Transmission

Contents

Sections

Issue record sheet 1

April 1985

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
Page No.										
Contents										
1	Sep 82	May 84	Oct 81	Jan 82	Oct 81	Jan 82	Apr 85	Sep 82	May 84	Apr 85
2		May 84	Oct 81	Oct 81	Oct 81	Oct 81	Apr 85	Sep 82	May 84	Apr 85
3	Sep 82	May 84		Oct 81	Jan 82	Oct 81		Sep 82	May 84	
4	Sep 82	May 84			Oct 81					
5	Aug 81				Oct 81					
6	Aug 81									
7	Aug 81									
8	Aug 81									
9	Aug 81									
10	Aug 81									
11	Aug 81									
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37										
38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										

Issue record sheet 2

April 1985

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20
Page No.										
Contents										
1	Oct 81	Oct 81	Nov 81	Nov 81	Sep 82	Nov 81	Nov 81	Nov 81	May 84	Dec 81
2		Oct 81	Nov 81	Nov 81		Nov 81	Nov 81	Nov 81	May 84	Dec 81
3		Oct 81	Nov 81	Nov 81		Nov 81	Nov 81	Sep 82	May 84	Dec 81
4		Oct 81	Nov 81	Nov 81		Nov 81		Nov 81	May 84	Dec 81
5		Oct 81				Nov 81		May 84	May 84	
6		Oct 81						May 84	May 84	
7		Oct 81						May 84	May 84	
8		Sep 82						May 84	May 84	
9		Apr 85							May 84	
10		Apr 85							May 84	
11									May 84	
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38										
39										
40										
41										
42										
43										
44										
45										
46										
47										
48										

Issue record sheet 3

September 1982

The dates quoted below refer to the issue date of individual pages within this chapter.

Sections	T21	T22	T23
Page No.			
Contents			
1	Dec 81	Dec 81	Dec 81
2	Dec 81	Dec 81	
3	Dec 81	Dec 81	
4	Dec 81	Dec 81	
5	Dec 81		
6	Dec 81		
7	Sep 82		
8	Dec 81		
9	Dec 81		
10	Dec 81		
11	Dec 81		
12	Dec 81		
13	Dec 81		
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31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			

Introduction

Contents

Transmission

Contents

Sections

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.

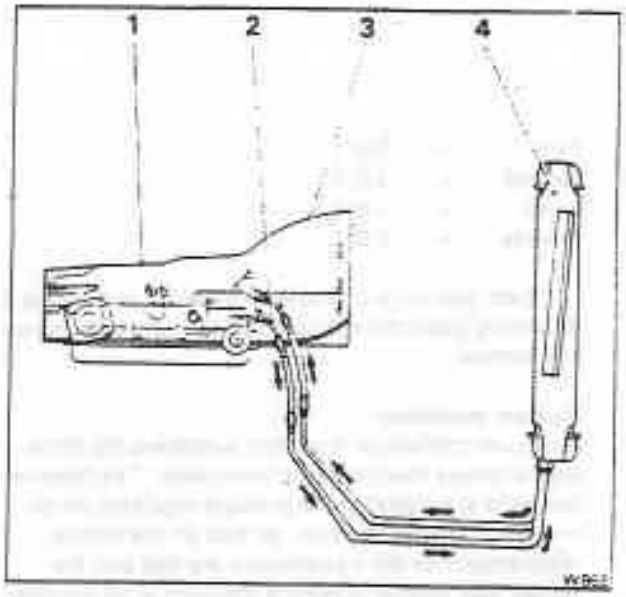

Fig. T1-1 Heat exchanger system
1 Transmission
2 Transmission fluid to heat exchanger
3 Transmission fluid from heat exchanger
4 Coolant radiator with heat exchanger in bottom tank

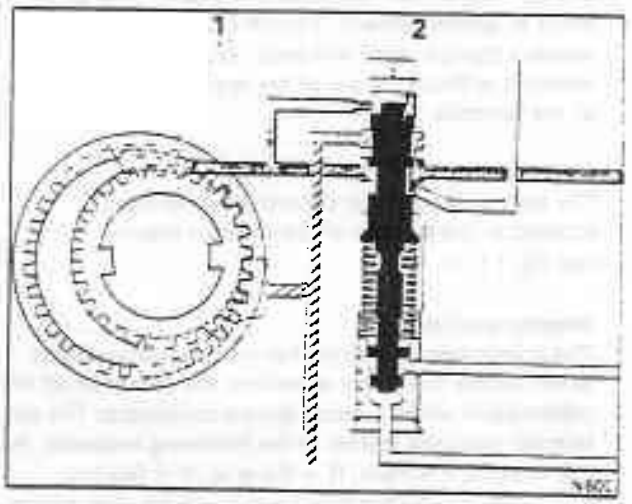

Fig. T1-2 Pressure control
1 Transmission oil pump
2 Pressure regulator valve train

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.

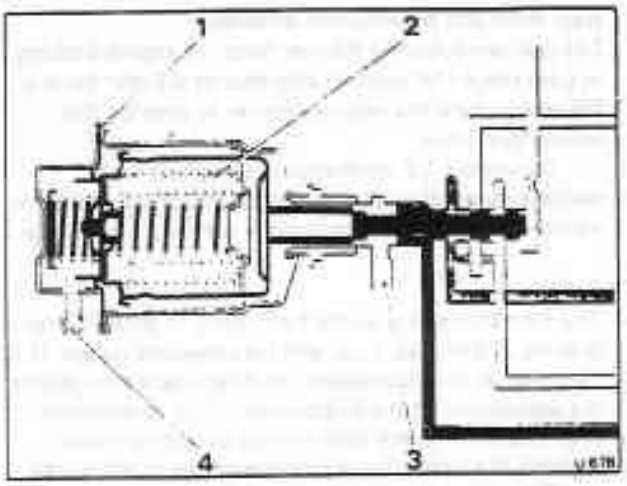

Fig. T1-3 **Vacuum modulator assembly**
1 Diaphragm
2 Aneroid bellows
3 Exhaust
4 Engine vacuum

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.

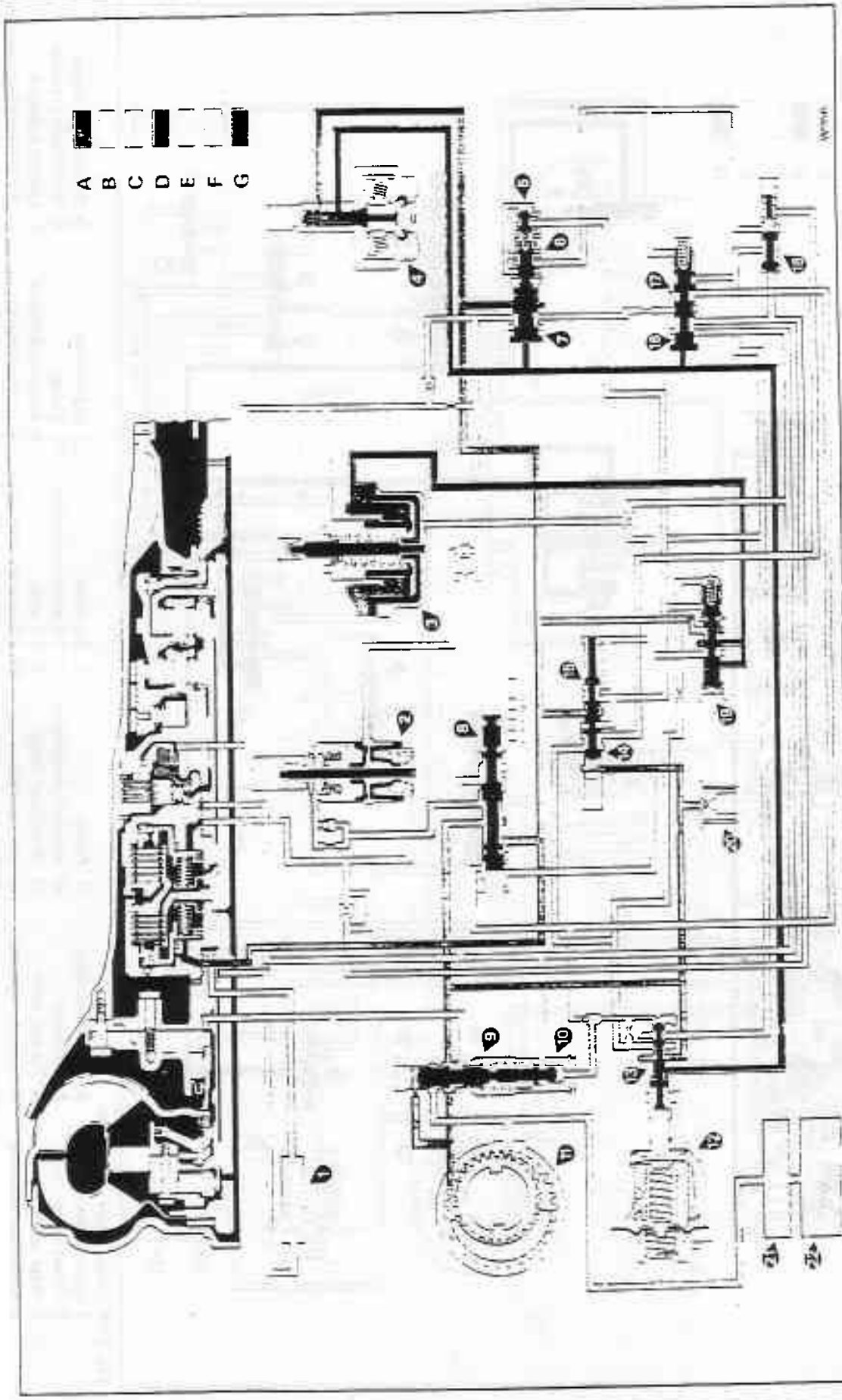

Fig. T1-4 Drive range — 1st gear

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

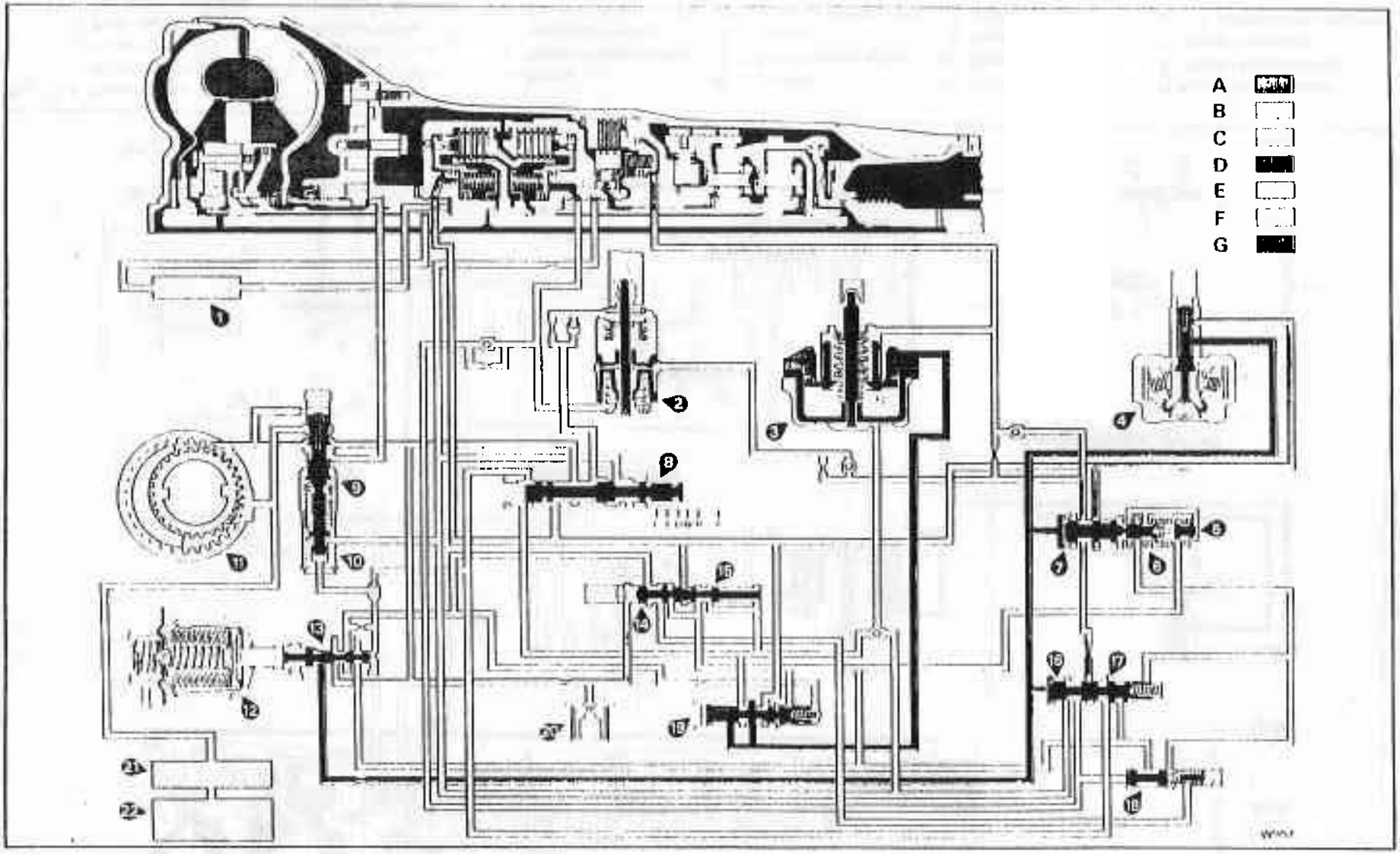

Fig. T1-5 Drive range – 2nd gear

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

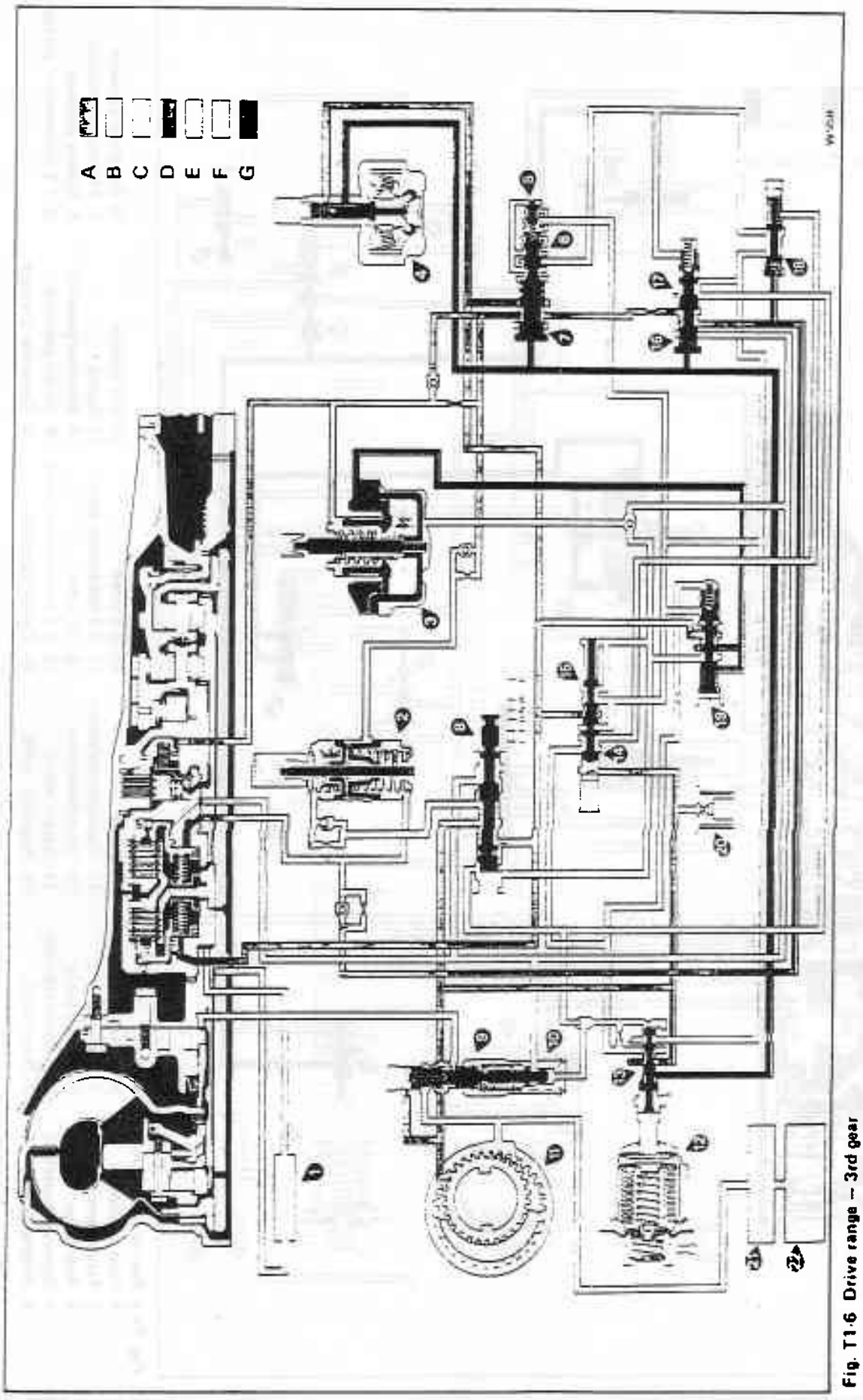

Fig. T1-6 Drive range – 3rd gear

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

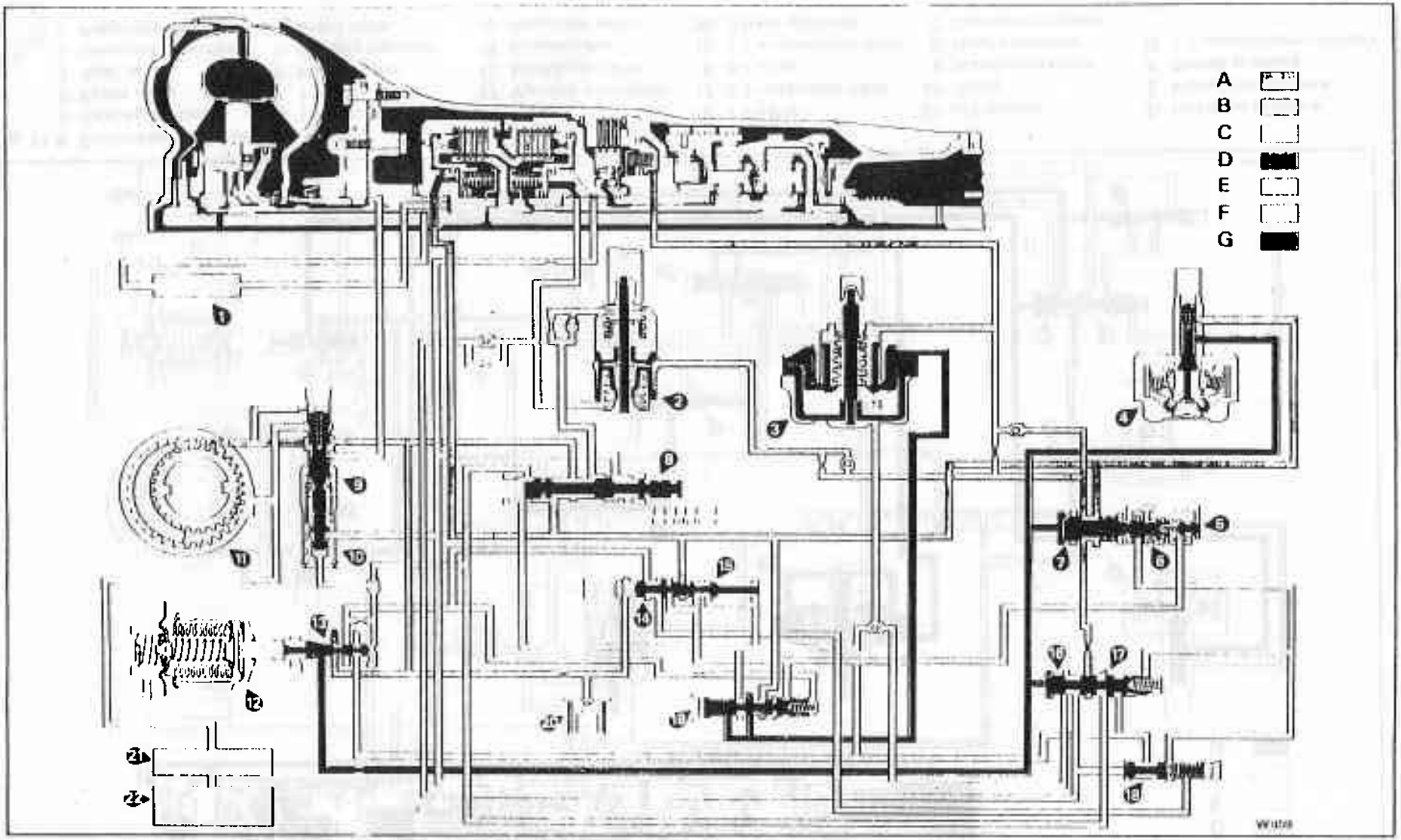

Fig. T1-7 Part throttle down-change

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

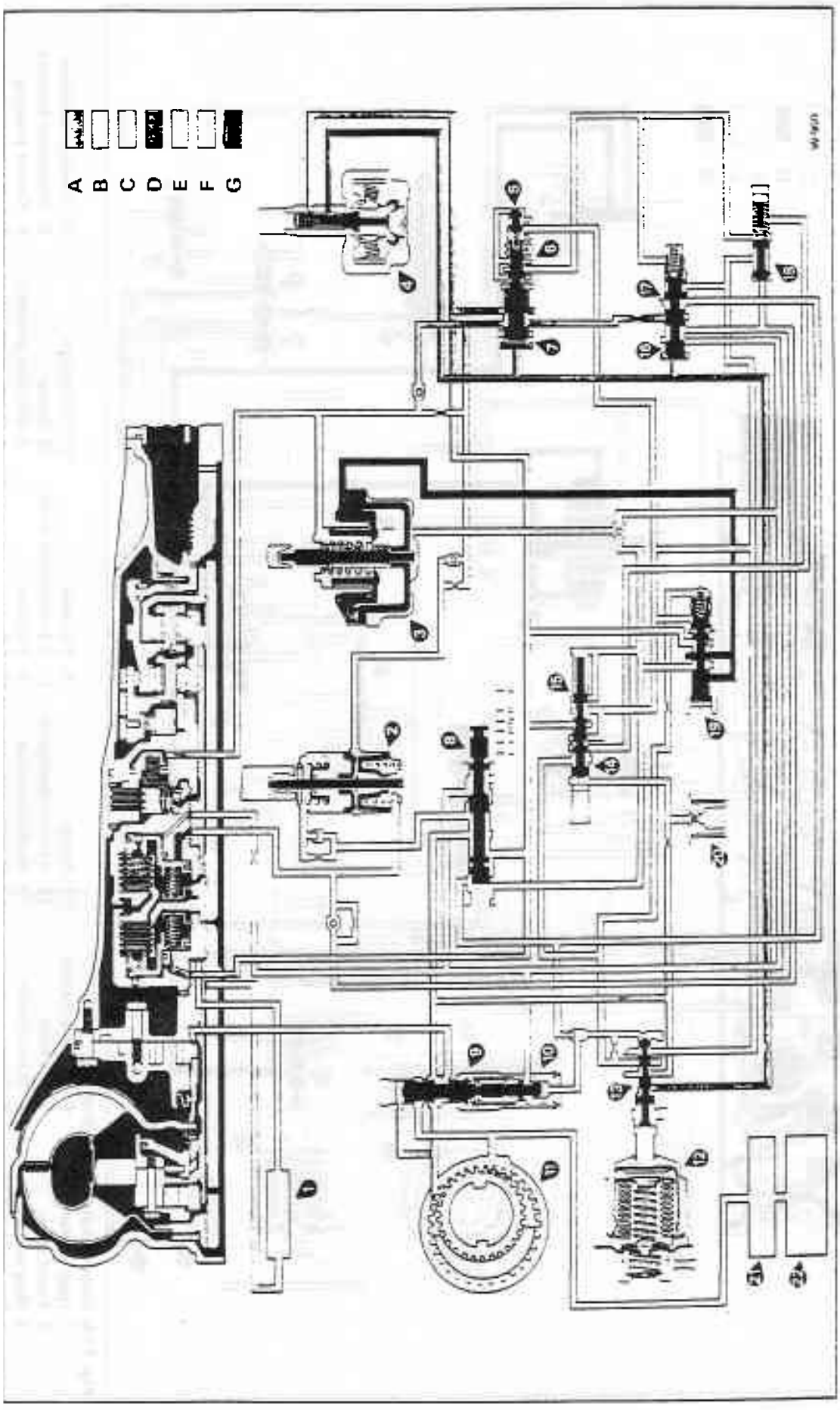

Fig. T1·8 Detent down-change

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

TSD 4400

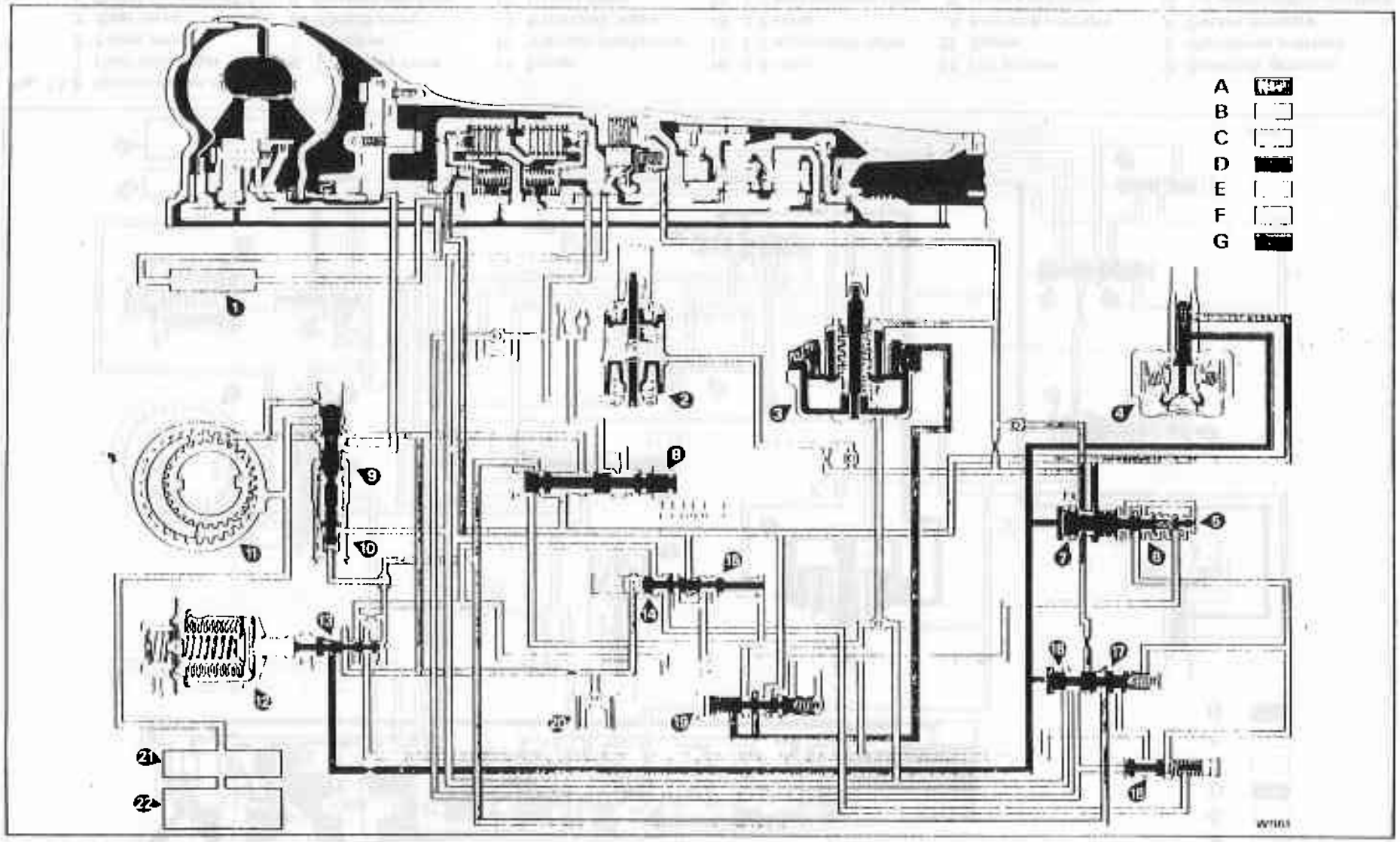

Fig. T1-9 Intermediate range – 2nd gear

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

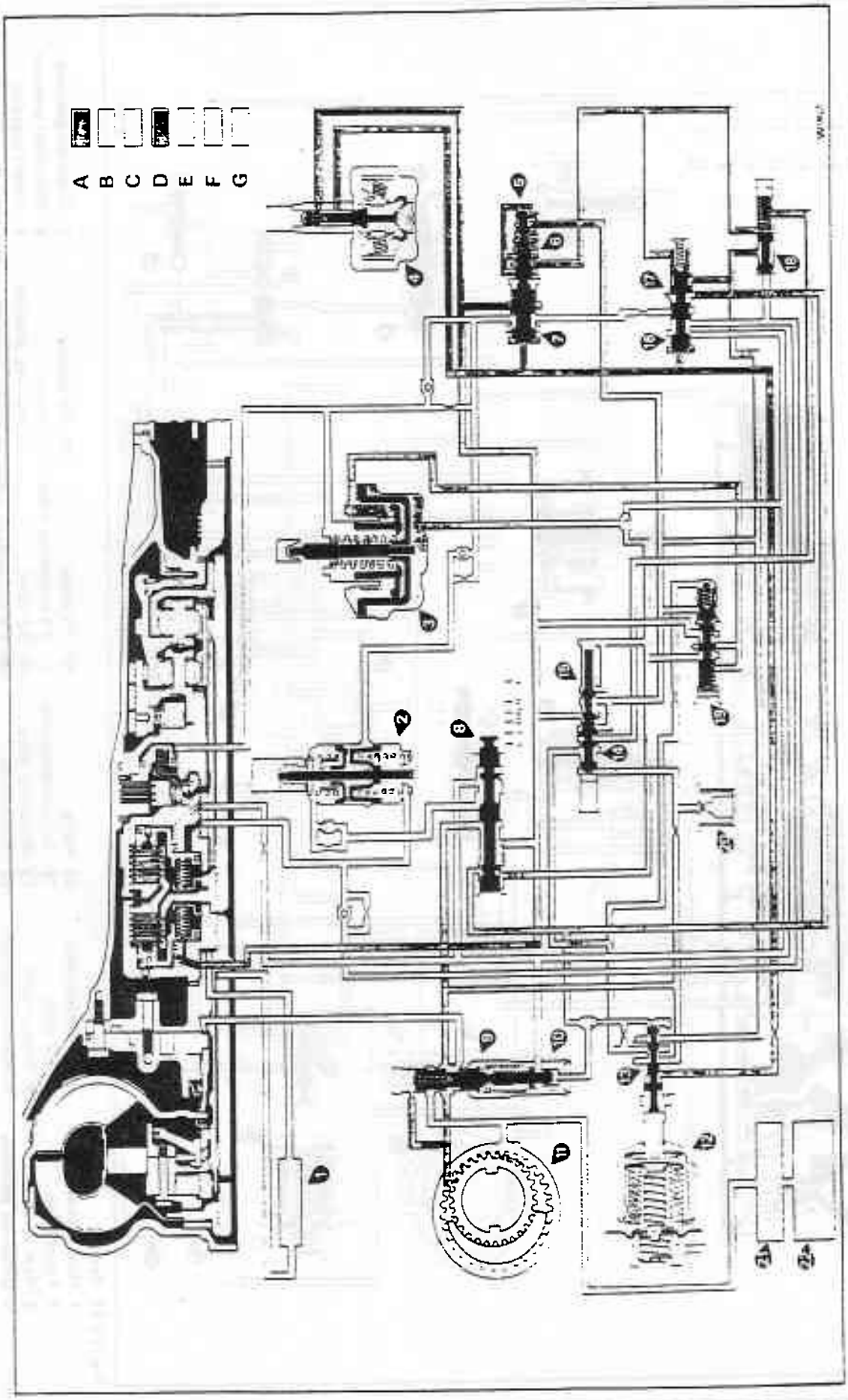

Fig. T1.10 Low range – 1st gear

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

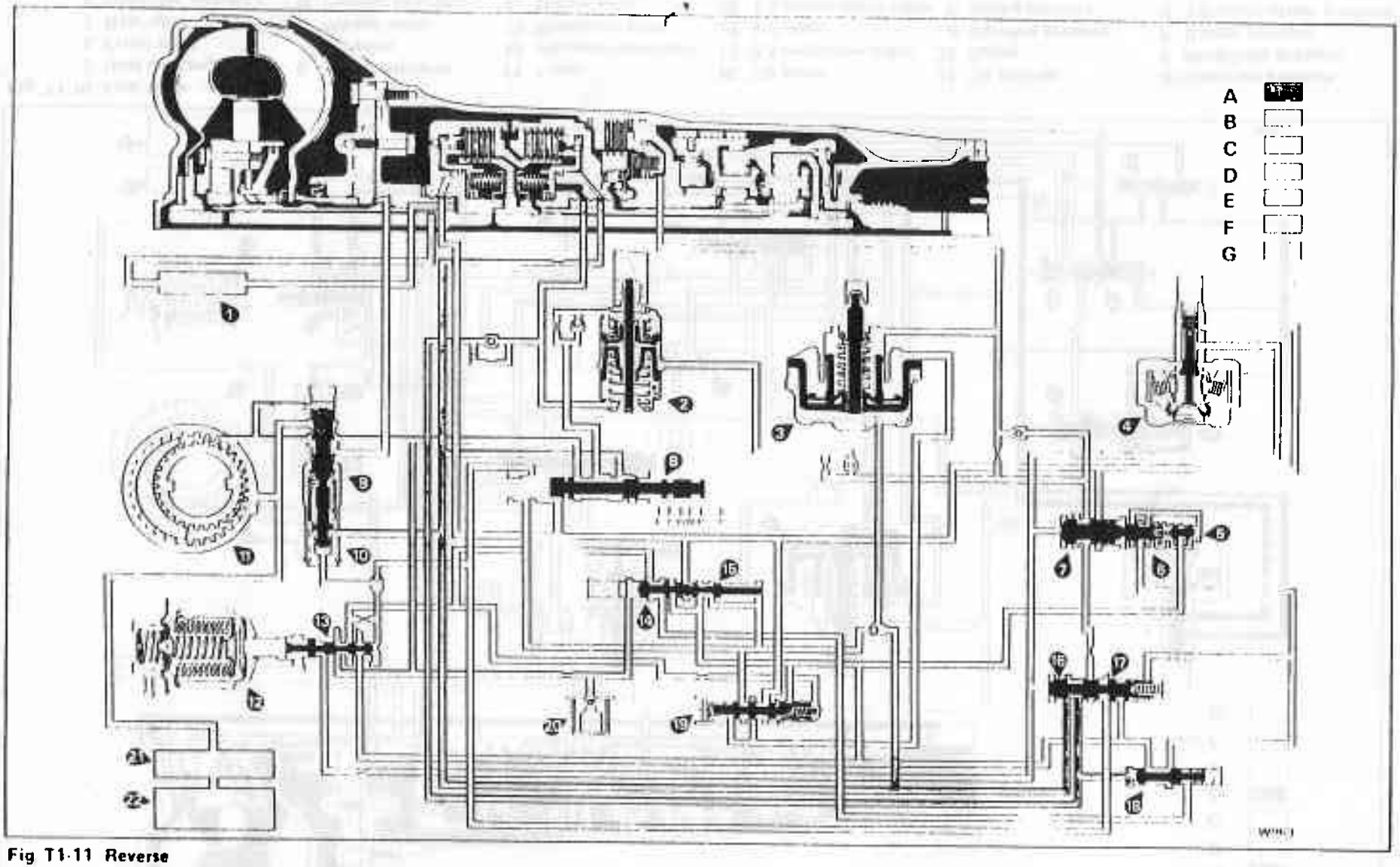

Fig T1-11 Reverse

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

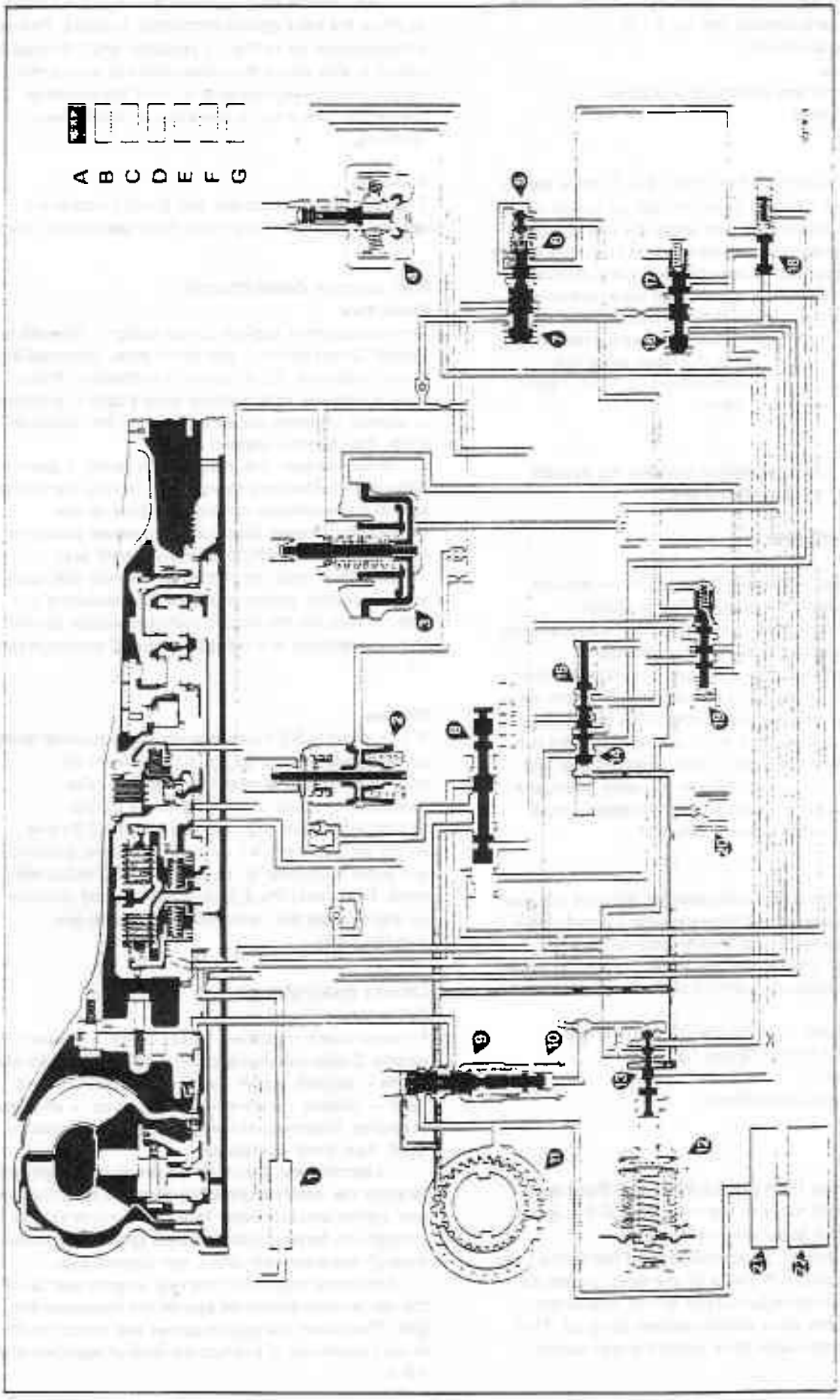

Fig. T1-12 Neutral – Engine running

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

TSD 4400

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.

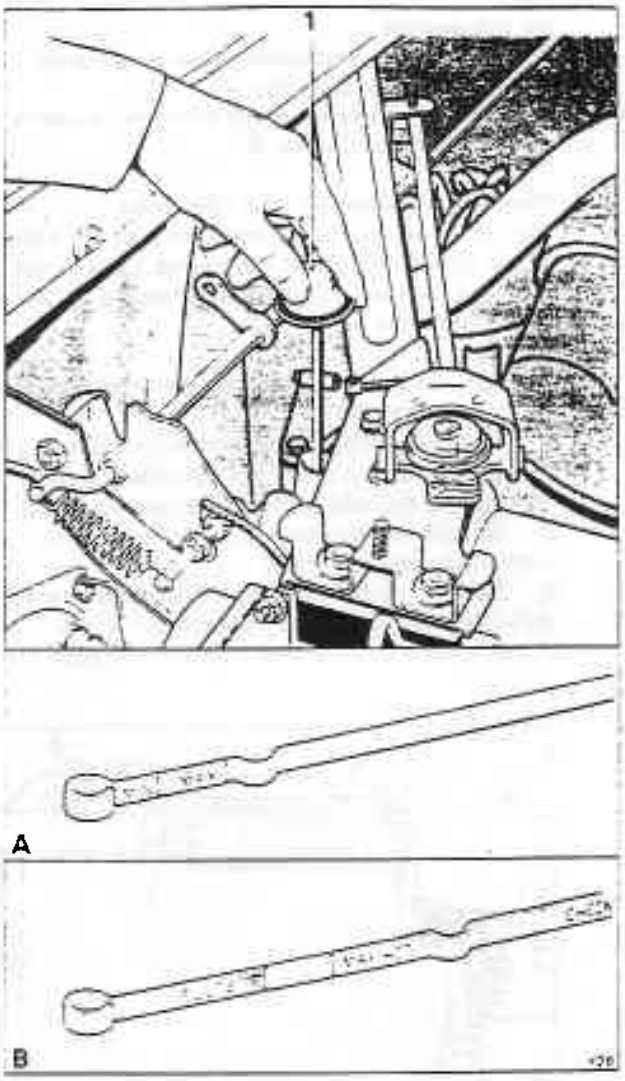

Fig. T2-1 Checking the oil level
1 Transmission oil dipstick
A Original dipstick markings
B Revised dipstick markings

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).

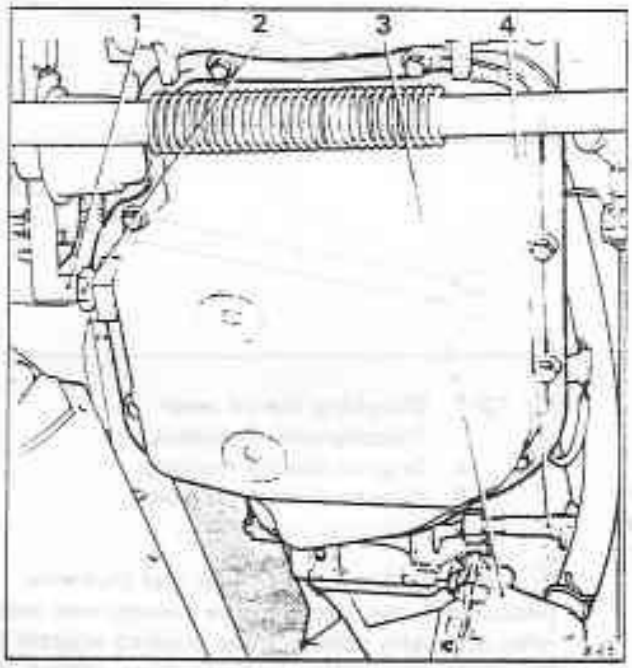

Fig. T2-2 Transmission sump
1 Fluid filler tube
2 Fluid drain point
3 Gearchange actuator
4 Electronic impulse transmitter

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.

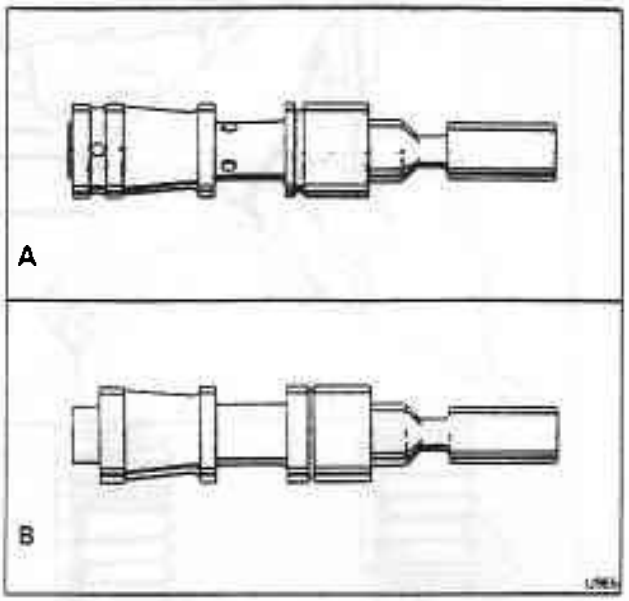

Fig. T4-1 Pressure regulator valve
A Early type with orifice plug
B Solid type

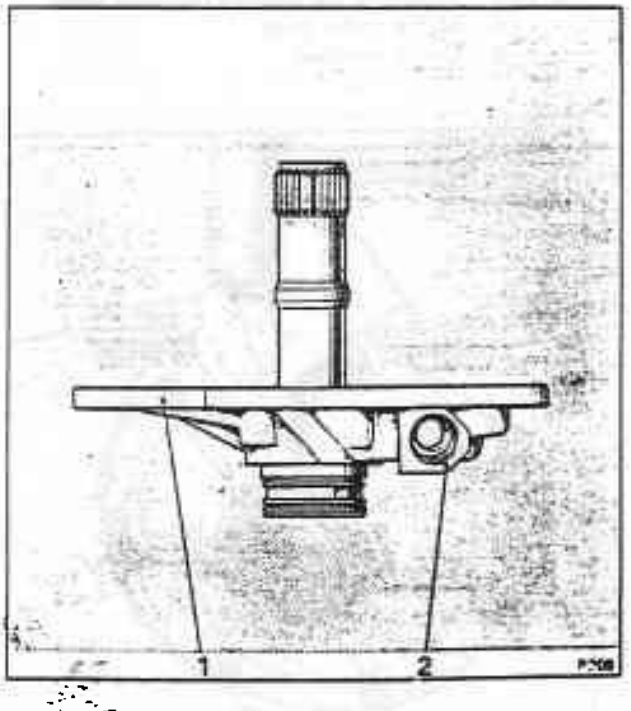

Fig. T4-2 Pump cover assembly
1 Pump cover
2 Pressure regulator boss

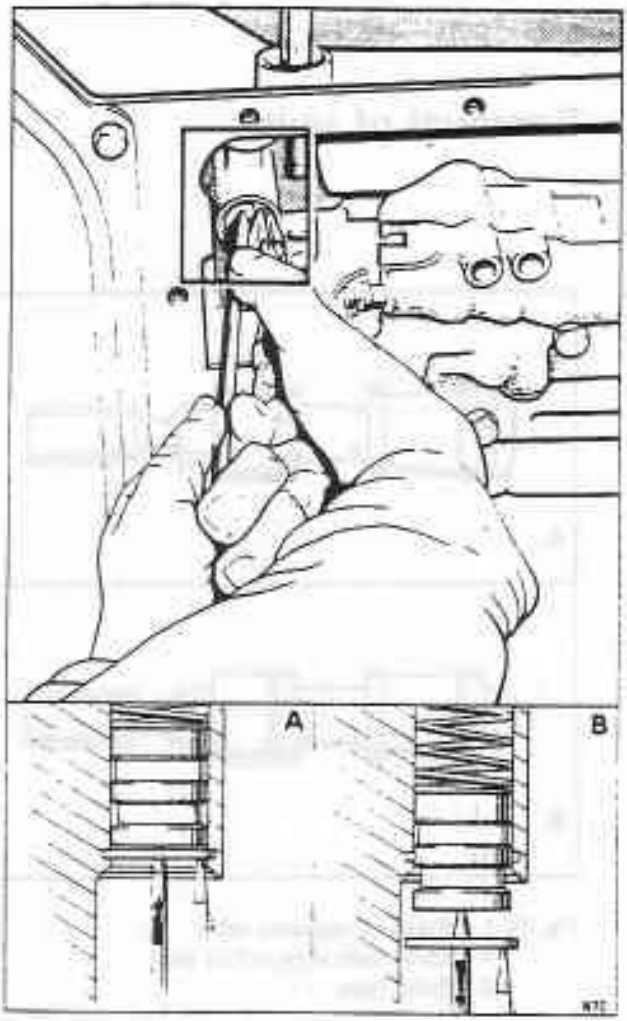

Fig. T4-3 Removing the pressure regulator valve
A Spring compressed
B Circlip removed

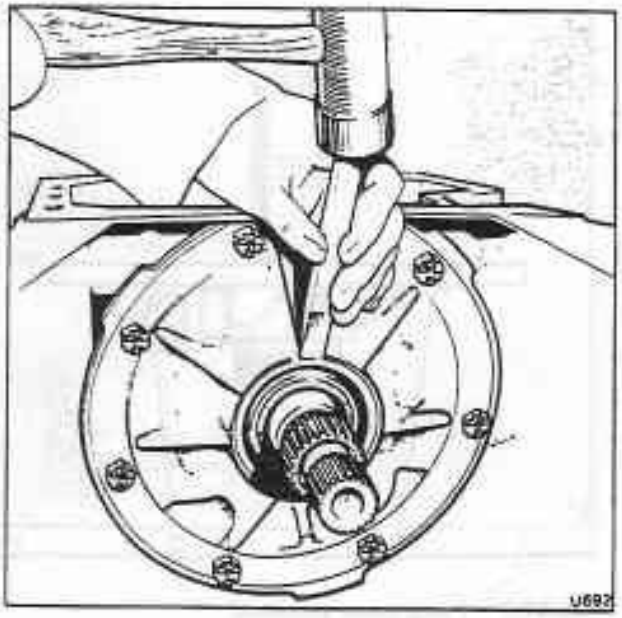

Fig. T4-4 Removing the oil pump seal

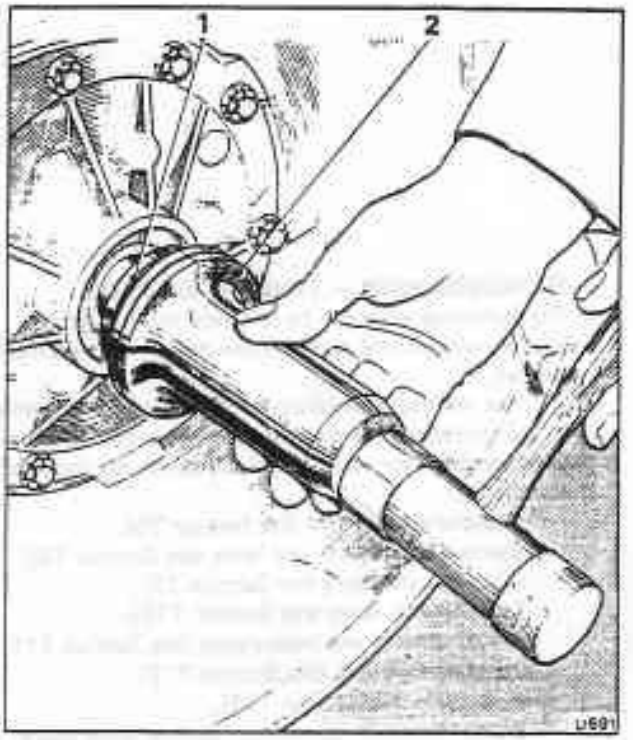

Fig. T4-5 Fitting the oil pump seal
1 Oil seal
2 Seal fitting tool

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.

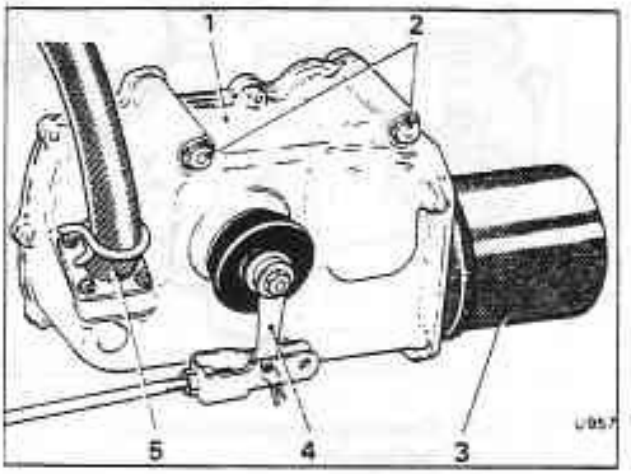

Fig. T5-1 Electric gearchange actuator

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.

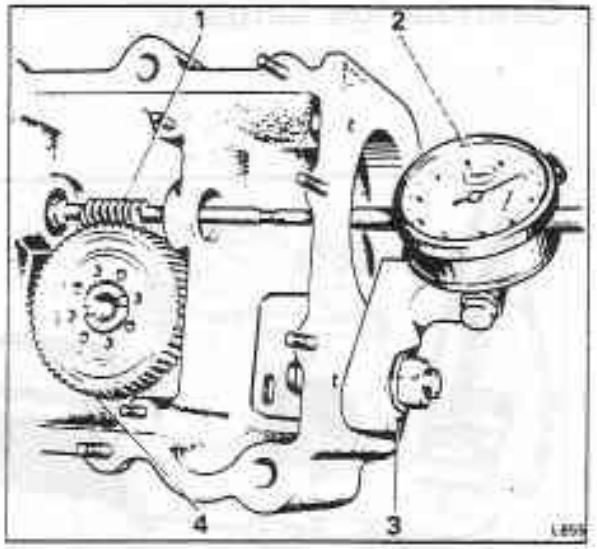

Fig. T5-2 Checking wormshaft end-float
1 Wormshaft
2 Dial indicator gauge
3 Gauge arm
4 Slave gear

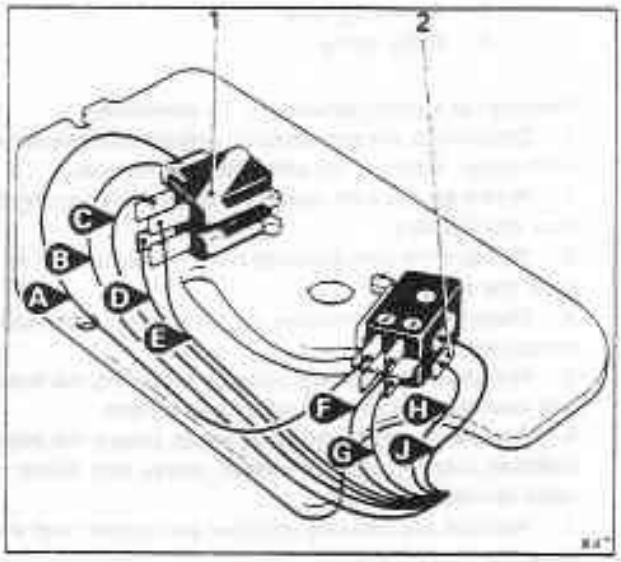

Fig. T5-3 Micro-switch connections
1 Reverse micro-switch
2 Neutral start switch
A Green/yellow cable
B Blue/brown cable
C White/brown cable
D Brown/slate cable
E Green/blue cable
F Green/black cable
G White/red cable
H White/yellow cable
J Light green/green cable

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).

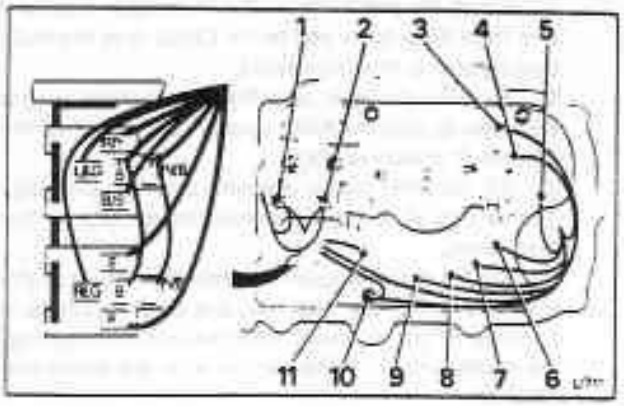

Fig. T5-4 Cable connections
1 Red/light green to motor
2 Blue/light green to motor
3 Red to relay
4 Black/brown to loom
5 Black/red to loom
6 Black/blue to loom
7 Black/green to loom
8 Black/yellow to loom
9 Black/white to loom
10 Black to earth terminal
11 Red/yellow to relay

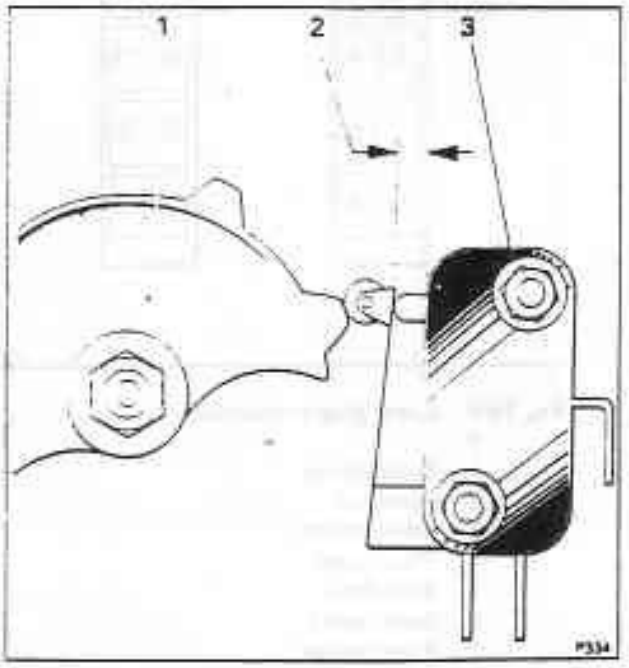

Fig. T5-5 Adjustment of micro-switches
1 Cam
2 Gap 0,51 mm (0.020 in)
3 Micro-switch

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.

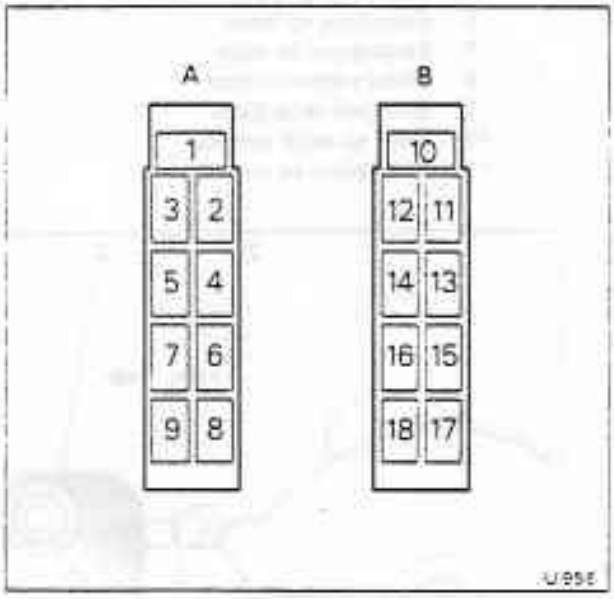

Fig. T5-6 Loom plug connections

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

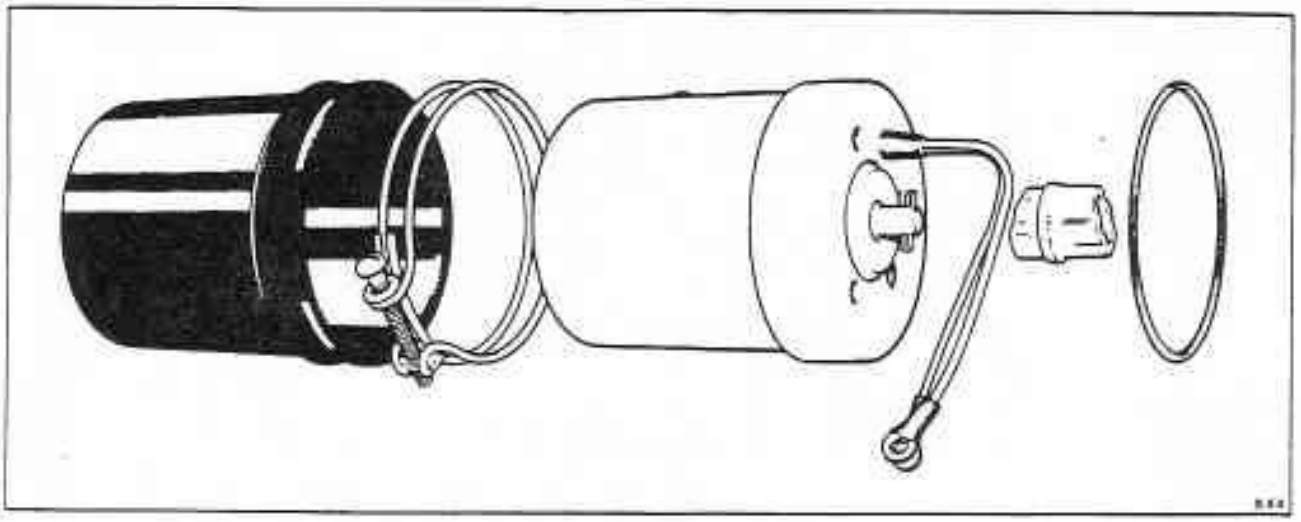

Fig. T5-7 Gearchange actuator motor

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).

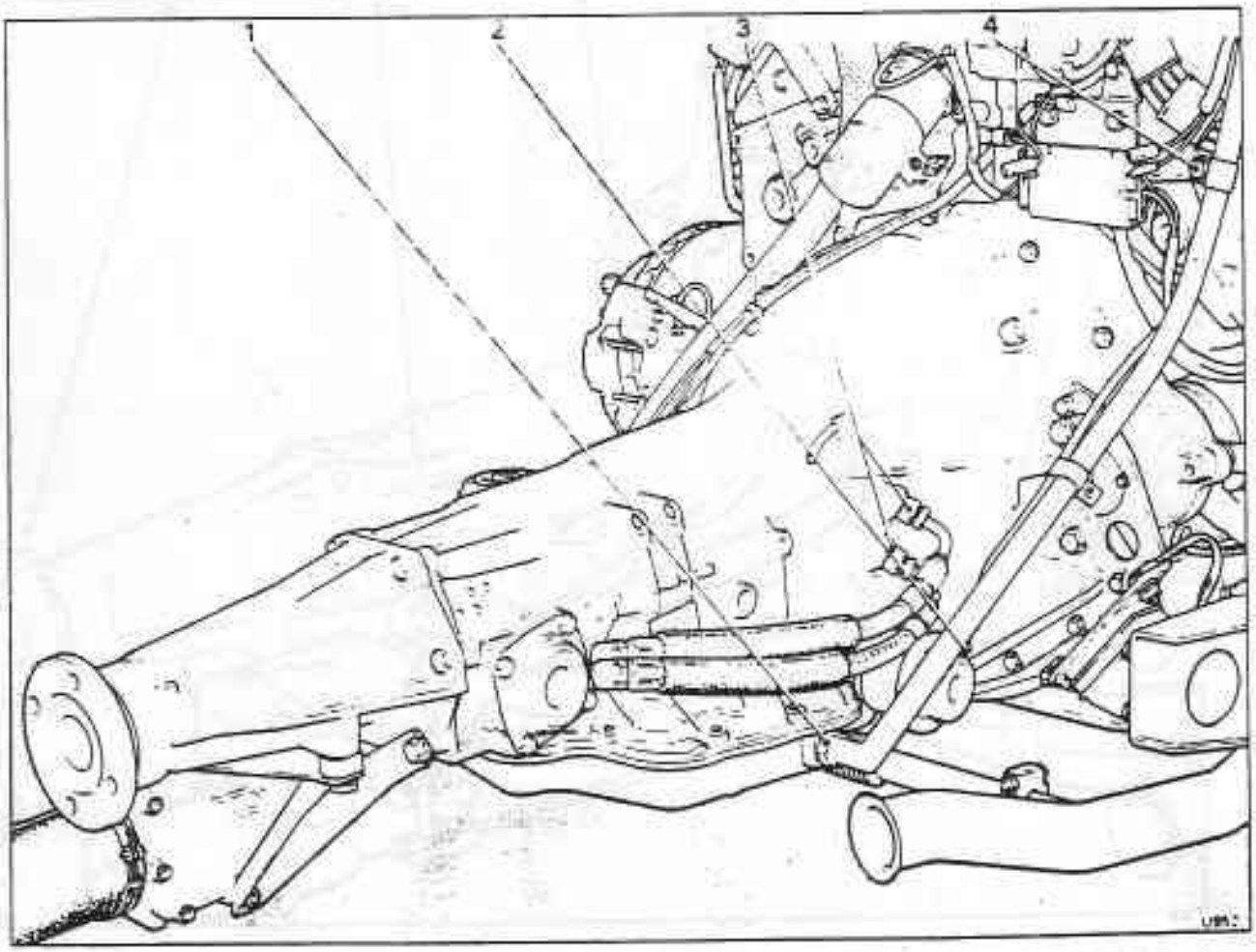

Fig. T6-1 Transmission disconnecting points – Right-hand side

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.

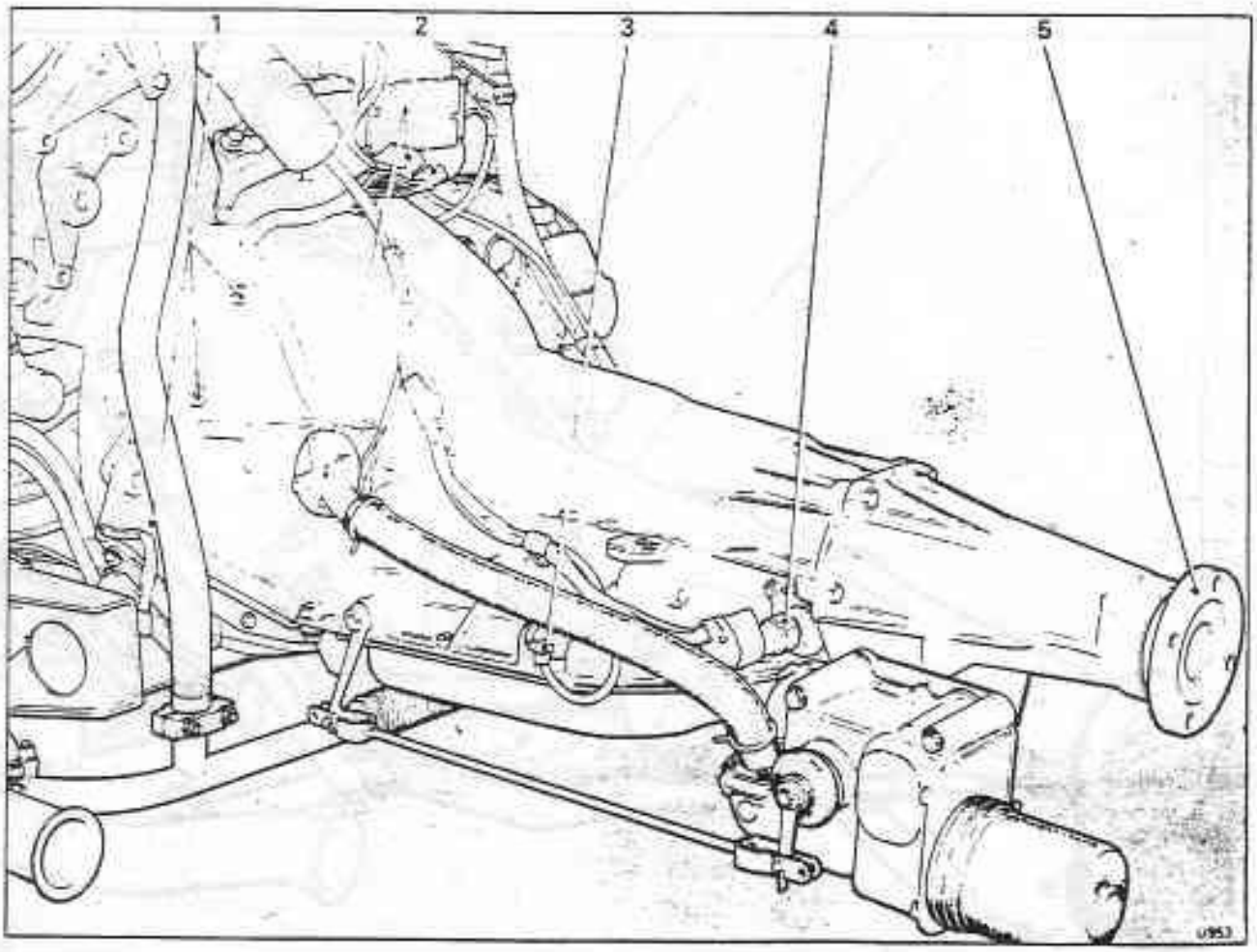

Fig. T6-2 Transmission disconnecting points – Left-hand side

1 Transmission securing setscrews
2 Gearchange actuator connections
3 Top gear switch/detent solenoid connections
4 Electronic impulse transmitter
5 Coupling flange

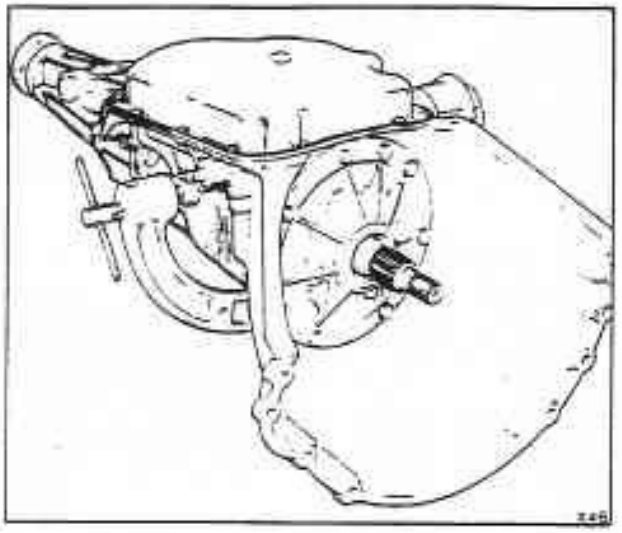

Fig. T6-3 Transmission in holding fixture

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.

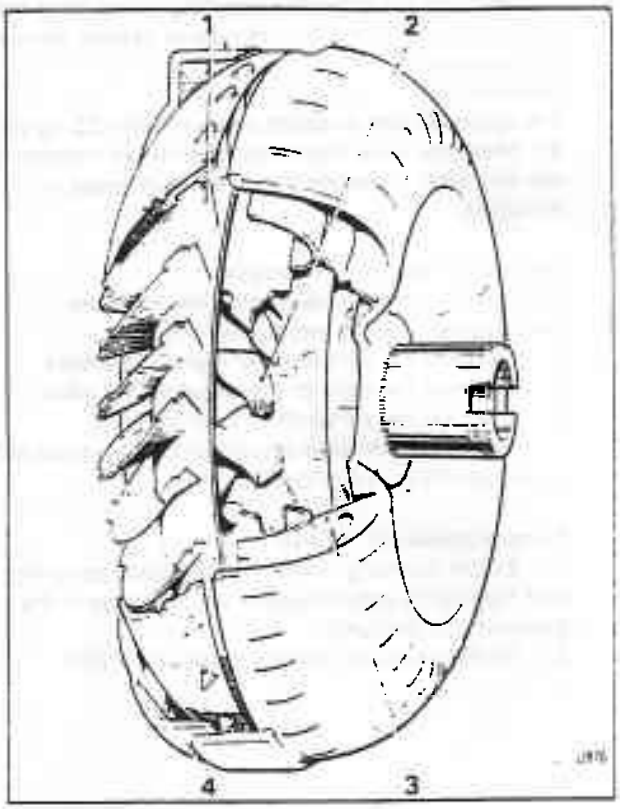

Fig. T7-1 Torque converter
1 Turbine
2 Stator
3 Pump
4 Converter cover

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

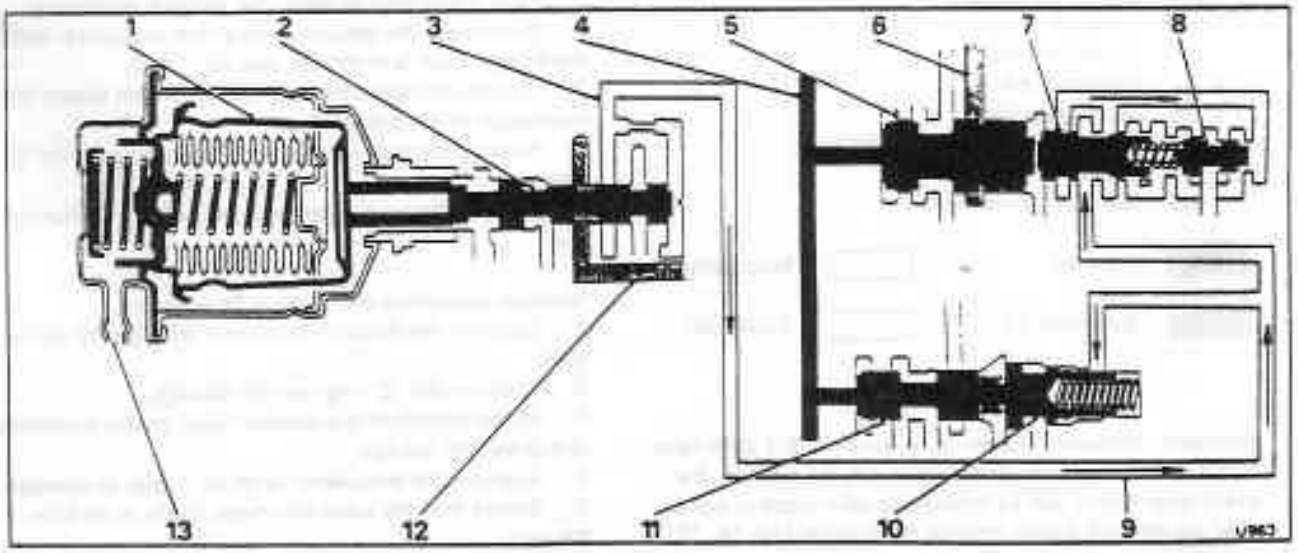

Fig. T8-1 Vacuum modulator and valve showing modulator pressure

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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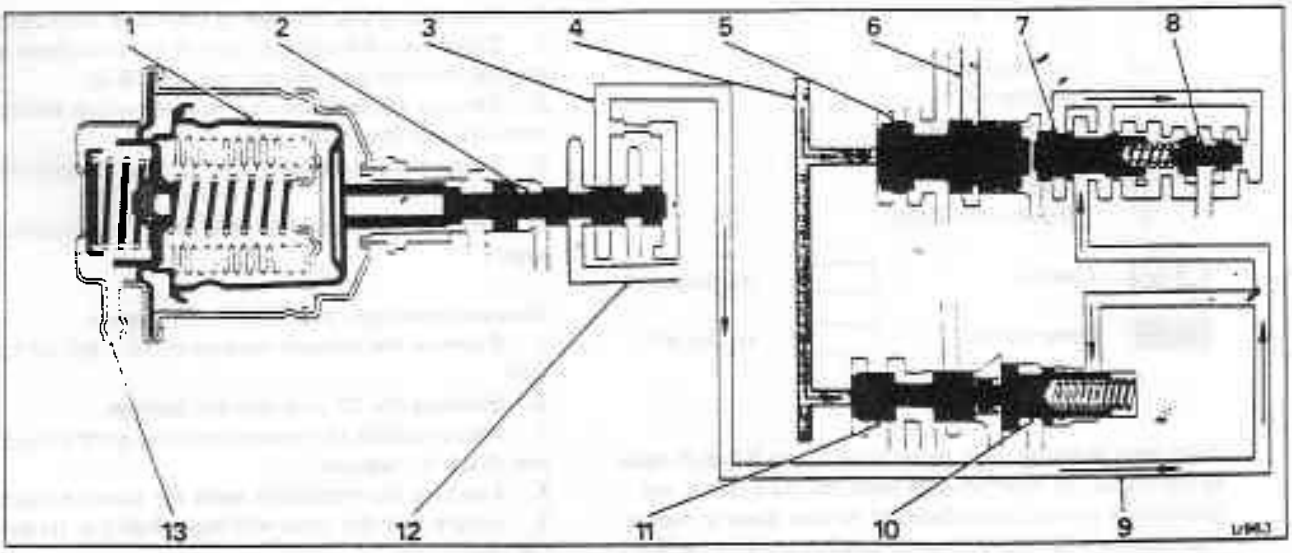

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2	Modulator valve	7	1-2 detent valve	11	2-3 valve
3	Modulator oil	8	Regulator valve	12	Line oil
4	Governor oil	9	Modulator oil	13	Vacuum connection
5	1-2 valve				

Drive or Line oil — Governor oil — Modulator oil

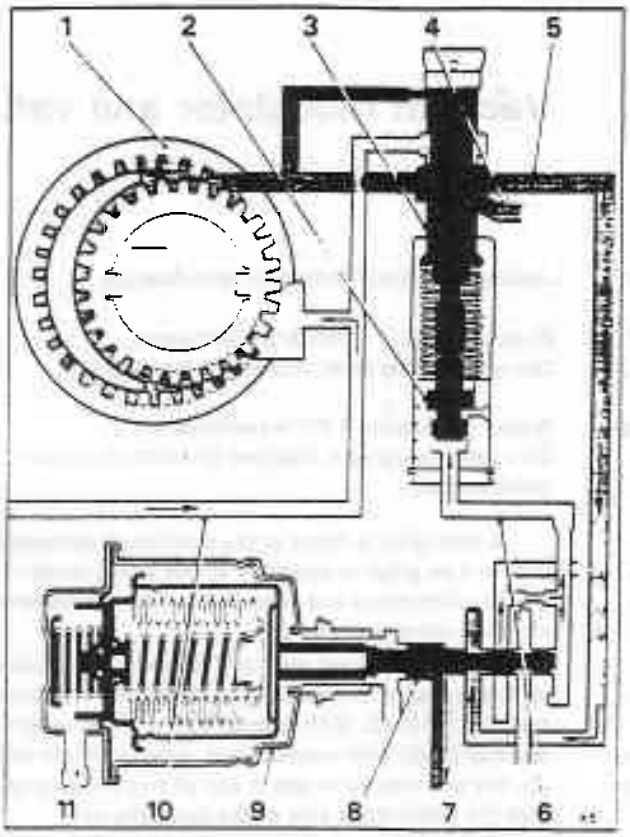

Fig. T8-2 Vacuum modulator and valve showing line pressure control

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

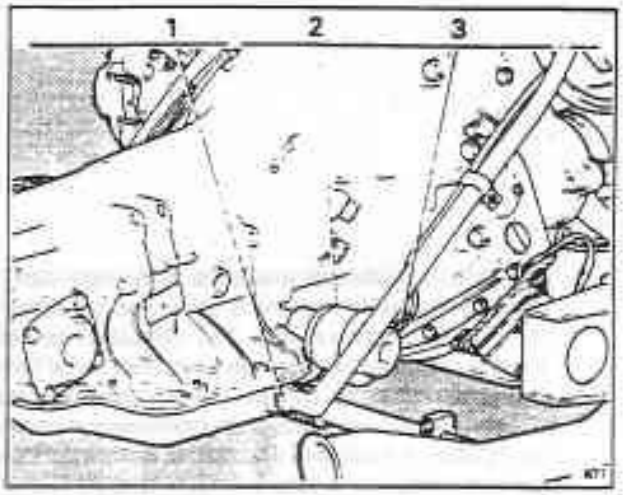

Fig. T8-3 Vacuum modulator and vacuum pipe

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.

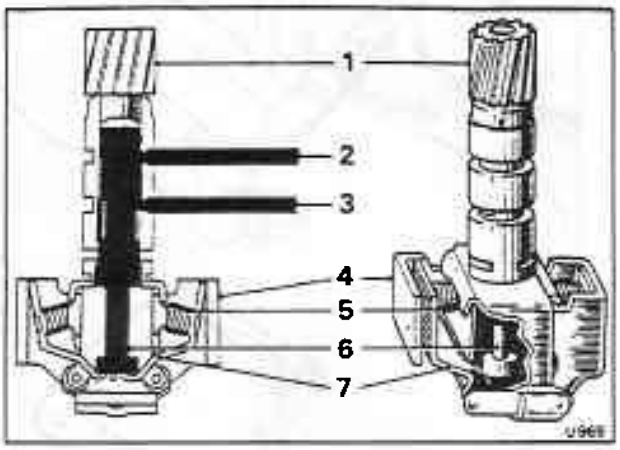

Fig. T9-1 Governor assembly

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

Drive oil Governor oil.

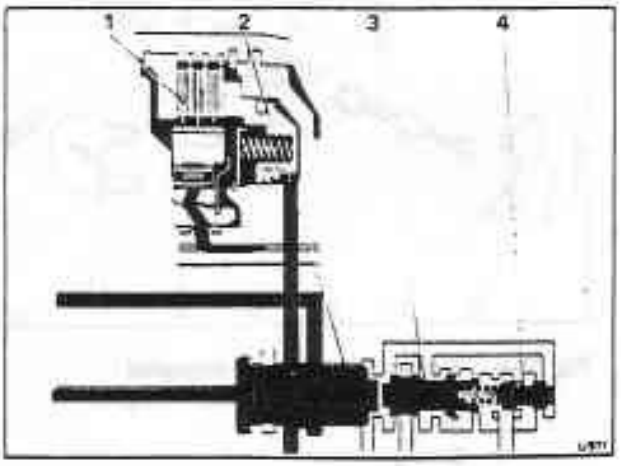

Fig. T9-2 Governor oil acting on the 1-2 shift valve

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.

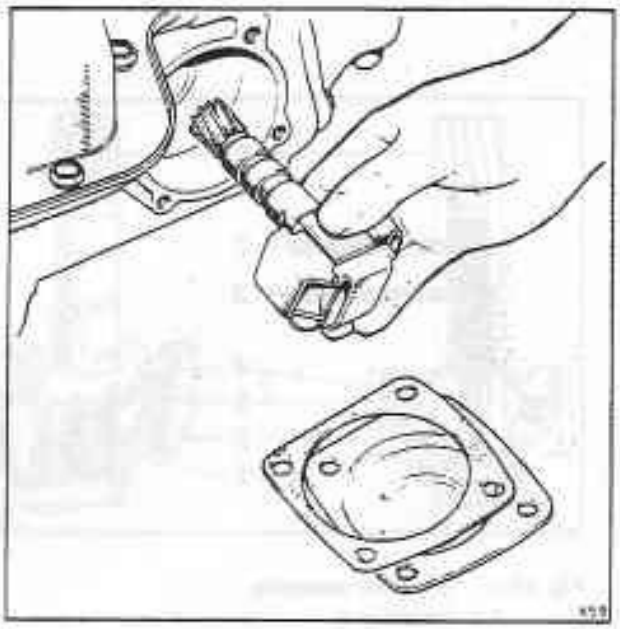

Fig. T9-3 Removing the governor assembly

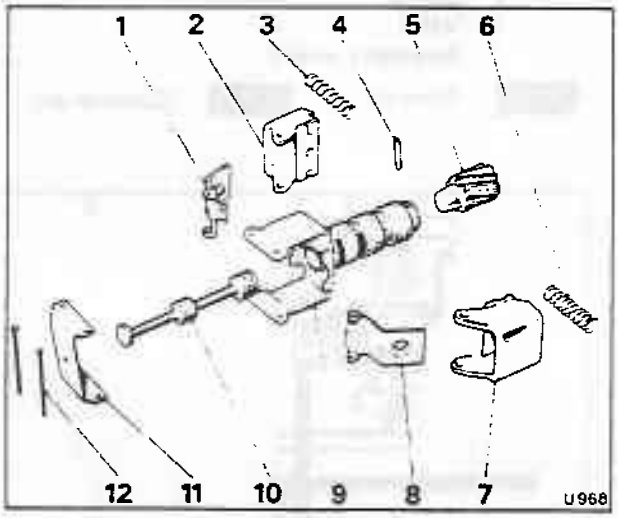

Fig. T9-4 **Governor assembly — exploded**

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.

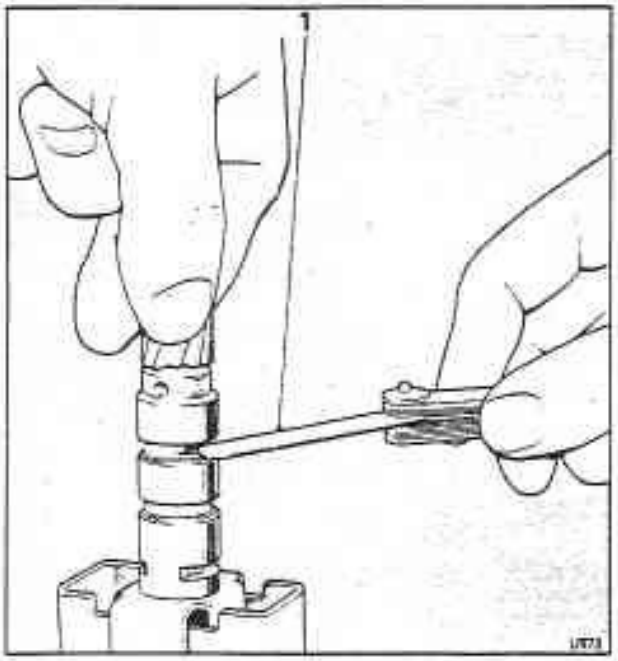

Fig. T9-5 Check valve opening (inlet)
1 0,51 mm (0.020 in) feeler gauge

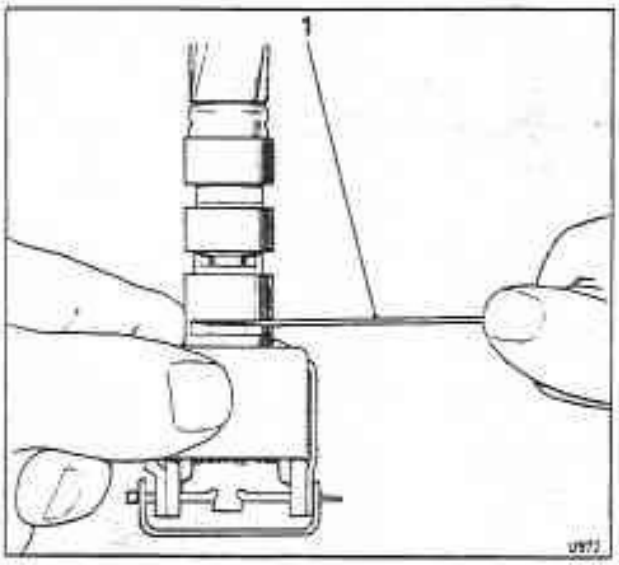

Fig. T9-6 Check valve opening (exhaust)
1 0,51 mm (0.020 in) feeler gauge

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.

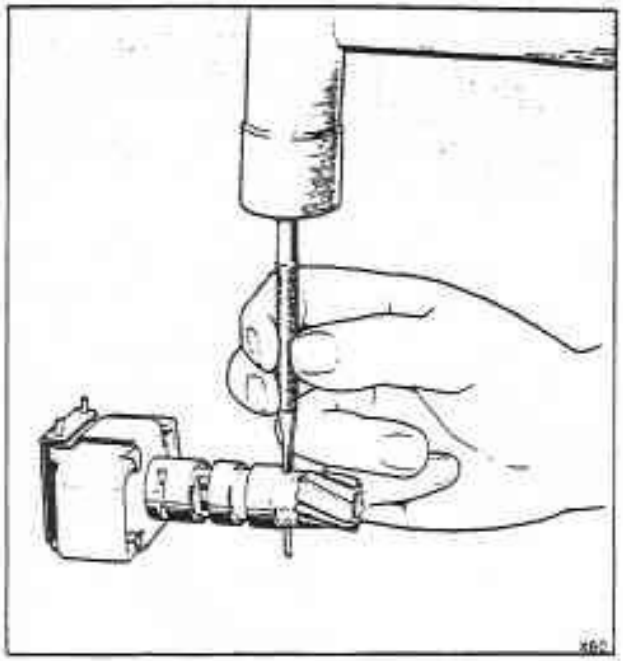

Fig. T9-7 Removing governor driven gear retaining pin

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.

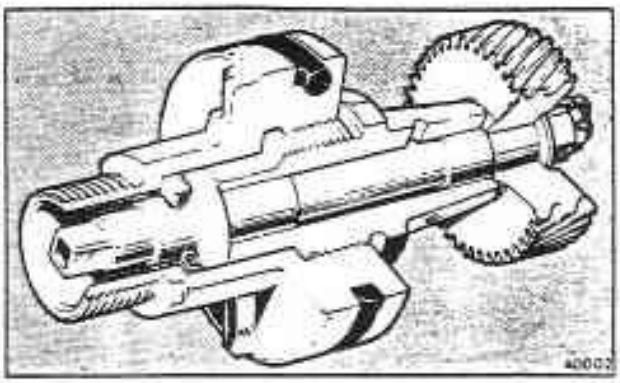

Fig. T10-1 **Speedometer drive** Cars produced prior to 1984

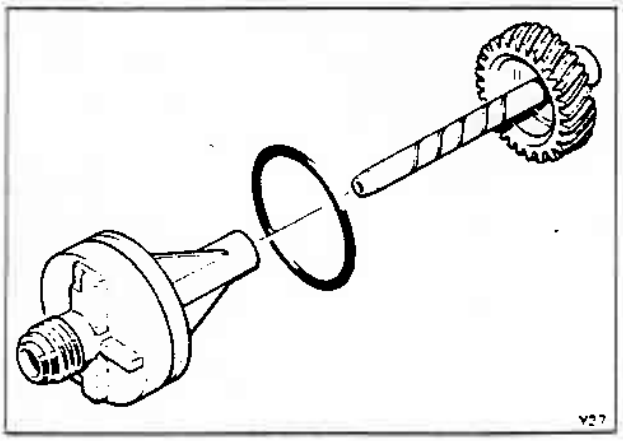

Fig. T10-2 **Speedometer drive** Cars produced from 1984 and onwards

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.

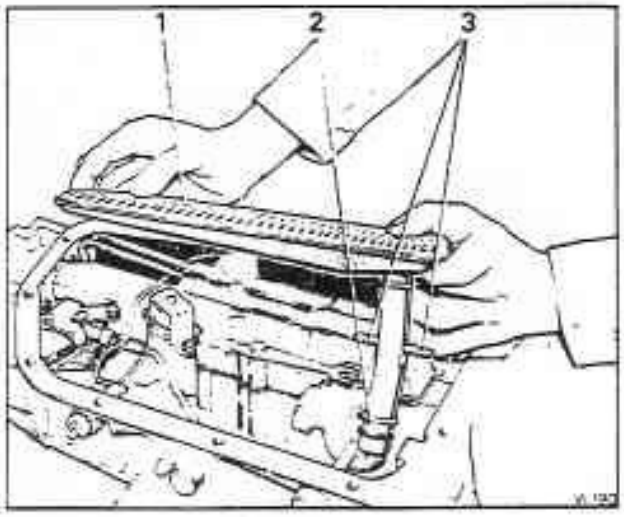

Fig. T11-1 Removing intake pipe and strainer assembly
1 Strainer assembly
2 Intake pipe with 'O' ring
3 Location tabs

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

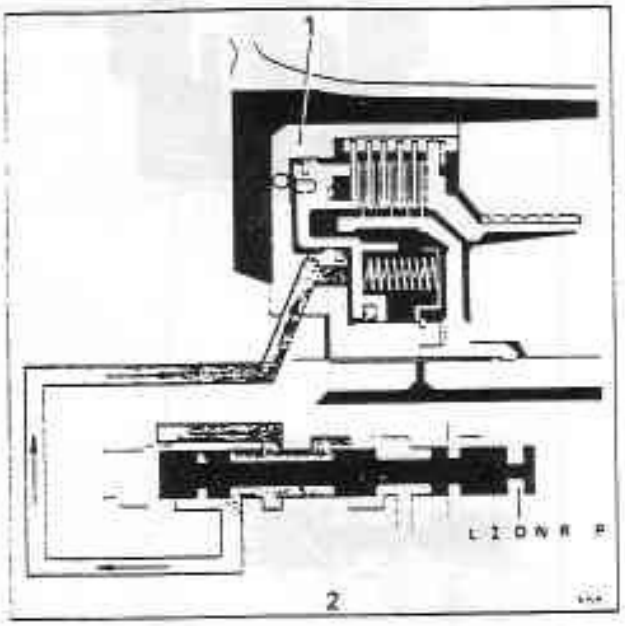

Fig. T12-1 Manual valve and forward clutch
1 Forward clutch
2 Manual valve

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

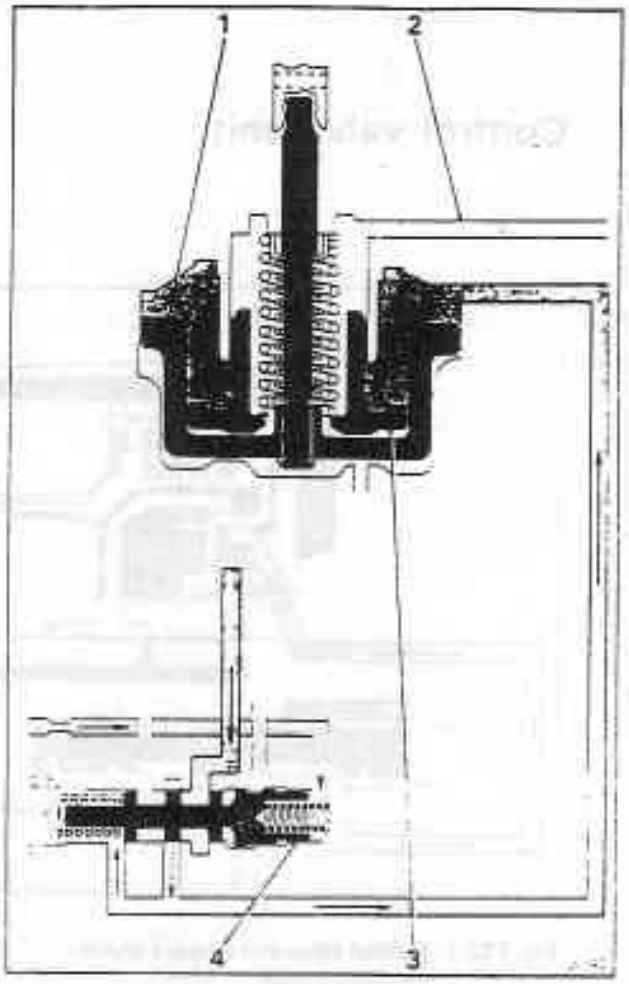

Fig. T12-2 Rear servo accumulator piston – Prior to 1-2 up-change
1 Servo piston
2 Intermediate clutch passage
3 Accumulator piston
4 1-2 accumulator valve

Drive oil

Modulator oil

1-2 accumulator oil

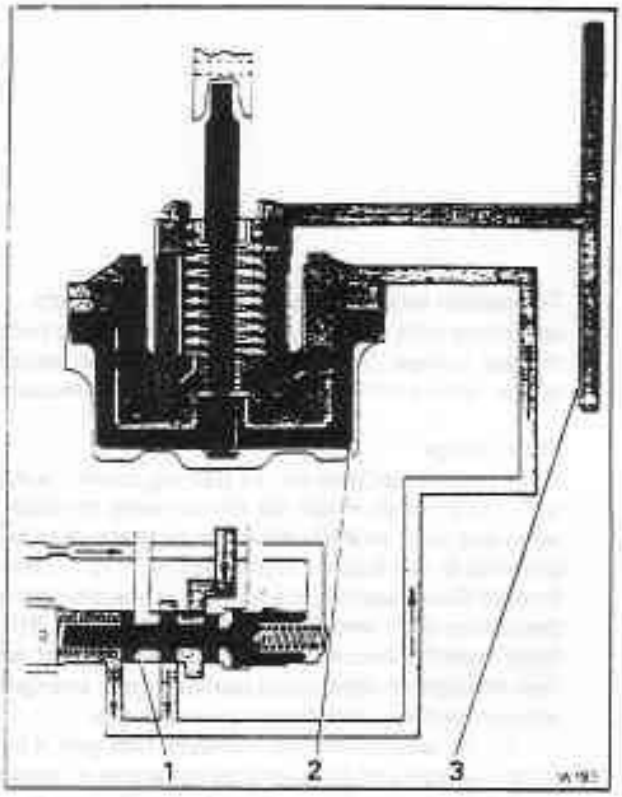

Fig. T12-3 Rear servo accumulator piston cushioning intermediate clutch application
1 1-2 accumulator valve
2 Servo piston
3 Intermediate clutch passage

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

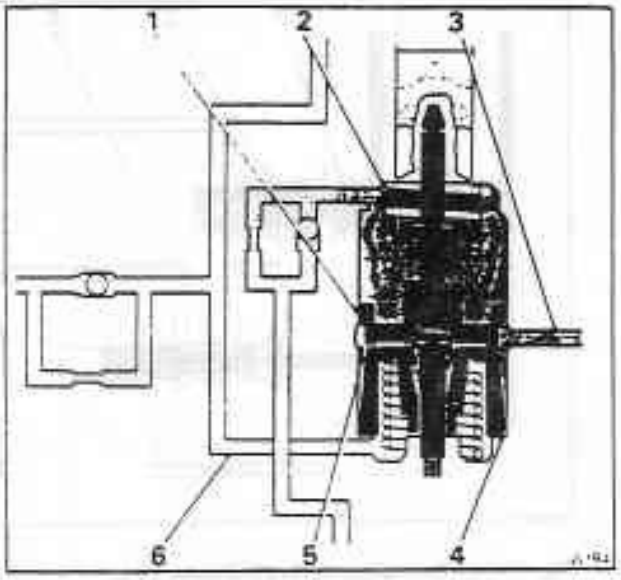

Fig. T12-4 Front servo accumulator piston – Prior to 2-3 up-change

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

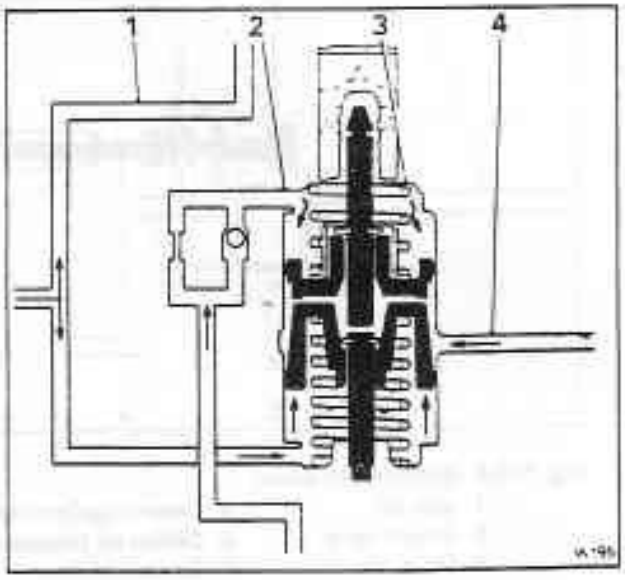

Fig. T12-5 Front servo accumulator piston cushioning direct clutch application

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

Direct clutch, front servo, and intermediate clutch oil

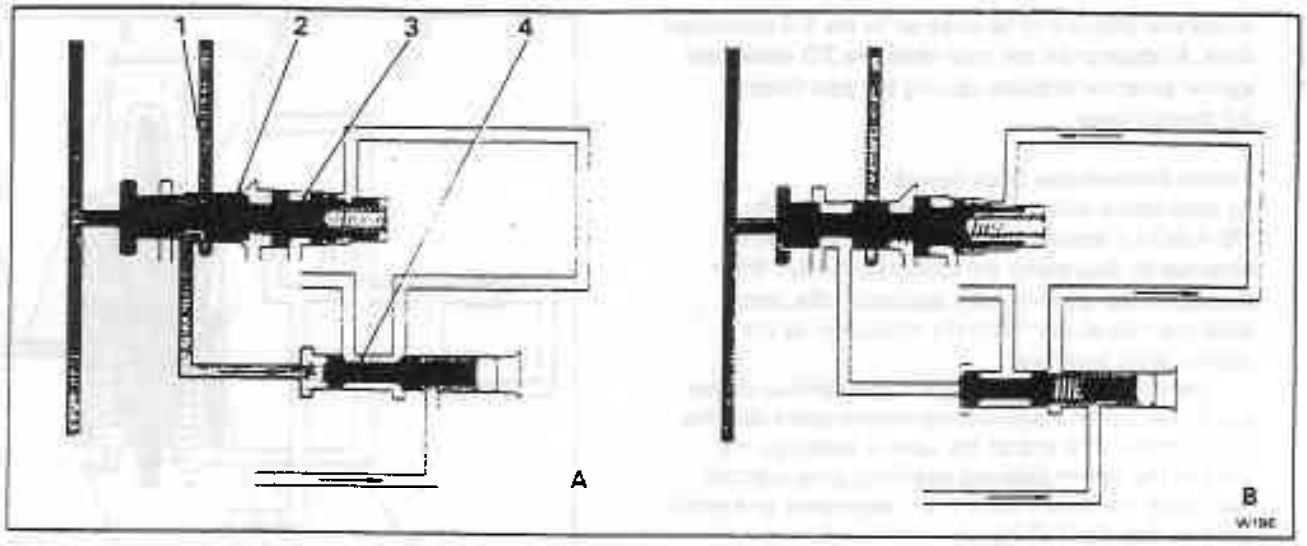

Fig. T12-6 Part throttle down-change (3-2)

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)

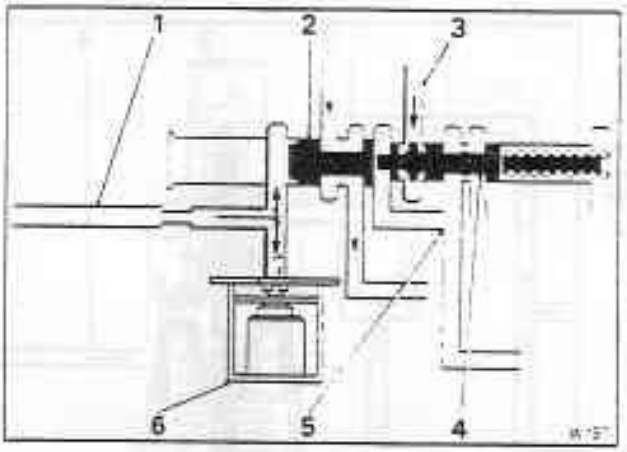

Fig. T12-7 Detent valve closed

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.

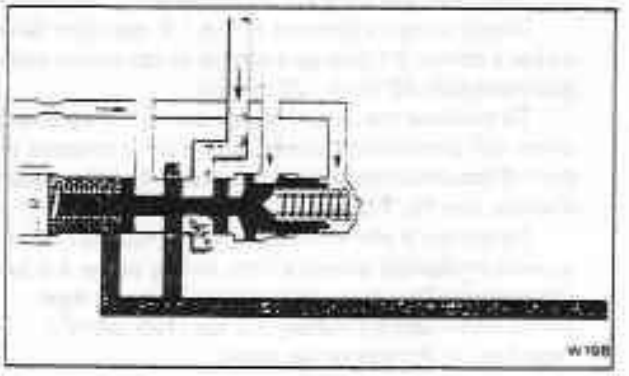

Fig. T12-8 1-2 Accumulator valve

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

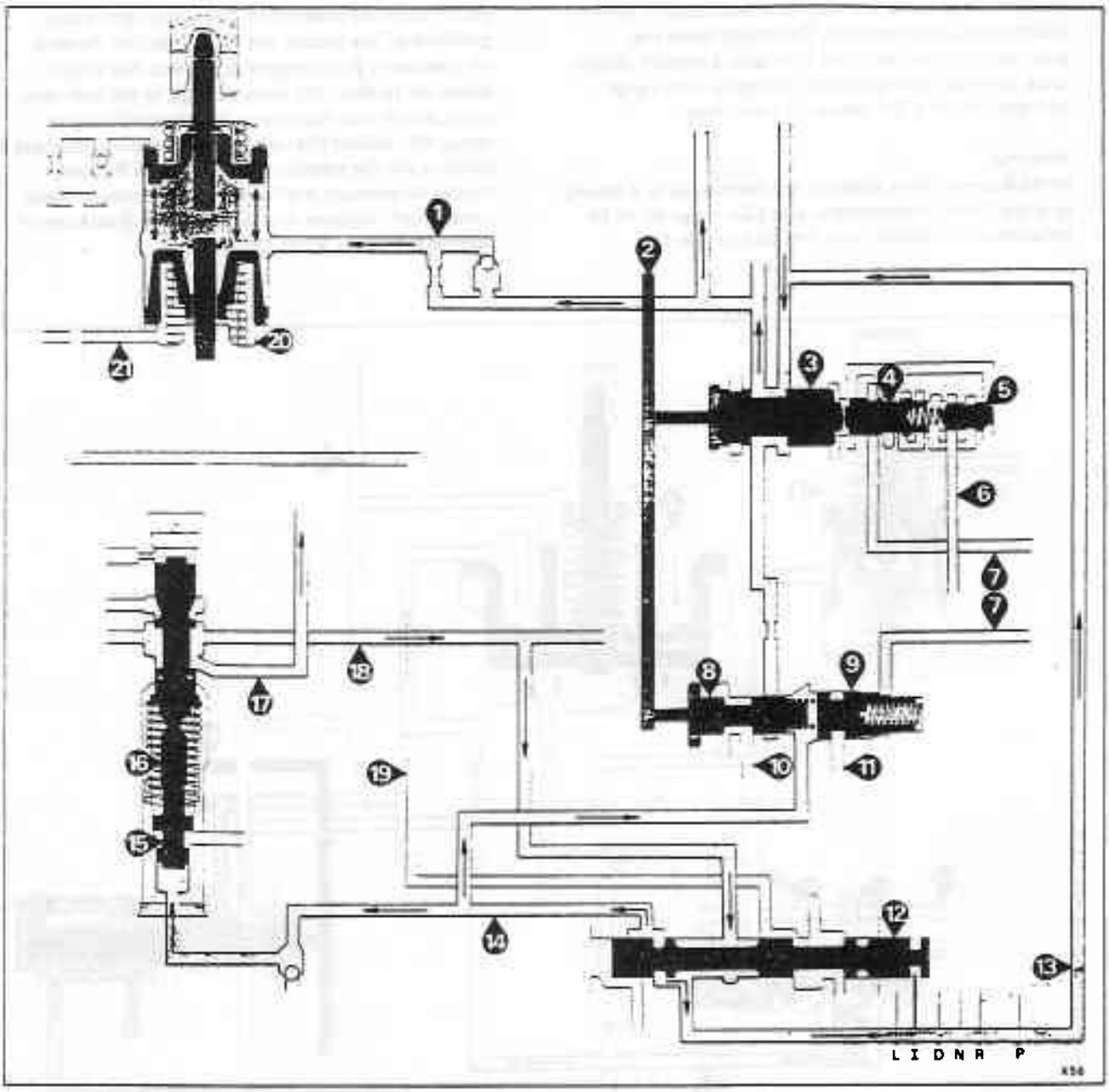

Fig. T12-9 Valves — Intermediate range — 2nd gear

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).

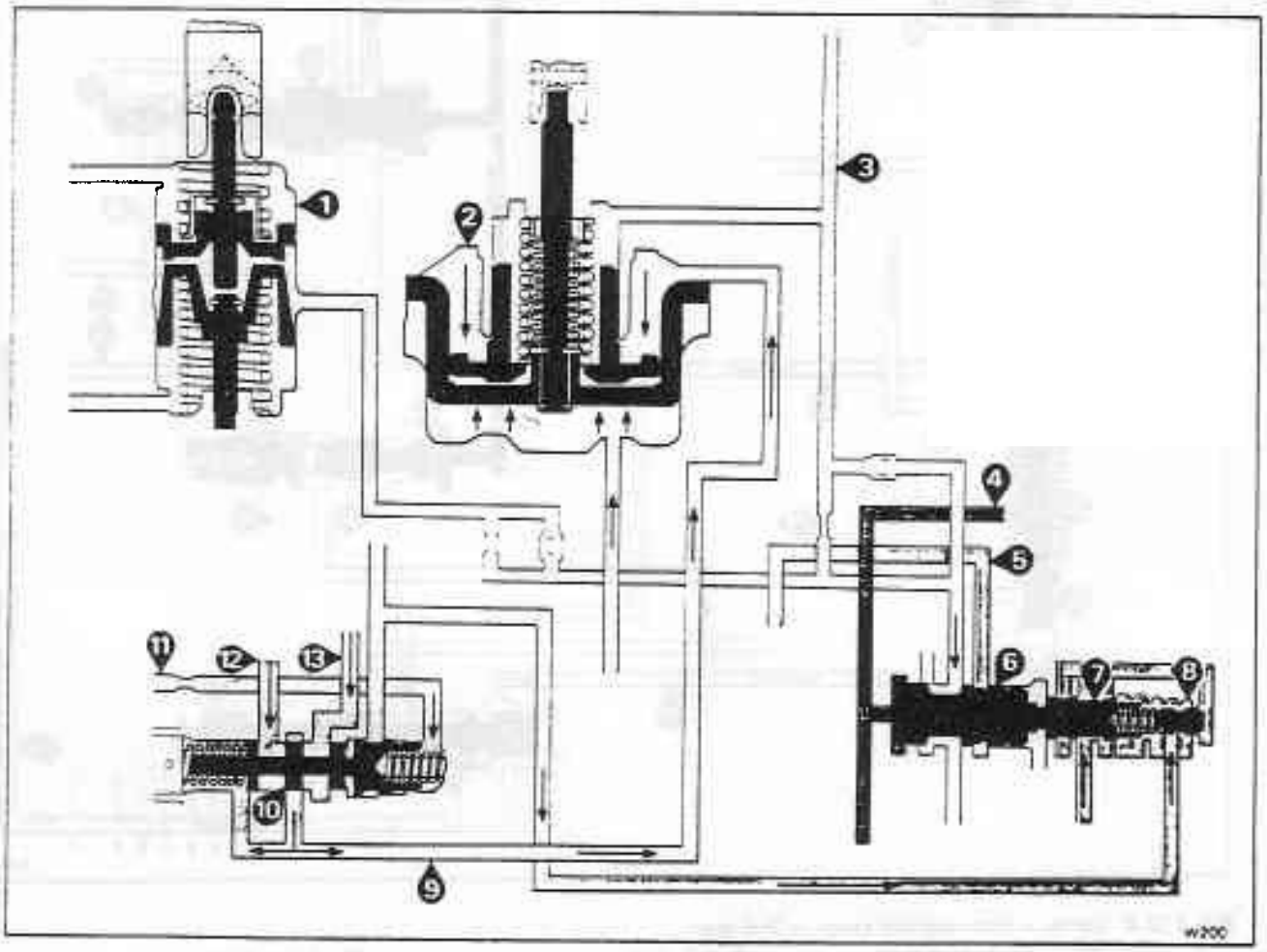

Fig. T12-10 Low range – 1st gear – rear band applied

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.

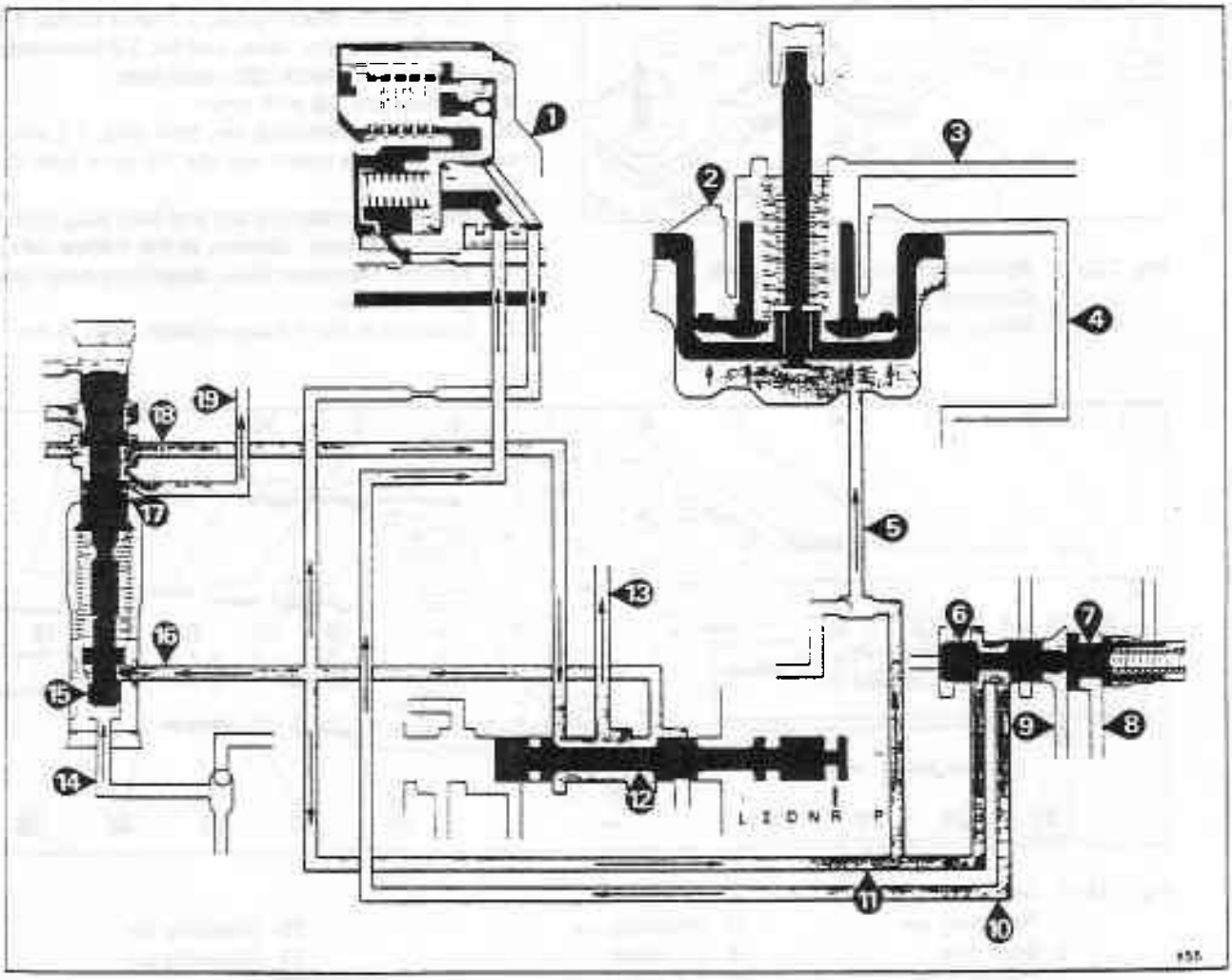

Fig. T12-11 **Reverse — rear band applied**

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

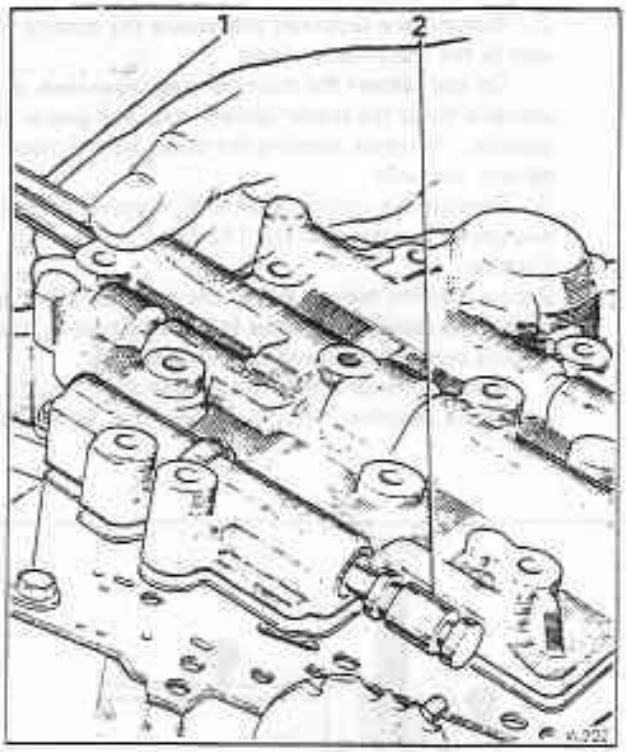

Fig. T12-12 Removing the control valve unit
1 Governor pipes
2 Manual valve

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

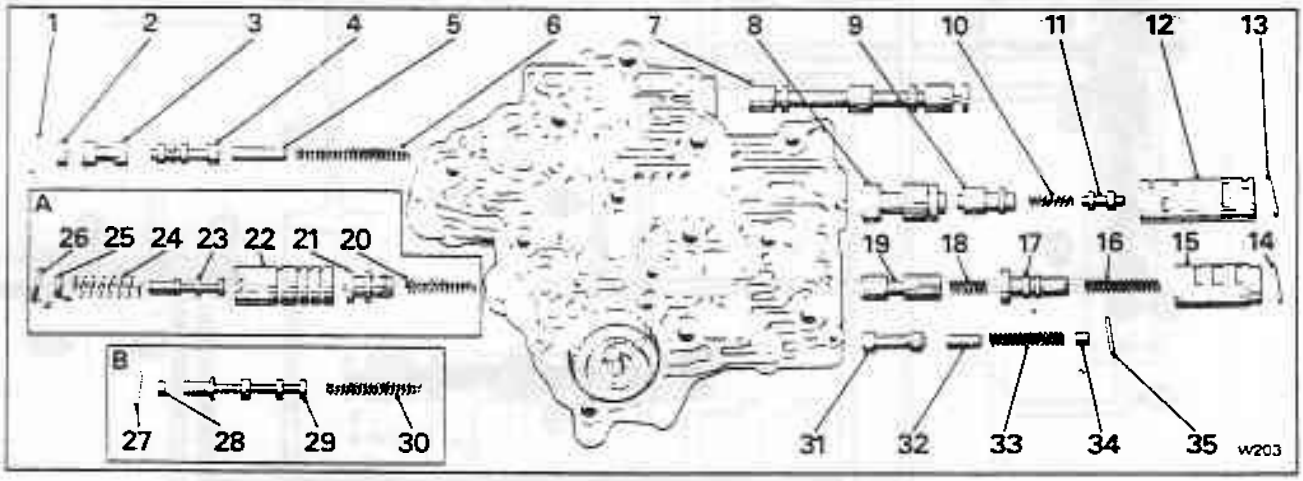

Fig. T12-13 Control valve unit

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.

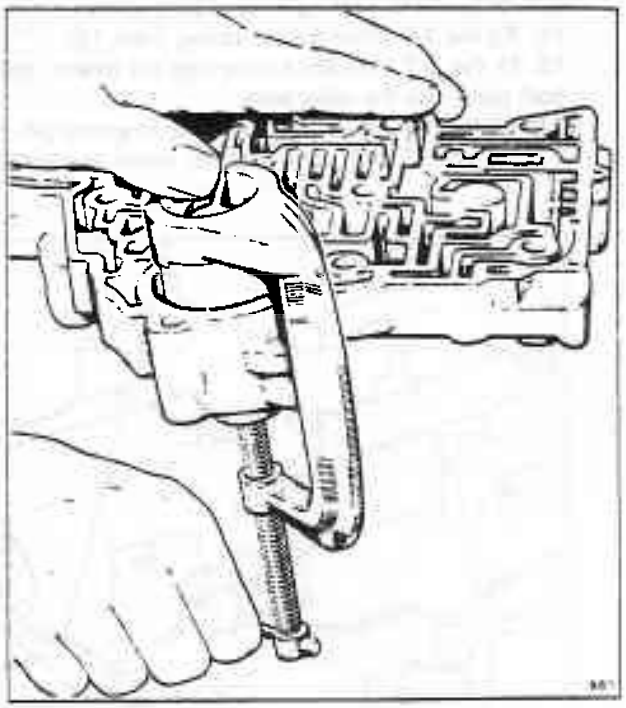

Fig. T12-14 **Fitting the front accumulator piston and spring**

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.

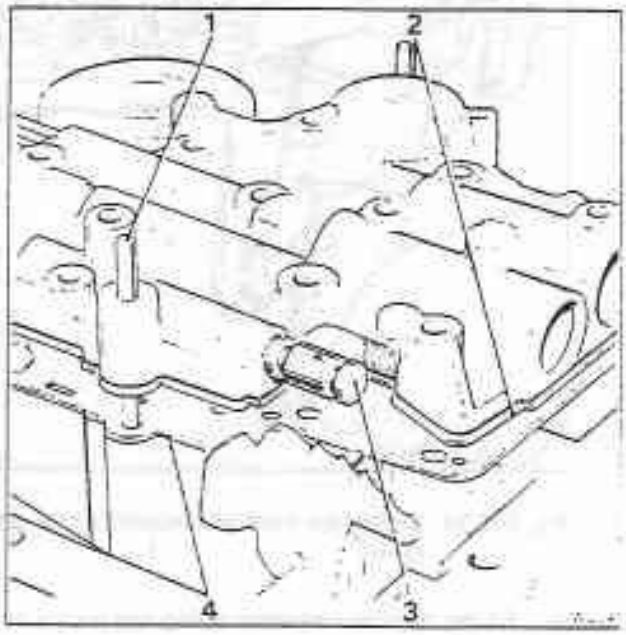

Fig. T12-15 Fitting the control valve unit
1 Guide pin
2 Control valve gasket
3 Manual valve
4 Spacer (guide) plate gasket

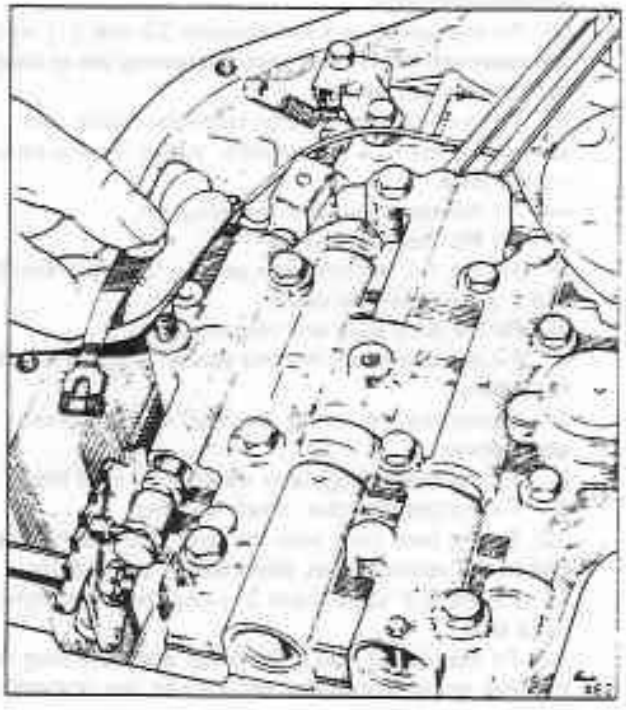

Fig. T12-16 Fitting the detent spring and roller

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.