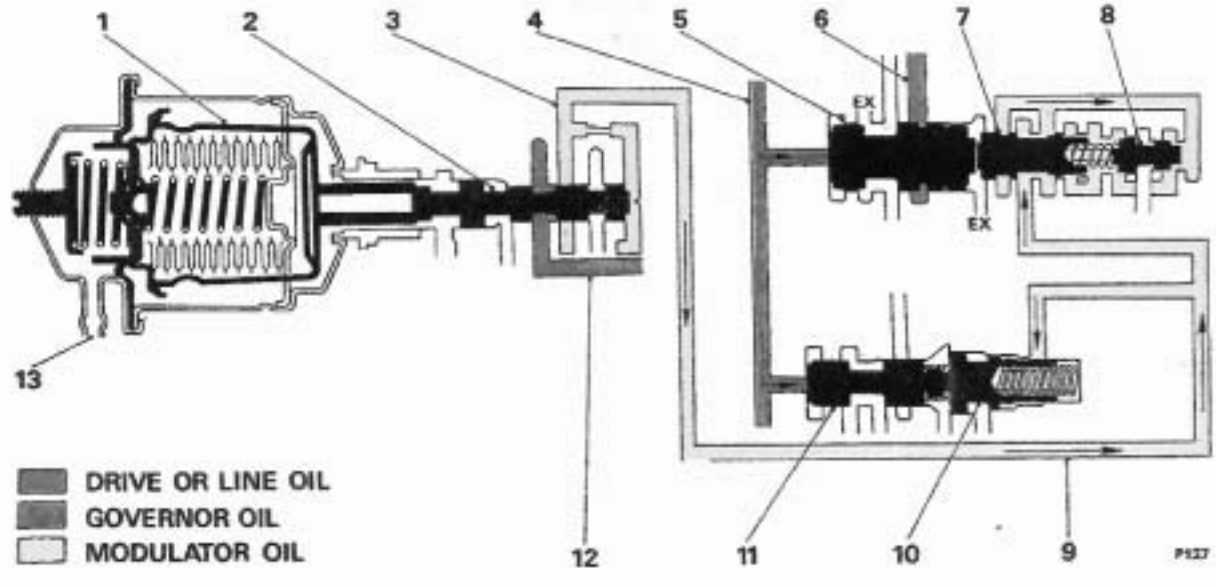

FIG. T173 VACUUM MODULATOR AND VALVE SHOWING MODULATOR PRESSURE

1 Vacuum modulator
2 Modulator valve
3 Modulator oil
4 Governor oil
5 1–2 valve
6 Drive oil
7 1–2 detent valve
8 Regulator valve
9 Modulator oil
10 2–3 modulator valve
11 2–3 valve
12 Line oil
13 Vacuum connection

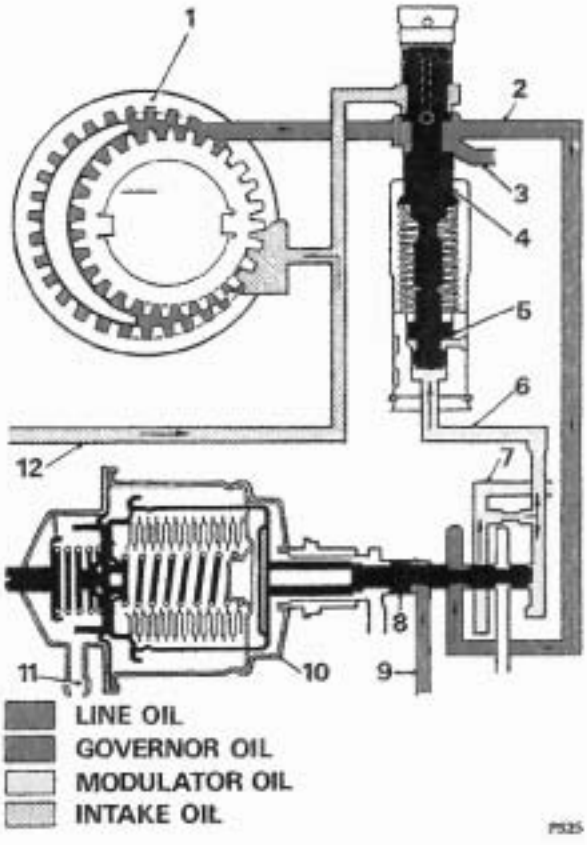

FIG. T174 VACUUM MODULATOR AND VALVE SHOWING LINE PRESSURE CONTROL

1 Vacuum modulator
2 Modulator valve
3 Modulator oil
4 Governor oil
5 1–2 valve
6 Drive oil
7 1–2 detent valve
8 Regulator valve
9 Modulator oil
10 2–3 modulator valve
11 2–3 valve
12 Line oil
13 Vacuum connection

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 change the prefix letters of the transmission were change from RR to RS. It should also be noted that on later cars 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.

Modulator pressure is directed to the 1–2 regulator valve which regulates modulator pressure to a lesser pressure which is proportional to modulator pressure. This tends to keep 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 gear change points can be delayed to take place at higher road speeds with heavy throttle application (*see Fig. T173*).

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. T174*).

To regulate modulator pressure and in turn, line pressure, with the converter torque ratio that 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. T175*).
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 16 lb. (7,3 kg.) pressure. If the bellows is 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, approximately 20° from the vertical.
4. Fit the retainer with the curved side of the tangs facing the transmission.
5. Fit the retaining setscrew and torque tighten it to 18 lb. ft. (2,5 kg. m.).
6. Connect the vacuum pipe.

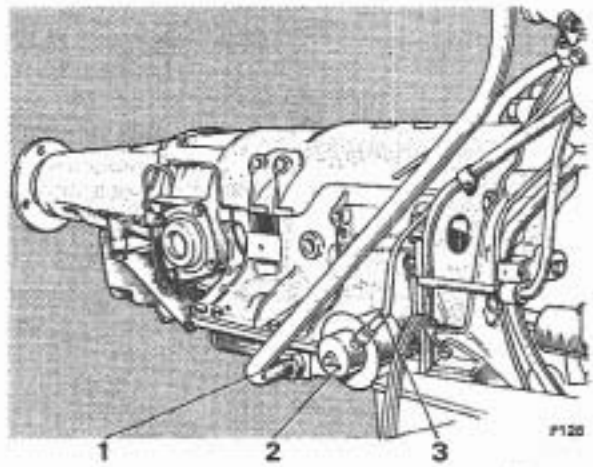

FIG. T175 VACUUM MODULATOR AND VACUUM PIPE

1 Oil filler tube securing nut
2 Vacuum modulator
3 Vacuum pipe

Printed in Great Britain
September 1971
S.D. 2476

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September 1971

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Section T12
GOVERNOR ASSEMBLY

The governor assembly (*see Fig. T176*) fits into the rear of the transmission casing on the right-hand side and is driven by a gear on the transmission output shaft.

The car speed signal to the transmission is supplied by this governor.

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.

Slight changes in output shaft r.p.m. at low speeds result in small governor pressure changes.

The primary weights add heavy force to the secondary weights to obtain greater changes in pressure as road speed and output shaft r.p.m. 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. T177*).

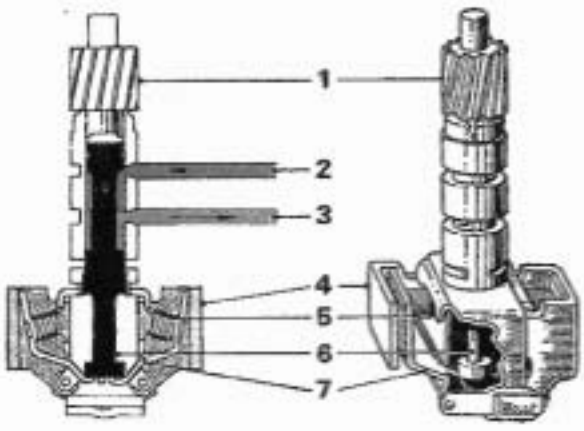

FIG. T176 GOVERNOR ASSEMBLY

1 Driven gear
2 Drive oil
3 Governor oil
4 Primary weight
5 Spring
6 Valve
7 Secondary weight

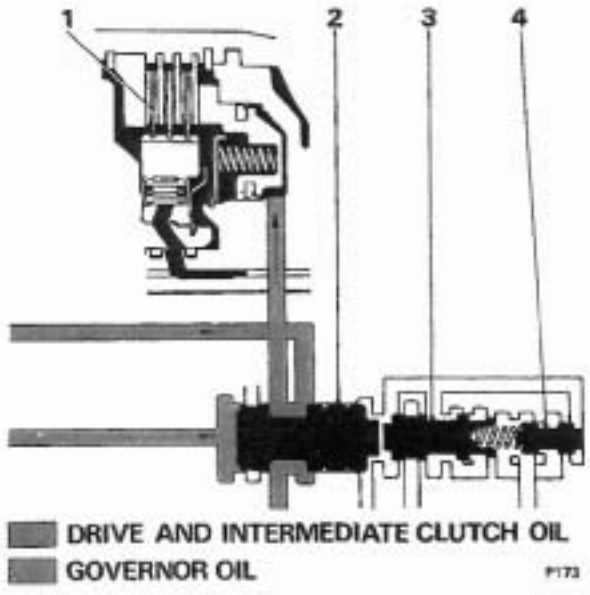

FIG. T177 GOVERNOR OIL ACTING ON THE 1-2 SHIFT VALVE

1 Intermediate clutch
2 1–2 valve
3 1–2 detent valve
4 Regulator valve

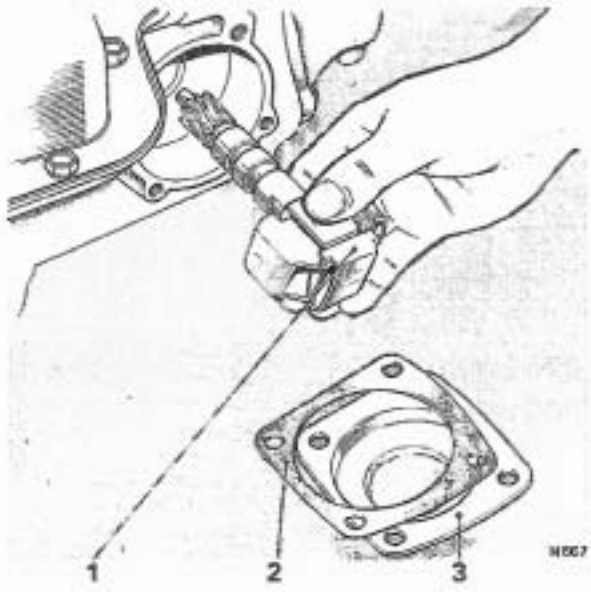

FIG. T178 REMOVING THE GOVERNOR ASSEMBLY

1 Governor
2 Gasket
3 Cover plate

As the car road speed 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 T11.

On cars fitted with **transmissions prior to Serial Number 72 RR 2268** lubrication for the governor was provided by means of an output shaft with an axial lubrication passage which takes lubricant to a point rearwards of the speedometer drive gear. From this point the lubricant passes through a radial drilling to the governor sleeve, providing lubrication for governor.

Cars fitted with **transmission Serial Number 72 RR 2268 and onwards,** governor lubrication is provided by a flat in the governor sleeve which allows oil to pass to the moving parts of the governor. The output shaft of these later transmissions is not provided with any lubrication passages.

In view of these changes it is most important that the new output shaft without the oil passage and the governor with the lubrication flat are used on the later transmission only.

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.

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. T178*).

On later transmissions, changes to manufacture of the transmission case has eliminated the shoulder at the bottom of the governor pipe holes. As a result it is possible to force the governor pipes deep enough into the transmission case to enter the governor bore and either bind or lock the governor.

Therefore, if difficulties are experienced when removing the governor assembly, withdraw the pipes approximately 0·125 in. (0,32 cm.).

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September 1971

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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 of each of the governor weight retaining pins.

2. Remove the pins, thrust cap, governor weights and springs (*see Fig. T179*). 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 (kerosene) 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. Check the valve opening at inlet and exhaust; the minimum is 0·020 in. (0,508 mm.).

10. Hold the governor as illustrated in Figures T180 and T181 when carrying out this check.

Governor driven gear—To renew

1. Drive out the gear retaining pin using a hammer and drift (*see Fig. T182*).

2. Support the governor sleeve on two 0·187 in. (4,76 mm.) 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.

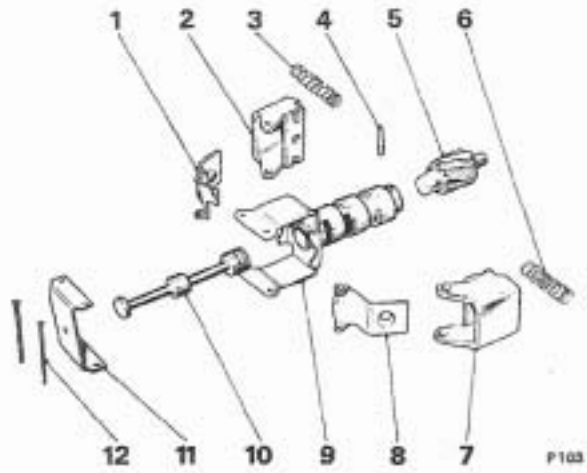

FIG. T179 GOVERNOR ASSEMBLY — EXPLODED

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

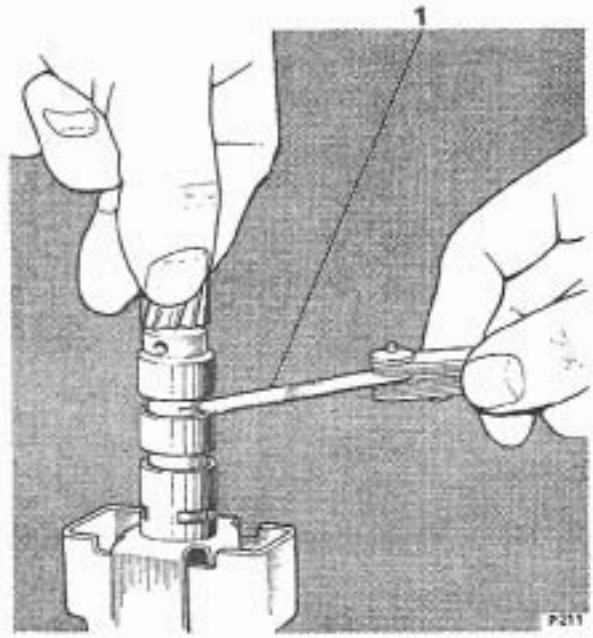

FIG. T180 CHECK VALVE OPENING (INLET)

1 0.020 in. (0,508 mm.) feeler gauge

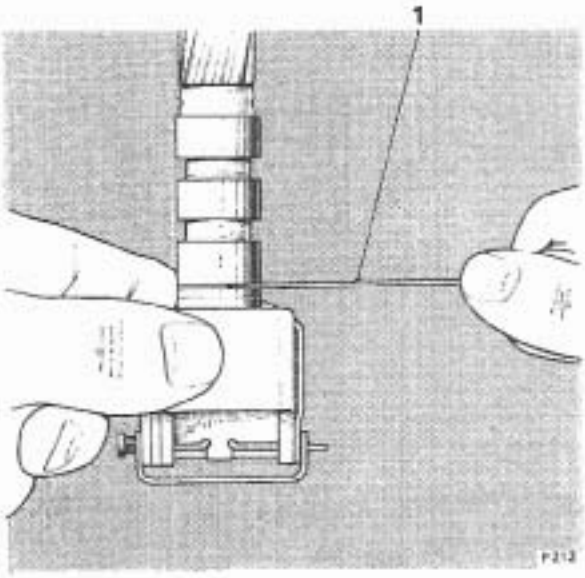

FIG. T181 CHECK VALVE OPENING (EXHAUST)
1 0.020 in. (0,508 mm.) feeler gauge

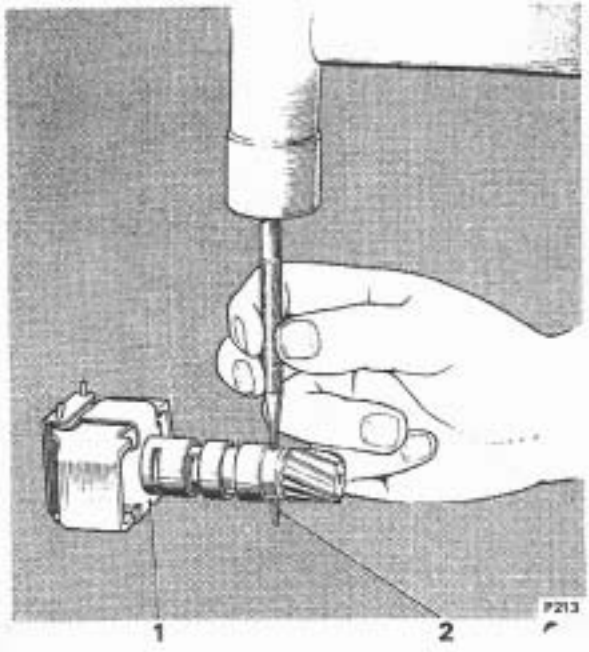

FIG. T182 REMOVING GOVERNOR DRIVEN GEAR RETAINING PIN

1 Governor assembly
2 Gear retaining pin

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. A later type of casing incorporates a steady pin which locates the governor driven gear (*see Parts List*).

5. Support the governor sleeve on the two 0·187 in. (4,76 mm.) 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 0·187 in. (4,76 mm.) 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 (kerosene) 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 the valve for freeness 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.

4. On later transmissions when installing the governor assembly ensure that a clearance of approximately 0·250 in. (0,64 cm.) is maintained between the governor pipes and transmission case, at a point 1·00 in. (2,54 cm.) from the right angle bend of the pipes.

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September 1971

T.S.D. 2476

Section T13
SPEEDOMETER DRIVE

The speedometer drive (*see Fig. T183*) 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.

Speedometer drive—To remove

1. To disconnect the speedometer cable unscrew the knurled nut at the transmission end then withdraw the cable.
2. If the speedometer drive is to be removed for any length of time, mask the open end of the drive cable to prevent the ingress of dust and dirt.
3. Remove the setscrew and retainer then withdraw the speedometer drive; discard the 'O' ring.

Speedometer drive—To dismantle

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 in soft jaws in a vice then unscrew the halves of the assembly.
5. Withdraw the drive-shaft.

Speedometer drive—To inspect

1. Wash all the dismantled parts in clean paraffin (kerosene).
2. Examine the gear teeth for damage or excessive wear.

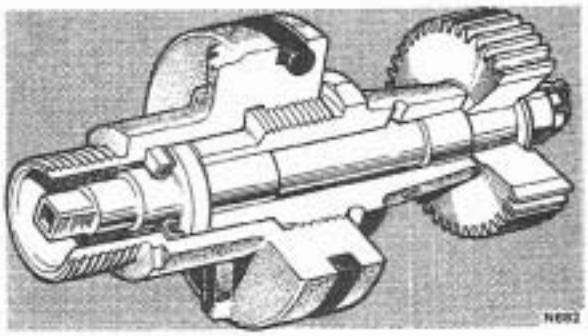

FIG. T183 SPEEDOMETER DRIVE

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

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

1. Torque tighten the castellated nut to 8 lb. ft. (1,1 kg. m.) then take the nut to the nearest split pin hole.

2. Do not slacken the nut to correlate the hole and slot.
3. Fit a new split pin.
4. Lightly lubricate the drive-shaft before passing it through the oil seal.
5. Ensure that the body and the seal housing are screwed tightly together.
6. Check the drive-shaft end float; there should be a minimum of 0·015 in. (0,38 mm.).

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 18 lb. ft. (2,49 kg. m.).
4. Connect the speedometer drive cable.

DIMENSIONAL DATA FOR SECTION T13
SPEEDOMETER DRIVE

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Drive-shaft end float.	0·015 in. (0,38 mm.) minimum	——	——
Gears backlash.	0·008 in. to 0·014 in. (0,20 mm. to 0,35 mm.)	——	——
Castellated nut — gear to shaft.	Torque tighten to 8 lb. ft. (1,11 kg.m.)	——	Take nut to next split pin hole.
Setscrew — speedometer housing retainer to casing.	Torque tighten to 18 lb. ft. (2,49 kg.m.)	——	——

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September 1971

T.S.D. 2476

Section T14
SUMP, STRAINER AND INTAKE PIPE

Strainer and intake pipe—To remove

The strainer and intake pipe assembly may be removed from the transmission whether the transmission is fitted to the car or not.

The following procedure should be adopted, assuming that the transmission is fitted to the car.

1. Position a clean container under the dipstick tube nut where it enters the sump. The capacity of the container should be 4 pints (Imp.), 4,8 pints (U.S.), 2,27 litres minimum.
2. Slacken the setscrews in the clips at the top of the dipstick tube.
3. Unscrew the sleeve nut at the bottom of the tube then pull the tube clear of the sump; allow the oil to drain.

Early cars only

4. Remove the heat exchanger fluid pipes (*see Fig. T184*). Blank off the feed and return holes in the case and the heat exchanger.
5. Remove the four setscrews which secure the heat exchanger to the bottom cover of the torque converter.
6. Push the heat exchanger clear of the sump and secure it temporarily to obtain access to the setscrews securing the front of the sump.

All cars

7. Remove the thirteen setscrews securing the sump.
8. Lower the sump and drain the remaining oil; discard the gasket.

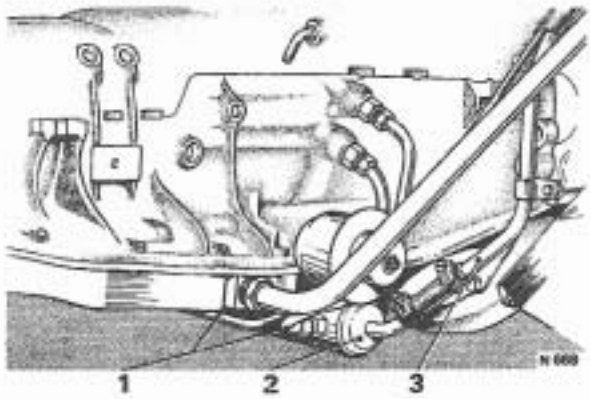

FIG. T184 HEAT EXCHANGER FLUID PIPES (EARLY CARS)

1 Transmission fluid pipes
2 Heat exchanger
3 Coolant pipe

Early cars only

9. Lift out the strainer and intake pipe assembly (*see Fig. T185*).
10. Remove and discard the intake pipe 'O' ring.

Later cars

11. Remove the filter retaining bolt.
12. Lift out the pump intake pipe and filter assembly (*see Fig. T186*). Remove the intake pipe from the filter and discard the filter.

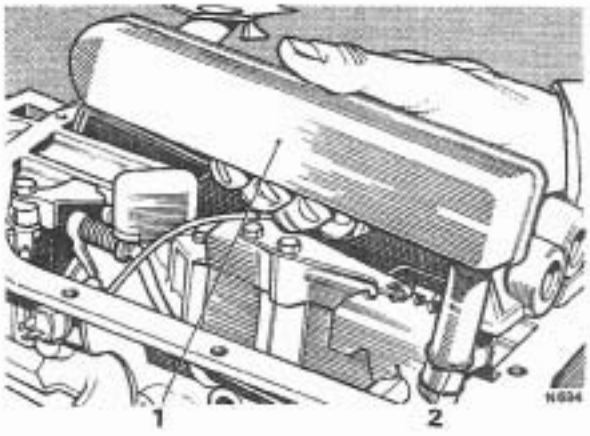

FIG. T185 REMOVING THE STRAINER AND INTAKE PIPE ASSEMBLY (EARLY CARS)

1 Strainer and intake pipe assembly
2 'O' ring

13. Remove and discard the intake pipe 'O' ring.

Note **In cases where the transmission has failed, the strainer and intake pipe must be renewed.**

Strainer and intake pipe—To fit

Early cars

1. Fit a new 'O' ring into the intake pipe bore in the transmission case.
2. Lightly lubricate the 'O' ring then fit the strainer and intake pipe assembly.

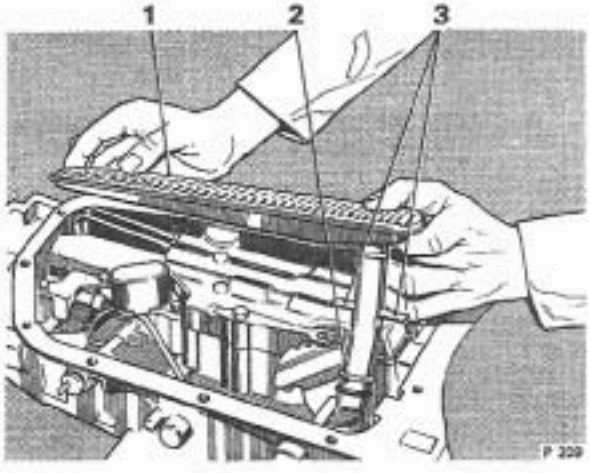

FIG. T186 REMOVING INTAKE PIPE AND FILTER ASSEMBLY

1 Filter assembly
2 Intake pipe with 'O' Ring
3 Locator tabs

Later cars

3. Fit a new intake pipe 'O' ring onto the pipe. Lightly lubricate the 'O' ring. Fit the intake pipe into the strainer. Fit the intake pipe and strainer assembly into the transmission.

All cars

4. Ensure that the sump is clean then fit the sump, using a new gasket.
5. Fit the setscrews to secure the sump; torque tighten them to 12 lb. ft. (1,66 kg. m.) (*see Chapter P*).
6. Fit the heat exchanger and pipes, ensuring that the ends of the pipes and the sleeve nut threads are clean and free from dirt.
7. Fit the dipstick tube; tighten the sleeve nut and the two clip securing setscrews.

Note Reports indicate that the first early type strainer assembly with the integral intake pipe and shroud, has been installed in transmissions with the later type sump.

The late sump does not have the configuration to accommodate the first type strainer assembly. Use of the first type strainer assembly with the second type sump will result in low or erratic oil pressure and pump cavitation noise caused by the restricted intake to the strainer assembly because of the oil sump configuration. A transmission failure will result from this incorrect combination of sump and strainer assembly.

The first type oil sump is not deep enough to accommodate the flat second type strainer assembly and if their installation as a combination is attempted, the strainer assembly will be crushed.

When service replacement of the strainer assembly and/or oil sump is required, they must be used in the following combinations.

COMBINATION 1 — Use the first type strainer, Part Number GM 5579822, with the first type sump, Part Number GM 8623778.

COMBINATION 2 — Use the second type strainer assembly, Part Number GM 6437741, and intake pipe assembly, Part Number GM 8625428, with the second type oil sump, Part Number GM 8625766.

Always consult the latest relevant service literature concerning part numbers, etc.

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Section T15
CONTROL VALVE UNIT

The control valve unit comprises a cast iron body containing various shift valves and regulator valves which control the gear changes and the timing and spacing of the changes. The unit is secured to an oil 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, by way of levers and rods, to allow main line oil pressure to be delivered to the forward clutch (*see Fig. T187*). 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 and the transmission will be in 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 T12 — Governor Assembly*) 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 (*see Fig. T177 in Section T12*). This makes the intermediate roller 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.

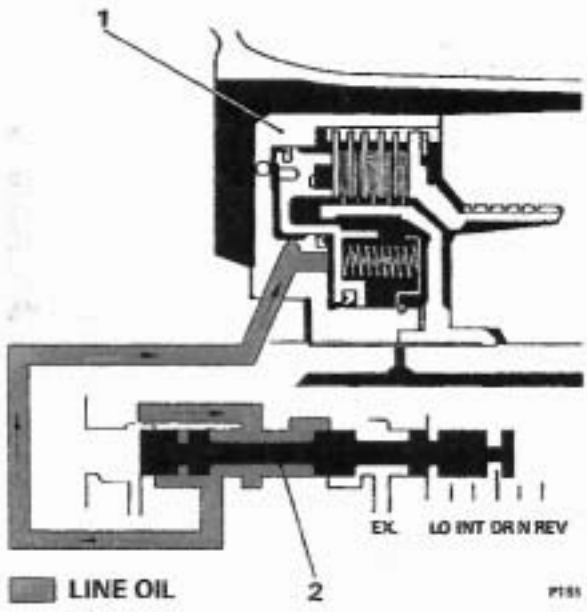

FIG. T187 MANUAL VALVE AND FORWARD CLUTCH

1 Forward clutch
2 Manual valve

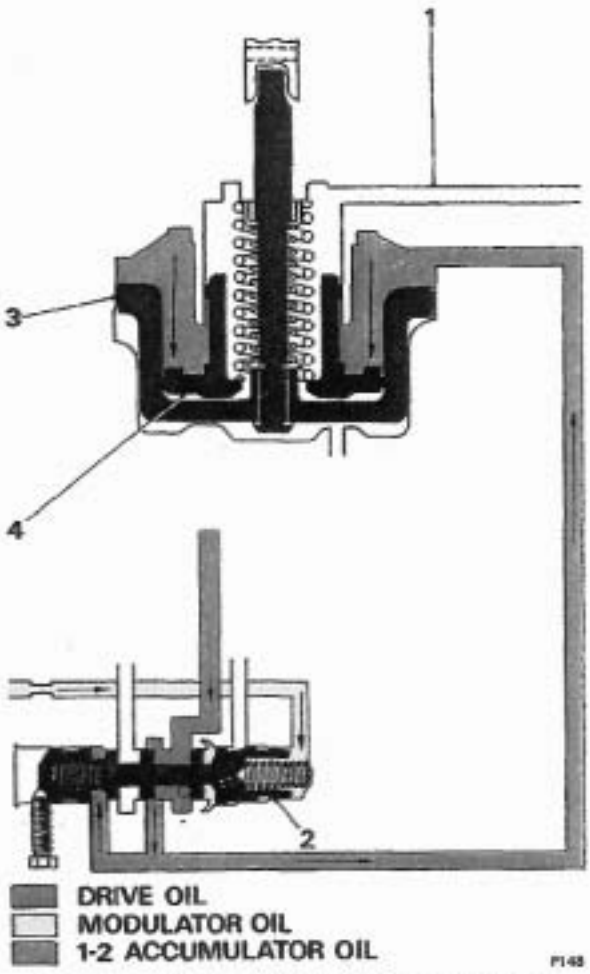

FIG. T188 ACCUMULATOR PISTON STROKE PRIOR TO 1–2 UP-CHANGE

1 Intermediate clutch passage
2 1–2 accumulator valve
3 Accumulator piston
4 Servo piston

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 T11 — Vacuum Modulator and Valve*).

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. T188*). The intermediate clutch is controlled according to throttle opening as follows.

Line pressure is varied by the modulator.

A 1–2 accumulator valve train provides a variable accumulator pressure to cushion clutch apply. 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 T15 — Rear Servo*). 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. T189*). 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 assembly, it is part of the front accumulator and servo piston system (*see Fig. T190*). In 'D' range, second gear, the accumulator is stroked against the accumulator spring by servo oil. Because servo oil is main line pressure and varies with throttle opening, the pressure in the accumulator is varied according to throttle opening.

When the 2–3 shift valve opens, direct clutch oil flows to the direct clutch and the front accumulator piston (*see Fig. T191*). 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 thus provide additional converter ratio for improved performance

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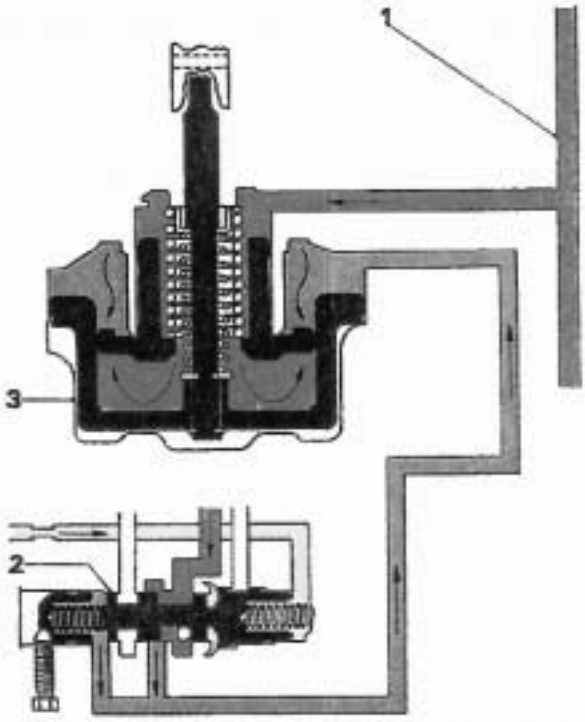

FIG. T189 ACCUMULATOR CUSHIONING INTERMEDIATE CLUTCH APPLICATION

1 Intermediate clutch oil
2 1–2 accumulator valve
3 Rear servo

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 108 lb/sq. in. (7,59 kg/sq. cm.) (*see Fig. T192*). Modulated oil pressure, plus spring pressure, will move the 3–2 valve against the force of direct clutch oil allowing modulator pressure to be directed to the shift valve trains. 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 70 m.p.h. (113 k.p.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 needle valve in the detent solenoid assembly. Line pressure thus holds the detent valve in an inoperative or normal position (*see Fig. T193*).

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 70 lb/sq. in. (4,92 kg/sq. cm.).

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 20 m.p.h. (32 k.p.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. T194*).

Detent oil is also directed to the modulator valve to prevent modulator pressure from falling below 70 lb/sq. in. (4,92 kg/sq. cm.). This prevents main line pressure from falling below approximately 105 lb/sq. in. (7,38 kg/sq. cm.) 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 range 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. T195*).

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 pressure on the end of the boost valve raises main line pressure to 150 lb/sq. in. (10,55 kg/sq. cm.) and provides sufficient holding forces for overrun engine braking.

Low range

When the selector lever is moved to the Low '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

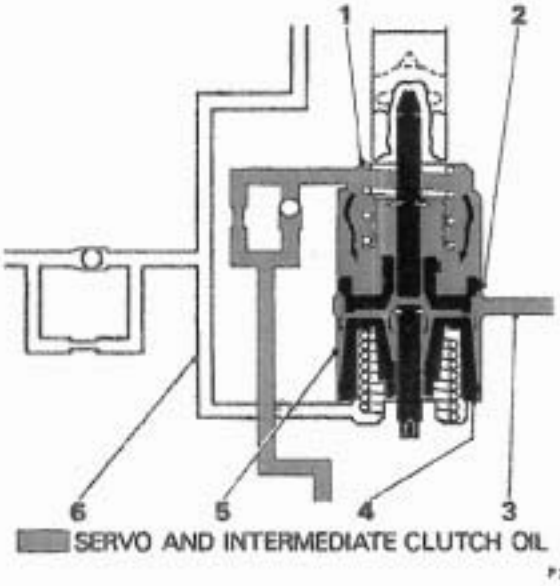

FIG. T190 FRONT ACCUMULATOR PISTON STROKED PRIOR TO 2–3 UP-CHANGE

1 Transmission case
2 Servo piston
3 Intermediate clutch oil
4 Accumulator piston
5 Valve body
6 Direct clutch oil passage

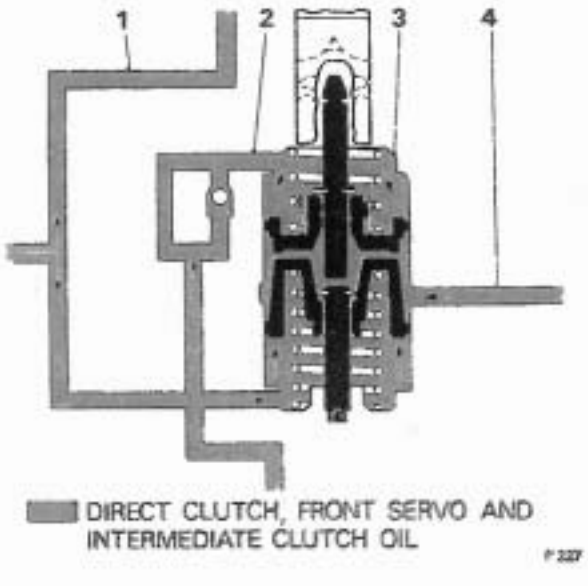

FIG. T191 FRONT ACCUMULATOR PISTON CUSHIONING DIRECT CLUTCH APPLICATION

1 Direct clutch oil
2 Intermediate clutch oil
3 Accumulator housing
4 Servo oil

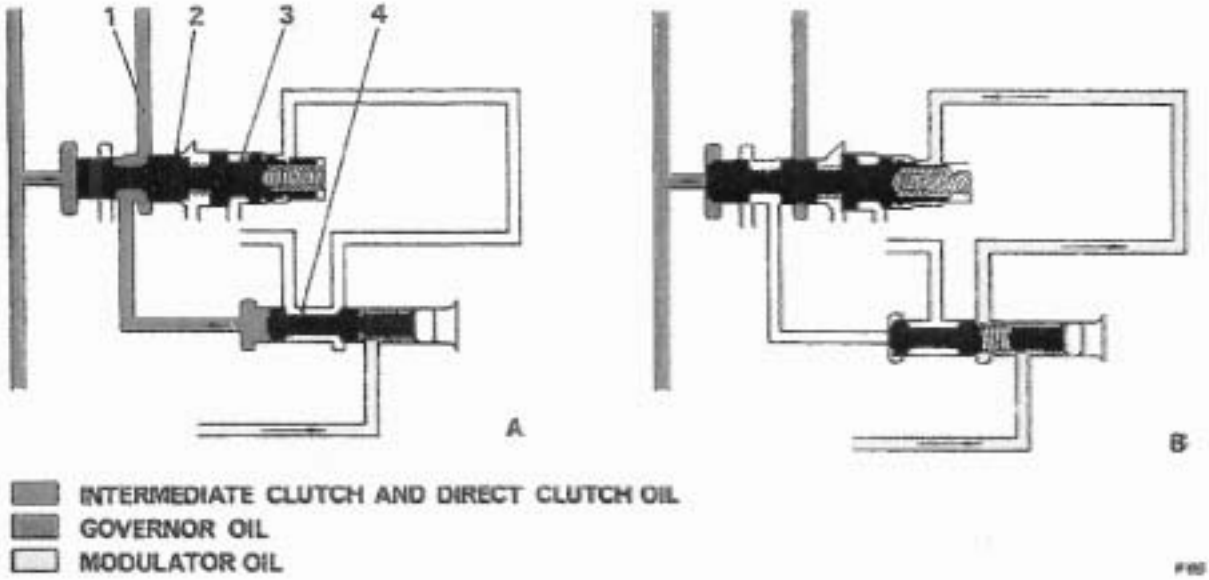

FIG. T192 PART THROTTLE DOWN-CHANGE

1 Intermediate clutch oil
2 2-3 valve
3 2-3 modulator valve
4 3-2 valve

A Valves in 3rd gear position, modulator pressure below approximately 108 lb/sq. in. (7,6 kg/sq. cm.)
B Part throttle down-change valves in 2nd gear position modulator pressure above 108 lb/sq. in. (7,6 kg/sq. cm.)

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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 150 lb/sq. in. (10,55 kg/sq. cm.). As a result of this, the 1–2 shift valve will move to cause a down-change at road speeds below approximately 40 m.p.h. (64 k.p.h.) and will prevent an up-change, regardless of the speed of the car.

When the 1–2 shift valve closes, the exhausting intermediate clutch oil lifts two check balls off their seats to enable the front band and the intermediate clutch to release quickly (*see Fig. T196*).

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. This increased pressure, directed to the rear servo accumulator piston, resists servo apply pressure and 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. T197*). 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 directed also 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 260 lb/sq.in. (18,28 kg/sq.cm.).

Control valve unit—To remove

Note Before removing the control valve unit from a transmission installed in a vehicle, take note of the transmission serial number. If the **Transmission Serial Number** is **70-RR-2626 and onwards** take extreme care when removing the control valve unit as the front servo piston and related parts may fall from the transmission due to the normal freeness of the 'Teflon' oil sealing rings.

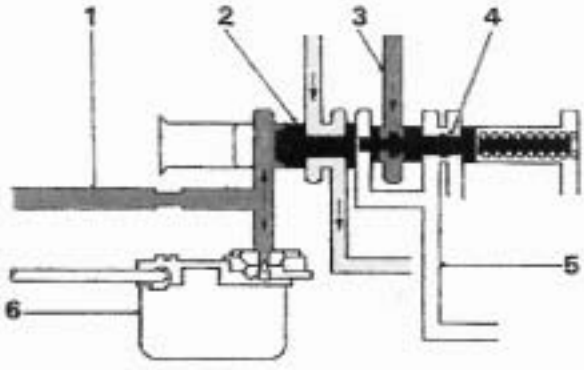

FIG. T193 DETENT VALVE CLOSED

1 Line oil
2 Detent valve
3 Drive oil
4 Detent regulator valve
5 Detent oil passage
6 Line oil

The control valve unit may be removed with the transmission in position 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 twelve setscrews which secure the control valve unit to the transmission case; remove the clips but leave them attached to the lead. Do not remove the solenoid securing screws.

Note On later models, the number of setscrew holes in the control valve unit was reduced by two, whilst the holes in the transmission case, spacer plate and gasket remain the same. When renewing a control valve unit, all the setscrew holes in the control valve unit must be used.

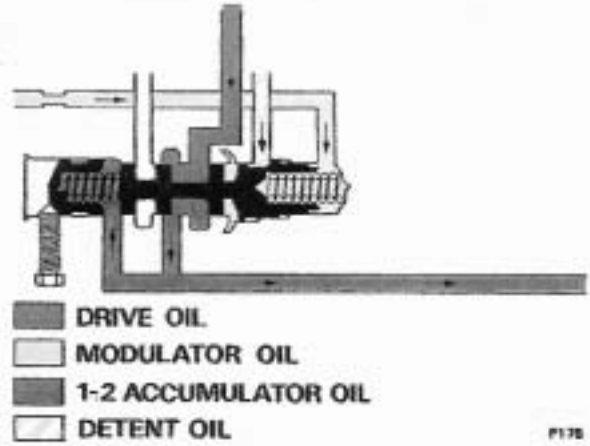

FIG. T194 1–2 ACCUMULATOR VALVE

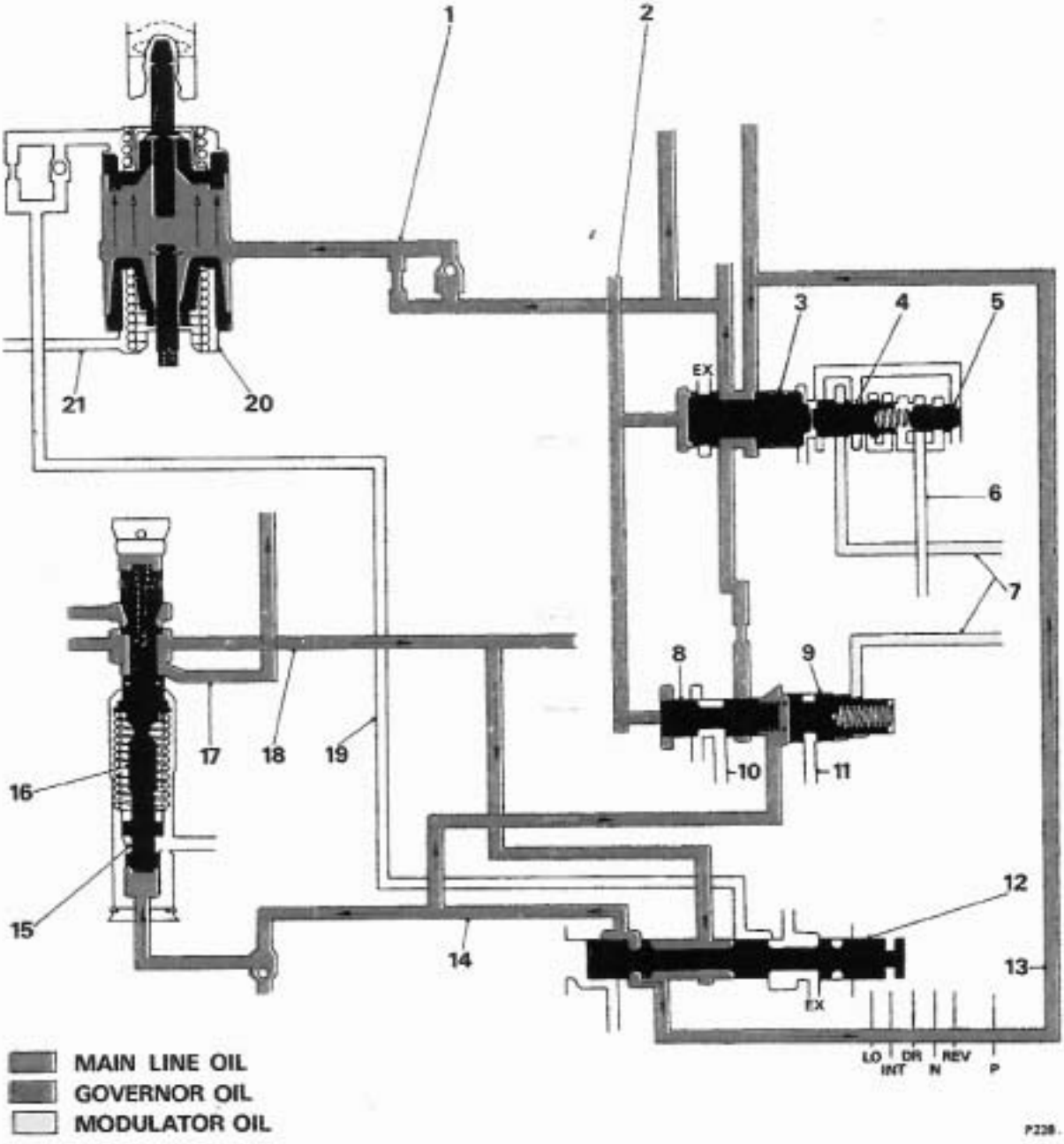

FIG. T195 VALVES—INTERMEDIATE RANGE— 2ND GEAR

1 Intermediate clutch oil
2 Governor oil
3 1–2 valve
4 1–2 detent valve
5 Regulator valve
6 Detent passage
7 Modulator oil
8 2–3 valve
9 2–3 modulator valve
10 Direct clutch passage
11 Detent passage
12 Manual valve
13 Drive oil
14 Intermediate oil
15 Boost valve
16 Pressure regulator valve
17 Converter oil
18 Line oil
19 Servo oil passage
20 Accumulator piston
21 Servo oil passage

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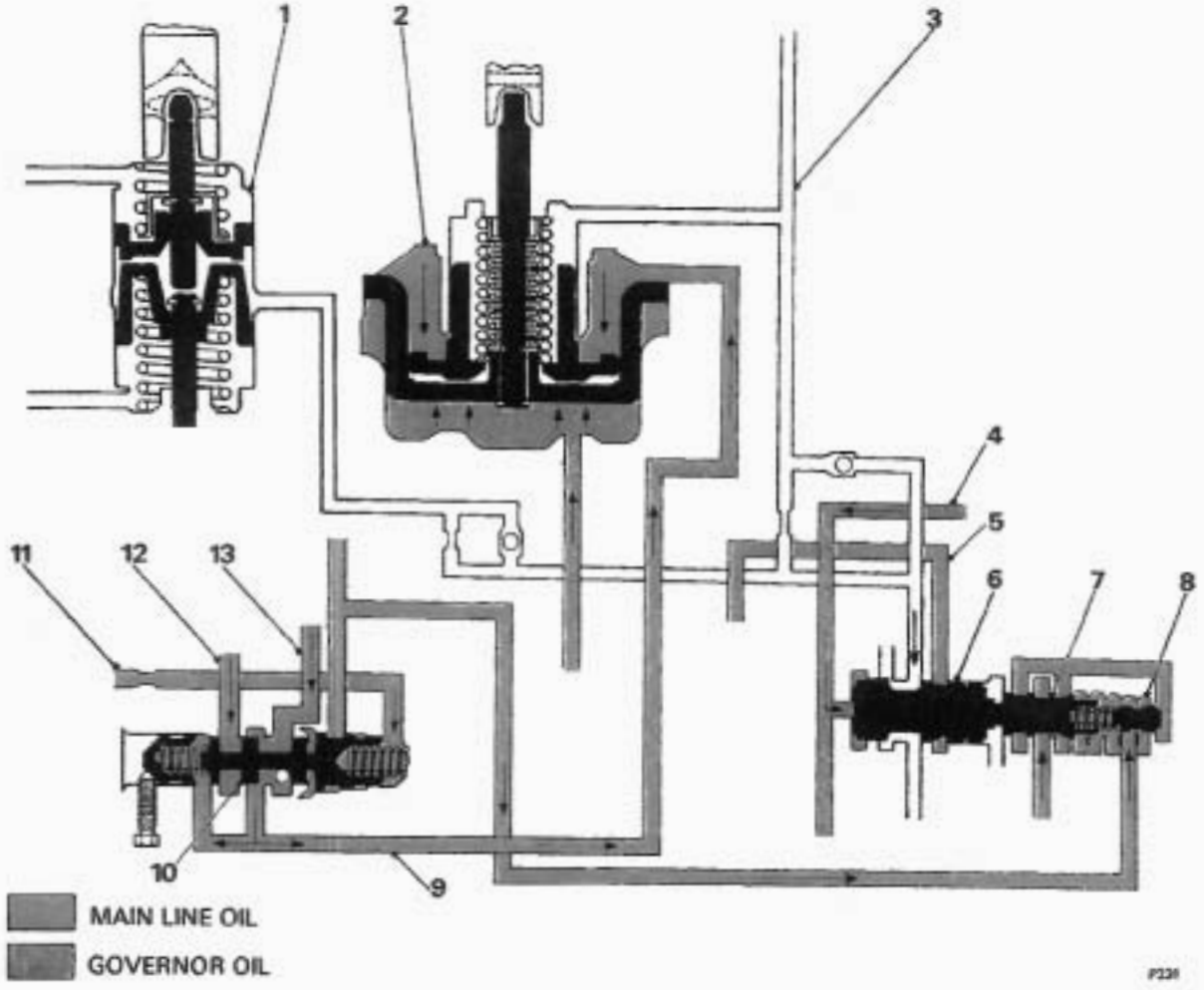

FIG. T196 LOW RANGE—1ST GEAR—REAR BAND APPLIED

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

3. Remove the control valve unit, together with the two governor pipes (*see Fig. T198*).

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.

Note If the transmission is to be dismantled further, remove the stator connector (if fitted) from its connection in the case, then remove the detent (short) lead from the stator connector.

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 T199.
2. Remove the manual valve from its bore.
3. Fit the control valve accumulator installing tool RH 7961 (J-21885) onto the accumulator piston.

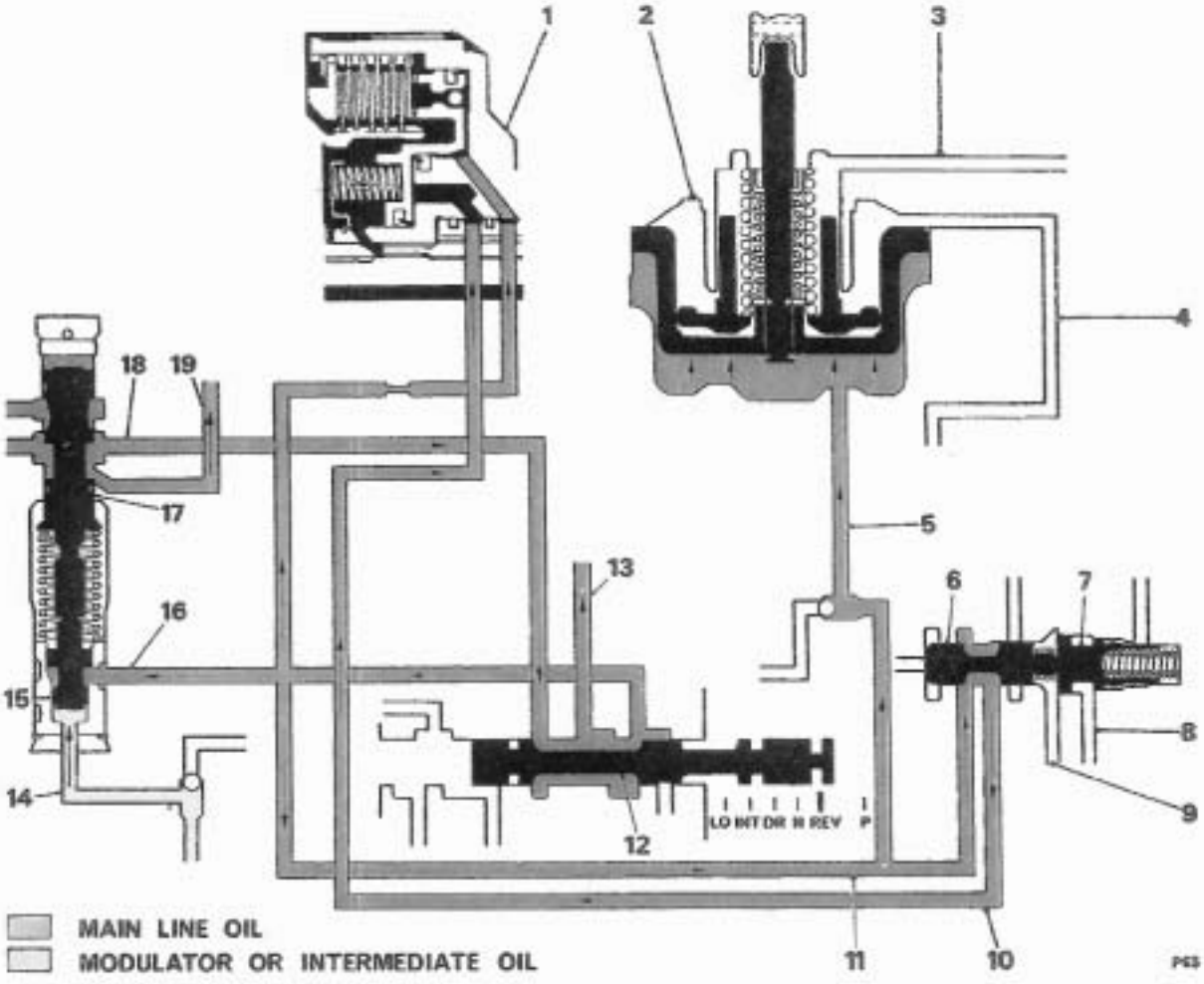

FIG. T197 REVERSE—REAR BAND APPLIED

1 Direct clutch (applied)
2 Rear servo applied
3 Intermediate clutch oil passage
4 1–2 accumulator oil 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 oil
16 Reverse oil
17 Pressure regulator
18 Line oil
19 Convertor oil

4. Compress the piston and remove the 'E' ring container.

5. Remove the accumulator control valve and spring.

6. Remove the retaining pin, 1–2 bushing, 1–2 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 bushing, 2–3 modulator valve and the 2–3 intermediate spring from the middle right-hand bore.

9. Remove the 2–3 shift valve.

10. Remove the retaining pin, bore plug, 3–2 spring and 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. Use an extractor to remove the pin from the back face of the valve.

12. Remove the bore plug, detent valve, detent regulator valve spring and the spacer.

13. Ensure that the 1–2 accumulator valve in the remaining bore is free, by moving the valve against the spring.

Note **Early cars only** The small adjusting screw on the outside of the 1–2 accumulator valve bore regulates accumulator valve pressure.

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Do not disturb the adjusting screw unless it is necessary to remove the valve to free it in the bore.

14. If it is necessary to remove the screw, its **exact** position must be determined before removal, using a 1·00 in. to 2·00 in. (2,5 cm. to 5,0 cm.) micrometer.
15. After removing any burrs, measure from the screw head to the machined surface of the valve body (*see Fig. T200*). Note the measurement.
16. Remove the adjusting screw.
17. Remove the 1–2 accumulator valve retaining pin from the machined surface of the valve body; remove the plug.
18. Remove the 1–2 accumulator sleeve, secondary spring and valve.
19. Remove the primary 1–2 accumulator valve and spring.

Control valve unit—To inspect

1. Wash in Trichlorethylene, the control valve unit body, valves and the remainder of the parts. 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 crocus 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 bushings with clean transmission fluid.
4. All valves and bushes 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 in any way 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, otherwise the transmission will not function correctly. Refer to Figure T199 during assembly procedure.

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

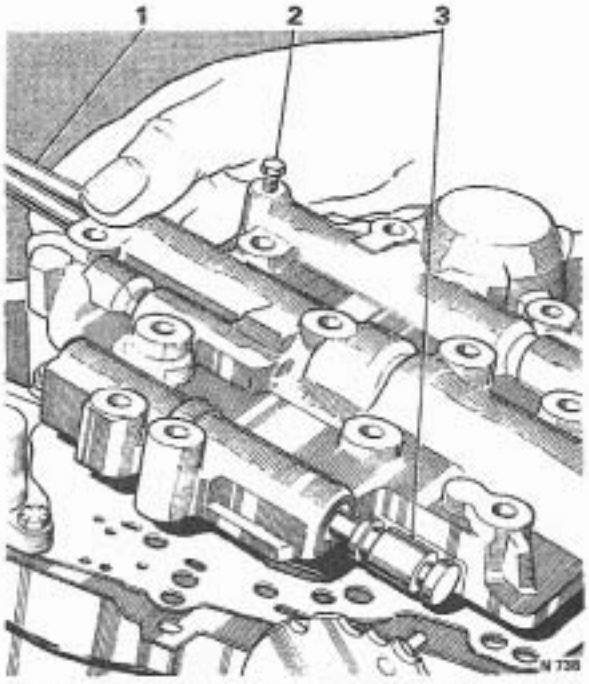

FIG. T198 REMOVING THE CONTROL VALVE UNIT

1 Governor pipes
2 Accumulator valve pressure adjusting screw (early cars only)
3 Manual valve

RH 7961 (J-21885). Align the piston and spring with the bore then compress the spring and piston (*see Fig. T201*).

4. Secure the piston with the 'E' ring retainer.
5. If the 1–2 accumulator valve train has been removed, fit the 1–2 primary spring into the primary 1–2 accumulator valve.
6. Fit the valve and spring into the lower left-hand bore, spring first.
7. Use a retaining pin as a retractor to hold the valve in its operating position.
8. Fit the 1–2 accumulator valve (wide land first) into the 1–2 accumulator sleeve.
9. Fit the 1–2 accumulator sleeve into its bore.
10. Fit the retaining pin.
11. Fit the 1–2 accumulator valve secondary spring and the 1–2 accumulator plug into the sleeve.
12. Fit the adjusting screw to conform to its original micrometer measurement.
13. Fit the detent spring and spacer into the next left-hand bore above.
14. Compress the spring and hold it with a small screwdriver.
15. Fit the detent regulator valve, wide land first.
16. Fit the detent valve, small land first.
17. Fit the bore plug with the hole facing the outside then fit the retaining pin. Remove the screwdriver.
18. Fit the 3–2 valve into the lower right-hand bore.

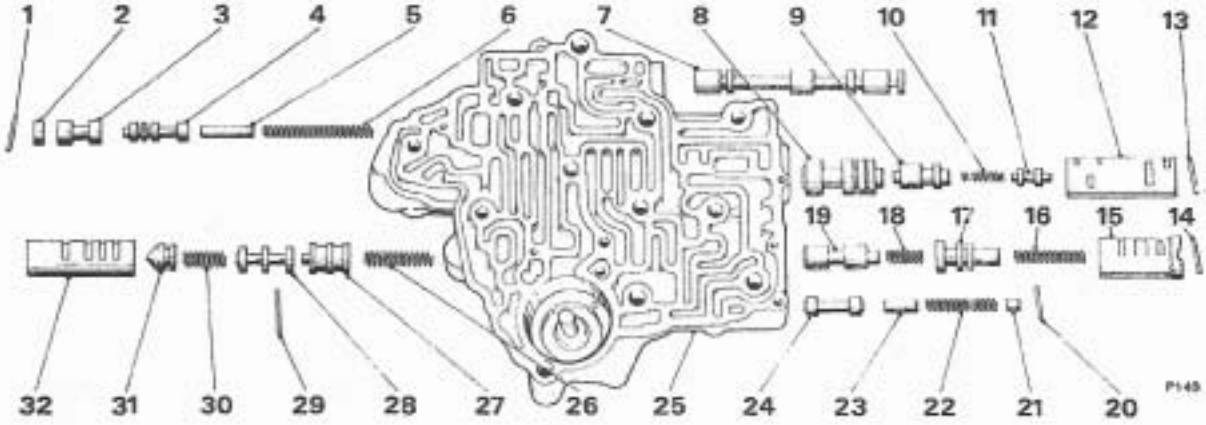

FIG. T199 CONTROL VALVE UNIT

1 Retaining pin
2 Bore plug
3 Detent valve
4 Detent regulator
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 2–3 intermediate spring
19 2–3 valve
20 Retaining pin
21 Bore plug
22 3–2 spring
23 Spacer
24 3–2 valve
25 Valve body
26 Primary spring
27 Primary 1–2 accumulator valve
28 Retaining pin
29 1–2 accumulator valve
30 Secondary spring
31 Bore plug
32 1–2 accumulator sleeve

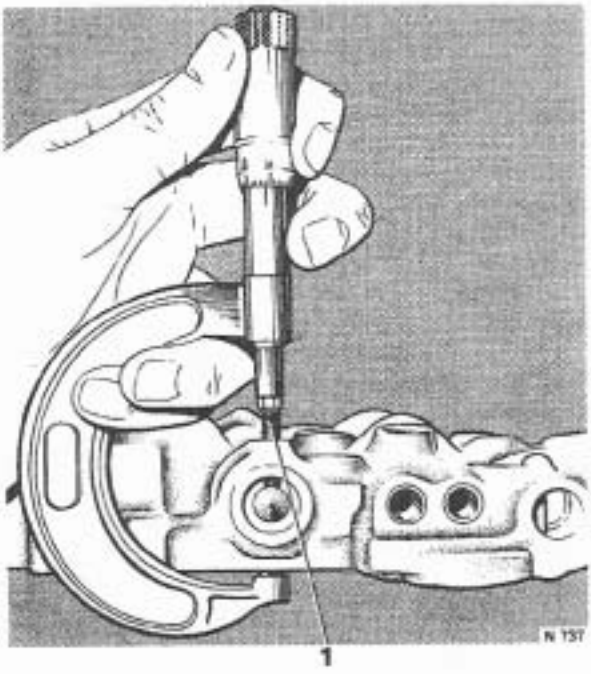

FIG. T200 MEASURING THE ADJUSTING SCREW (EARLY CARS)

1 Accumulator valve pressure adjusting screw

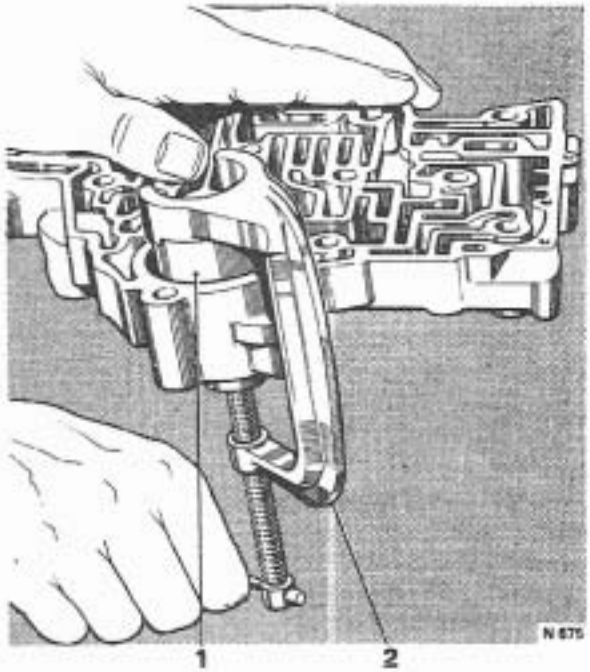

FIG. T201 FITTING THE ACCUMULATOR AND SPRING

1 Accumulator piston **2** Inserting tool

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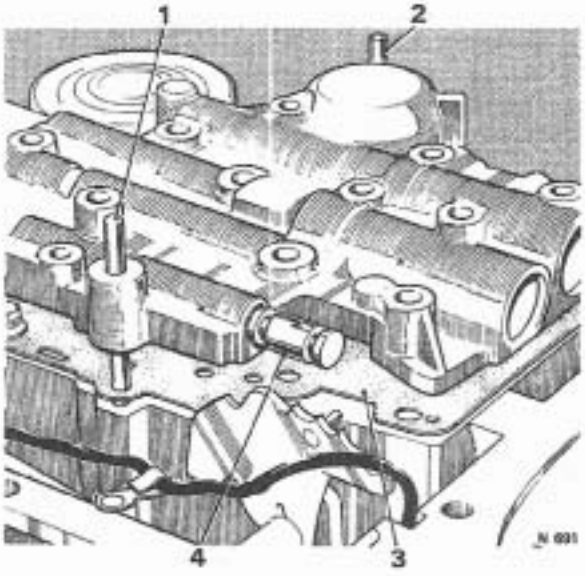

FIG. T202 FITTING THE CONTROL VALVE UNIT

1 Guide pin
2 Guide pin
3 Gasket
4 Manual valve

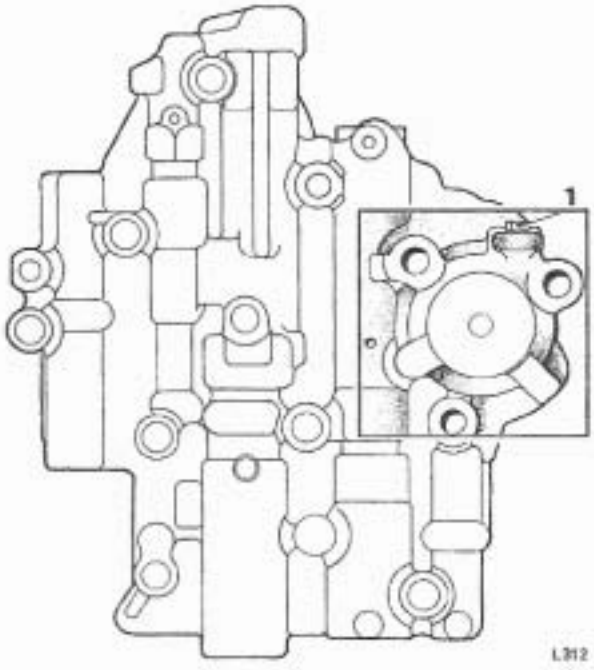

FIG. T204 PRESSURE SWITCH PLUG—REPLACEMENT CONTROL VALVE ASSEMBLY

1 Pressure switch pipe plug

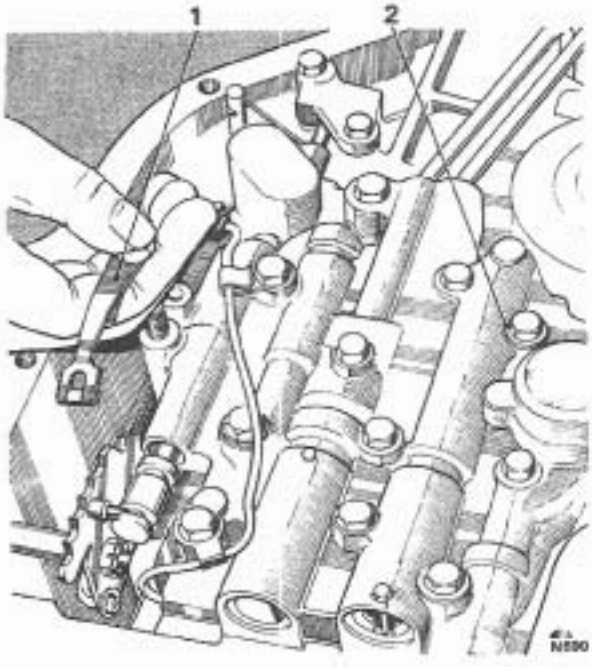

FIG. T203 FITTING THE DETENT SPRING AND ROLLER

1 Detent spring
2 Washer

19. Fit the 3–2 spring, spacer, bore plug with the hole facing the outside, and the retaining pin.
20. Fit the 2–3 shift valve, with the stem facing the outside, in the next right-hand bore above.
21. Fit the 2–3 intermediate spring.
22. Fit the 2–3 modulator valve into the sleeve, then fit both parts into the valve bore.
23. Fit the 2–3 valve spring and the retaining pin.
24. Fit into the next right-hand bore above, the 1–2 shift valve — small diameter first — then fit the 1–2 spring.
25. Fit the 1–2 regulator valve, spring and detent valve into the sleeve. Align the spring in the bore of the detent valve. Fit the parts into the valve bore.
26. Push in the sleeve against spring pressure then fit the retaining pin.
27. Fit the manual valve with the detent pin groove to the right-hand side (outmost).

Control valve unit—To fit

If a service replacement control valve assembly is to be fitted, ensure the switch pipe plug (if fitted) situated in the tapped hole adjacent to the front accumulator pocket is securely tightened in position.

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. Using two guide pins screwed into the casing, fit the control valve unit into position (*see Fig. T202*).

3. Ensure that the gasket and oil guide plate (spacer) are correctly positioned.

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

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

5. On later transmissions when installing the governor assembly ensure that a clearance of approximately 0·250 in. (0,64 cm.) is maintained between the governor pipes and transmission case, at a point 1·00 in. (2,54 cm.) from the right angle bend of the pipes.

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

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

7. Torque tighten the securing screws (*see Chapter P*).

8. Ensure that the stator lead is secured to the clips.

9. Fit the detent spring and roller assembly (*see Fig. T203*); fit the securing screw and torque tighten it to 8 lb. ft. (1,1 kg. m.) (*Chapter P*).

10. Fit the short (detent) lead to the stator connector (if it was removed) then fit the connector to the case.

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Section T16
REAR SERVO

The rear servo comprises an assembly of pistons and springs, and fits onto the bottom face of the transmission casing, adjacent to the control valve unit. It is secured to the casing 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. T205*). 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. T206*).

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 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.

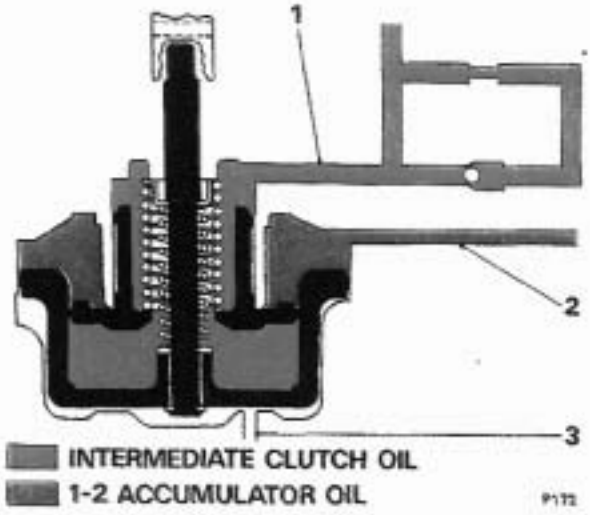

FIG. T205 DRIVE AND INTERMEDIATE—2ND GEAR

1 Intermediate clutch oil
2 1–2 accumulator oil
3 Reverse or low oil

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 which, 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. T207*). The servo release spring then strokes the servo piston to the band release position.

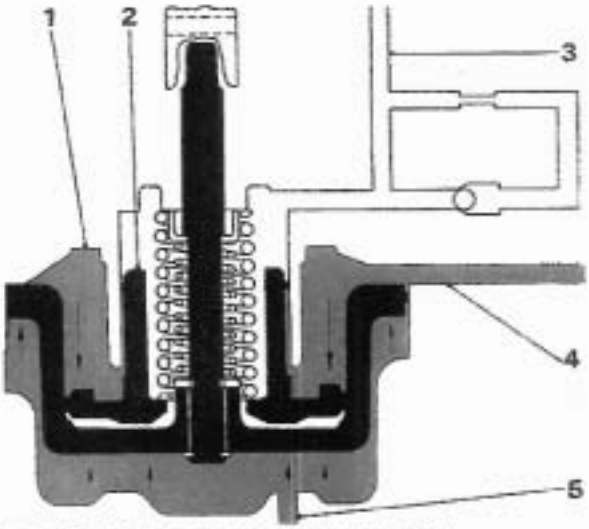

FIG. T206 LOW RANGE—1ST GEAR

1 To intermediate clutch
2 1–2 accumulator oil
3 Low range oil
4 Rear servo piston (applying)
5 Accumulator piston (resisting servo piston)

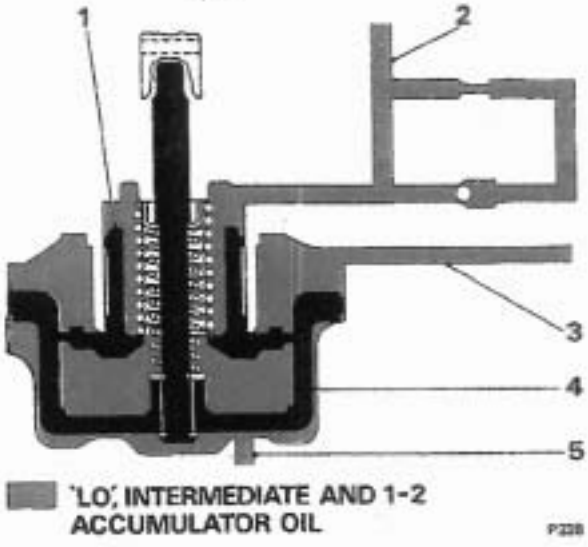

FIG. T207 LOW RANGE—2ND GEAR

1 Accumulator piston
2 To intermediate clutch
3 1–2 accumulator oil
4 Servo piston
5 Low range oil

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. T208*). To ensure that the rear band will hold the reaction carrier for the reverse gear ratio, line pressure is increased. No other oil is present in the servo to resist the movement of the servo piston.

Rear servo—To remove

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

1. Remove the sump (*see Section T14*).
2. Remove the control valve unit (*see Section T15*).
3. Remove the six setscrews which 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. T209*).
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 RH 7957 (J-21370-5) 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 brake linkage, and the smaller diameter end of the gauge pin RH 7957 (J-21370-5) in the servo pin bore (*see Fig. T210*).
2. Secure the gauge with two suitable setscrews e.g. rear servo cover screws; torque tighten the screws. (*see Chapter P*).
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 25 lb. ft. (3,46 kg. m.) to the hexagonal nut on the side of the gauge (*see Fig. T210*). 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.

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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 even 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 level with, or below the lower step on the gauge pin, a short (1 ring) 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. T211*).
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 with a maximum clearance of 0·003 in. (0,076 mm.).
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 heading 'Rear band apply pin — To select'.

Rear servo—To assemble

1. Fit the spring retainer (open end first), 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. If they were removed for cleaning purposes, fit the oil sealing rings onto the accumulator piston.
5. Fit the accumulator piston into the servo piston.

Transmissions with a **Serial Number 71-RR-1287 and onwards,** have a 'Teflon' oil sealing ring fitted to the large diameter ring groove of the rear accumulator piston (*see Fig. T212*).

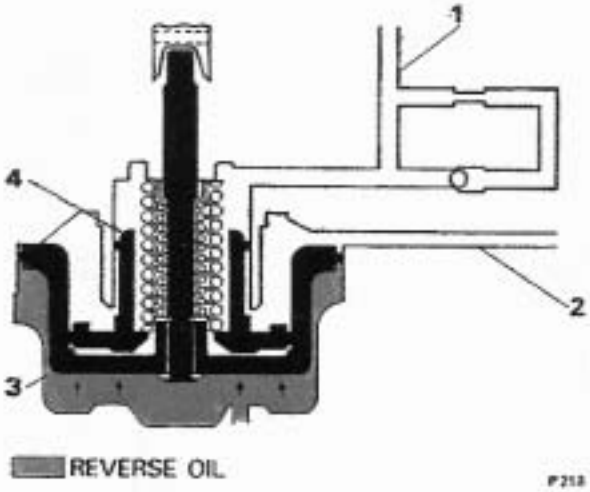

FIG. T208 REAR SERVO IN REVERSE POSITION

1 Accumulator piston
2 To intermediate clutch
3 1-2 accumulator passage
4 Rear servo piston (applying)

The 'Teflon' type of oil sealing ring requires a shallower machined ring groove in the piston and therefore, the two types of pistons and rings are **not** interchangeable as individual items.

As a complete assembly with their respective large diameter piston ring fitted, the early and late rear accumulator pistons are interchangeable.

The smaller diameter piston ring and ring groove have not been changed.

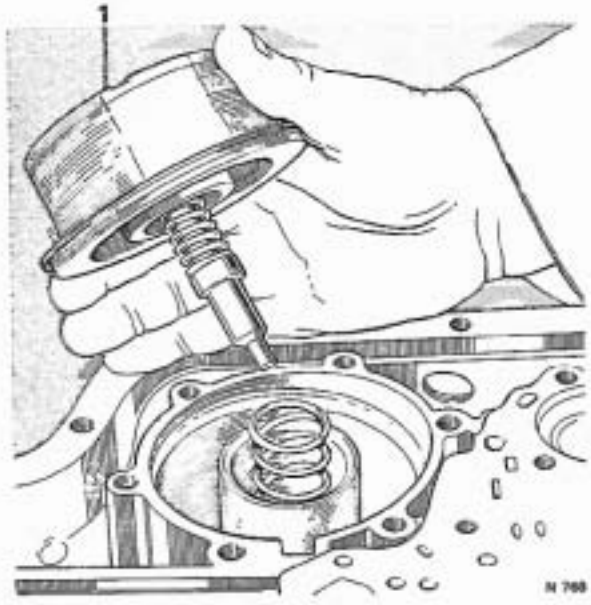

FIG. T209 REMOVING THE REAR SERVO

1 Rear servo

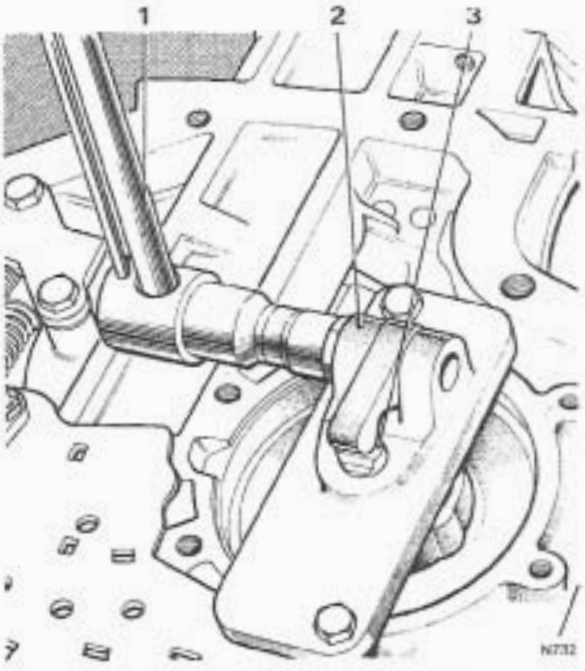

FIG. T210 SELECTING THE BAND APPLY PIN

1 Torque spanner
2 Gauge
3 Gauge pin

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 a new gasket and fit the cover.
6. Torque tighten the six setscrews (*see Chapter P*).

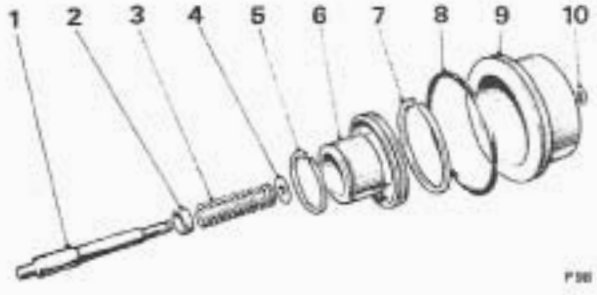

FIG. T211 REAR SERVO AND ACCUMULATOR—EXPLODED

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

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September 1971

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Section T17
DETENT SOLENOID, CONNECTOR, 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) a needle valve is caused to move and an exhaust port is opened behind the detent valve. This allows the detent valve spring to move the detent valve and allow oil at high pressure to be fed to the shift valves to oppose governor pressure (*see Forced down-change — kick-down — Section T15 — Control Valve Unit*).

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 — second gear, 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

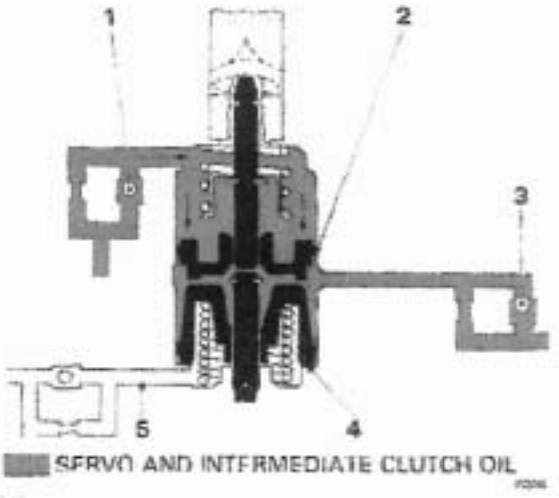

FIG. T212 DRIVE RANGE—2ND GEAR

1 Check ball (seated)
2 Servo piston
3 Intermediate clutch oil check ball (seated)
4 Accumulator piston
5 Direct clutch passage
6 Servo oil

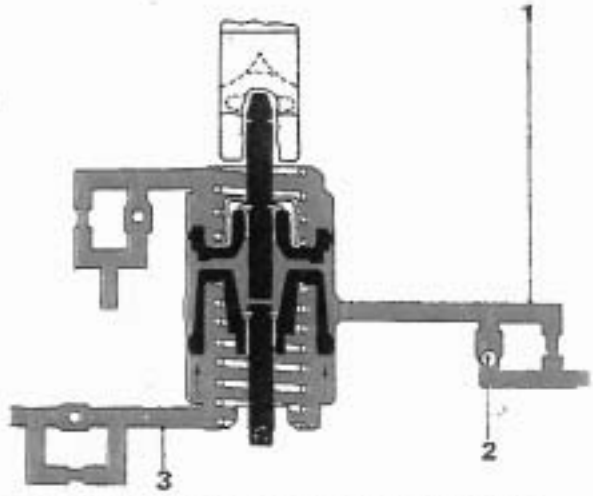

FIG. T213 DRIVE RANGE—3RD GEAR

1 Intermediate clutch oil
2 Check ball
3 Direct clutch oil

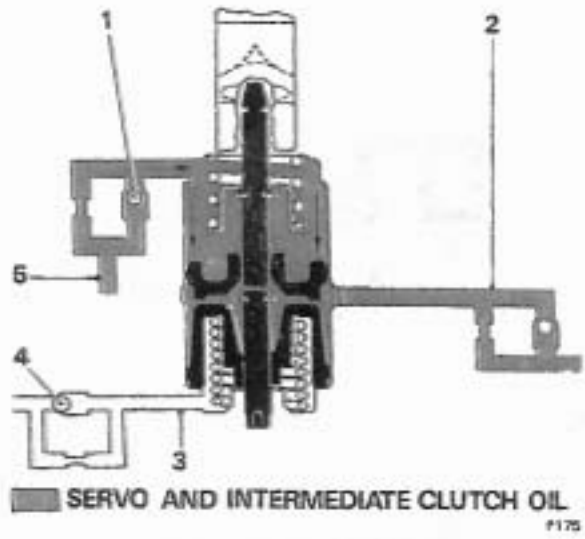

FIG. T214 DRIVE RANGE—3-2

1 Check ball (seated)
2 Intermediate clutch oil
3 Direct clutch passage
4 Check ball (seated)
5 Servo oil

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 (*see Fig. T212*). 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 pressure.

Drive range—third gear

When the direct clutch is applied, intermediate clutch oil pressure increases. This increased pressure, plus the accumulator spring, overcomes the servo oil pressure and the accumulator piston is moved until it reaches the stop on the pin (*see Fig. T213*). As the accumulator piston moves, it abuts the servo piston which moves a corresponding distance, until it contacts a washer 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 roller.

The controlled release pressure allows the engine to increase its r.p.m. 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. T214*).

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.

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. T215*). The oil which applies the band is controlled also by the stroking of the accumulator piston which is resisted by the accumulator spring and the restricted exhaust of direct clutch oil.

Detent solenoid, connector, control valve spaces and front servo—To remove

The units may be removed from the transmission whether the transmission is removed from the car or not.

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1. Drain the transmission fluid and remove the sump.
2. Remove the control valve unit and governor pipes (*see Section T15 — Control Valve Unit*).
3. Disconnect the solenoid lead(s) from the connector terminals.
4. Compress the tabs on the connector and remove the connector and 'O' ring from the casing; discard the 'O' ring.
5. Remove the two setscrews which secure the detent solenoid.
6. Remove the solenoid and gasket.
7. 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.

8. Remove the six check balls from the cored passages in the transmission case (*see Fig. T216*).
9. Lift the front servo piston, washer, pin, retainer and spring from the transmission case. An exploded view of the front servo is shown in Figure T217.

Front servo—To inspect

1. Examine the servo pin for damage.
2. Examine for damage the oil seal ring groove in the piston.
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, connector, control valve spacer and front servo—To fit

'Teflon' oil sealing rings are fitted to **Transmission Serial Number 70-RR-2626 and onwards.** Therefore, 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 fitted with 'Teflon' oil sealing rings 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 'Teflon' oil sealing ring, renew with the current aluminium (front servo) or cast iron (front accumulator) service rings.

Note The front accumulator piston, front servo piston and related parts are changed on 1971 transmissions and onwards; individual parts are not inchangeable (*see Fig. T218*).

1. Fit the front servo spring and retainer into the bore of the transmission casing.

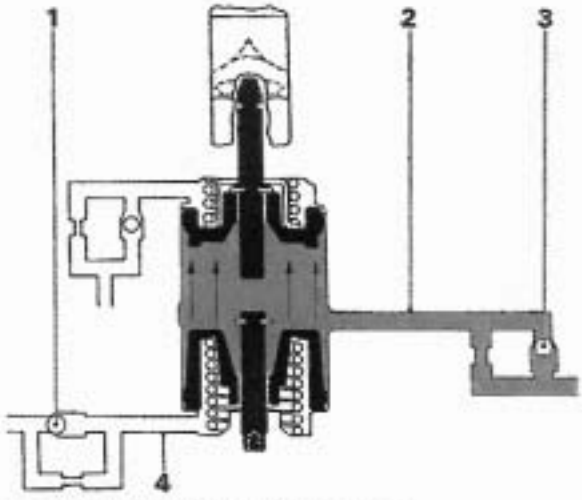

FIG. T215 INTERMEDIATE RANGE—2ND GEAR

1 Check ball
2 Intermediate clutch oil
3 Check ball
4 Direct clutch passage

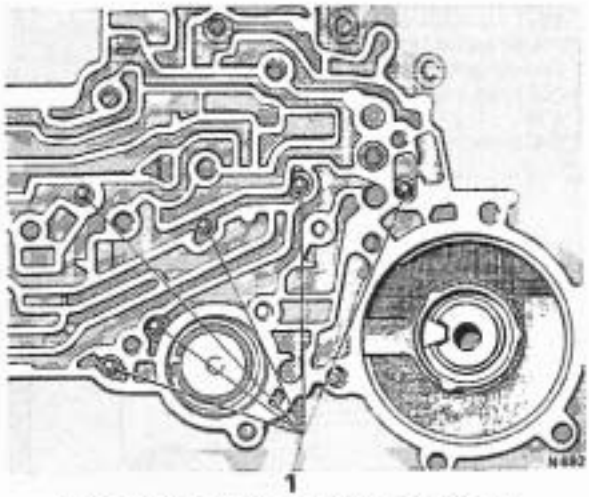

FIG. T216 LOCATION OF CHECK BALLS

1 Check balls

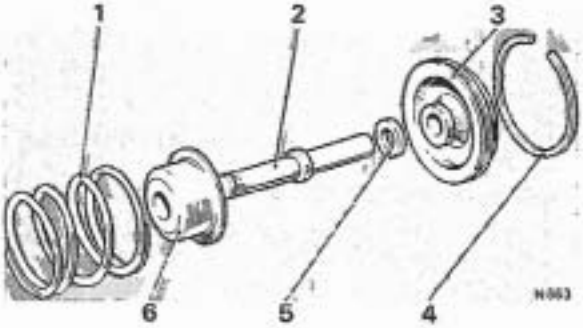

FIG. T217 FRONT SERVO—EXPLODED

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

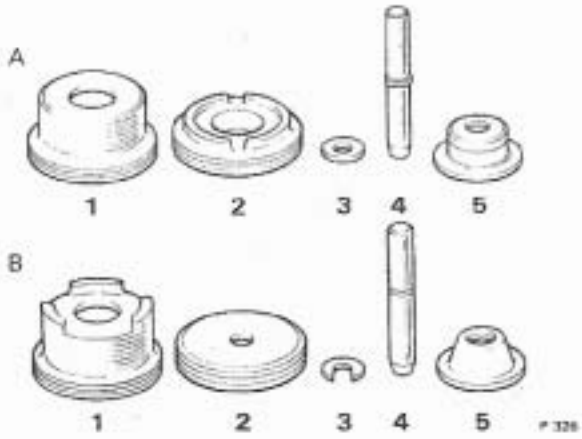

FIG. T218 IDENTIFICATION OF FRONT SERVO AND FRONT ACCUMULATOR COMPONENTS

A 1965 through to 1970 components
1 Accumulator piston
2 Servo piston
3 Washer — front servo piston
4 Pin front servo piston
5 Retainer front servo spring

B 1971 components
1 Accumulator piston
2 Servo piston
3 'C' ring — front servo piston
4 Pin — front servo piston
5 Retainer — front servo spring

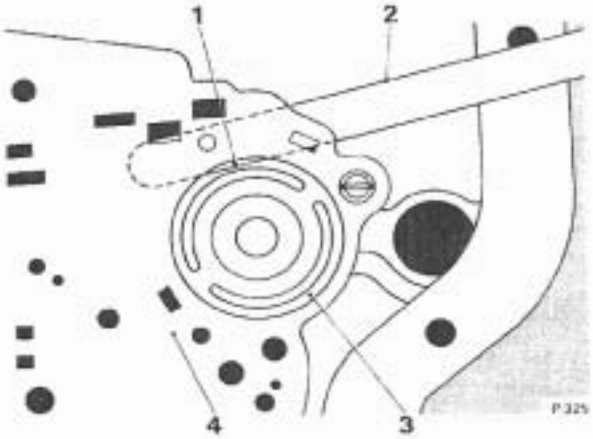

FIG. T219 METHOD OF TEMPORARILY HOLDING FRONT SERVO PISTON IN POSITION (TRANSMISSION INSTALLED IN A VEHICLE)

1 Locate feeler gauge in this position, allowing accumulator piston to enter the front servo piston before the feeler gauge is withdrawn
2 Feeler gauge
3 Front servo piston
4 Spacer plate

2. Fit the flat washer onto the front servo pin on the end opposite to the taper.
3. Fit the pin into the casing so that the tapered end contacts the forward band.
4. Fit the piston ring to the piston if it was removed.
5. Fit the piston onto the band apply pin so that the number on the shoulder of the piston faces toward the sump.

Note If the front servo assembly is to be fitted with the transmission in the car, hold temporarily in position until the accumulator piston has entered the front servo piston by means of a length of clean 0·020 in. (0,508 mm.) feeler gauge position across the servo piston as shown in Figure T219. Withdraw the feeler gauge before tightening the control valve body bolts.

6. Check the piston for freedom of movement by pushing it against the spring.
7. Fit the six check balls into the ball seat pockets in the transmission casing (*see Fig. T216*).

Note If the operation is being performed with the transmission in the car, fit the check balls into the ball seat pockets on the spacer plate.

8. Fit the case-to-spacer gasket (gasket with an extension for the detent solenoid).
9. Fit the control valve spacer.
10. Fit the control valve-to-spacer gasket (gasket with slot).
11. Fit the detent solenoid gasket.
12. Fit the detent solenoid assembly with the connector facing the outer edge of the casing. Fit the securing setscrews but do not tighten them.
13. Fit a new 'O' ring onto the solenoid connector.
14. Fit the connector with the lock tabs pointing into the casing.
15. Bend up the locating tabs on the side of the casing.
16. Fit the solenoid and stator leads to the connector terminals.
17. Fit the control valve unit as described in Section T15 then torque tighten the two solenoid securing setscrews (*see Chapter P*).

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Section T18
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 T18.
2. Remove the propeller shaft as described in Chapter F.
3. Place a drip tray beneath the rear extension.
4. Remove the coupling flange by withdrawing it from the output shaft.
5. Remove the six setscrews which 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 square section 'O' ring or gasket, whichever is fitted, 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 bore in which the seal fits is clean and free from damage and that the seal drain-back port is not obstructed.
6. Lightly smear with Wellseal the outer edge of the new seal then, drive in the seal using tool RH 7953 (J-21359).

Note The webbing on the seal installation tool RH 7953 (J-2 359) must be undercut by approximately 0·125 in. (3,17 mm.) as shown in Figure T220.

7. Ensure that the rear face of the transmission casing and the front face of the extension are clean and free from burrs.

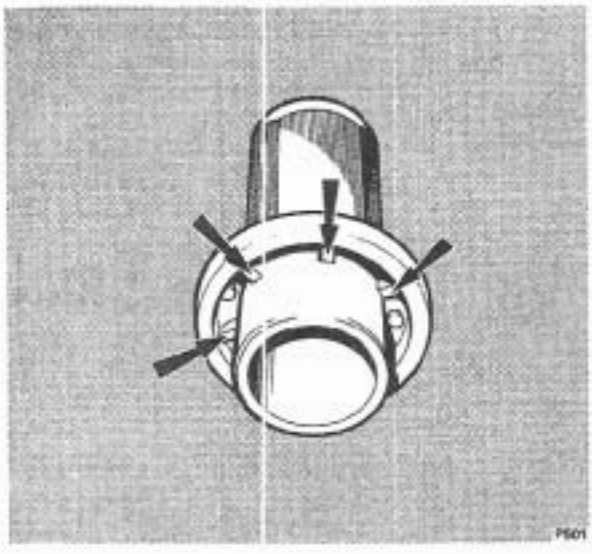

FIG. T220 UNDER CUTTING WEBBING OF SEAL INSTALLATION TOOL RH 7953 (J-21359)

Rear extension—To fit

1. Fit a new square sectioned 'O' ring or a gasket, whichever was removed, 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.
4. Fit the six setscrews and torque tighten them to the figure specified in Chapter P.
5. Fit the coupling flange.
6. Fit the propeller shaft.
7. Fit the electric actuator.