

Section T20

Transmission case

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

The lower inner face of the case forms part of the hydraulic passages onto which the control valve unit is fitted. The oil pump is fitted to a machined face at the front of the case. This machined face contains oil passages which convey transmission fluid from the pump to various points in the case (see Fig. T127).

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

Transmission case - To inspect

1. When the transmission has been completely dismantled, the case should be thoroughly washed in clean paraffin, then dried with compressed air.

2. Ensure that all the oil passages are flushed out.
3. Take care not to create burrs on the ends of the passages.

Note

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

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

Note

Stripped threads in bolt holes are repairable with heli-coil inserts (see Fig. T129 and Heli-coil chart).

7. Inspect the intermediate clutch plate lugs for damage.

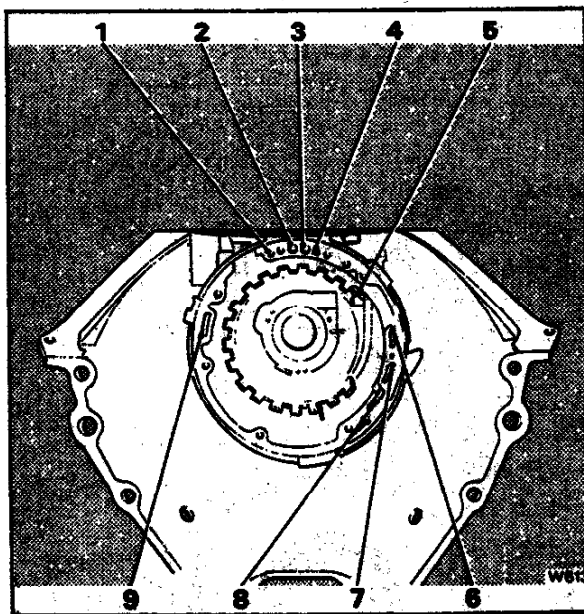


Fig. T127 Transmission case oil passages

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

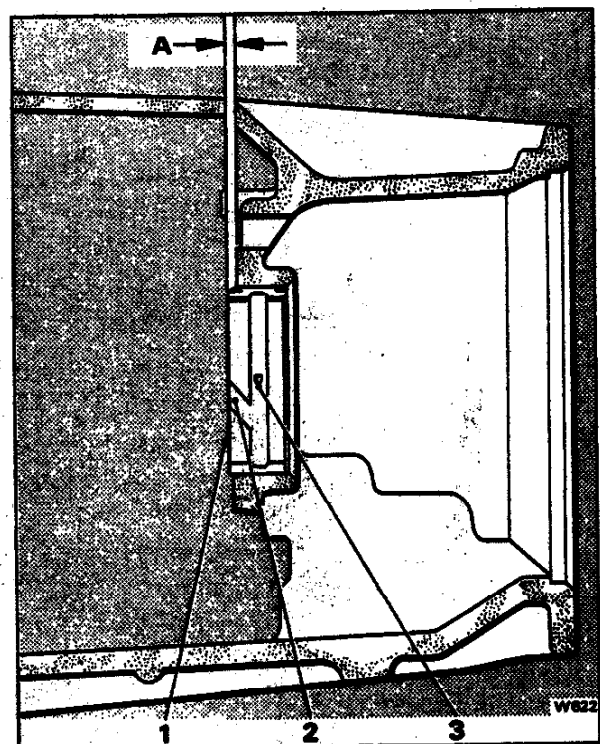


Fig. T128 Fitting a new case bush

- 1 Bush
  - 2 Oil groove in direction shown
  - 3 Stake mark
- A 1.02 mm. to 1.40 mm. (0.040 in. to 0.055 in.)

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

#### External damage

External damage is usually caused by handling, road hazards or the converter to flex plate set-screws becoming loose as a result of incorrect fitting. Therefore, when external damage is evident as previously described, fit a new case.

#### Internal damage

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

High oil pressure (faults usually located in the pressure regulator valve system) can also result in internal damage, if this is the cause, fit a new

case and rectify the problem.

If the case bushing is found to be worn or scored, fit new bushing (see Fig. T128).

#### Repair procedure for minor case porosity

1. Bring the transmission fluid up to the normal operating temperature approximately 82°C (180°F).
2. Locate the source of the oil leak.
3. Thoroughly clean the area to be repaired with cleaning solvent and a brush; dry the area with compressed air. A clean, dry soldering acid brush may be used to clean the area and also to apply the epoxy cement.
4. Following the manufacturer's instructions, mix a sufficient amount of epoxy cement, such as 3M Scotch Weld 2216 or equivalent, to carry out the necessary repair.

#### Note

Observe the manufacturer's precautions in handling.

5. While the transmission is still at operating temperature, apply the epoxy cement to the area under repair. Ensure that the area is completely covered.
6. If 3M Scotch Weld 2216 has been used, allow 1

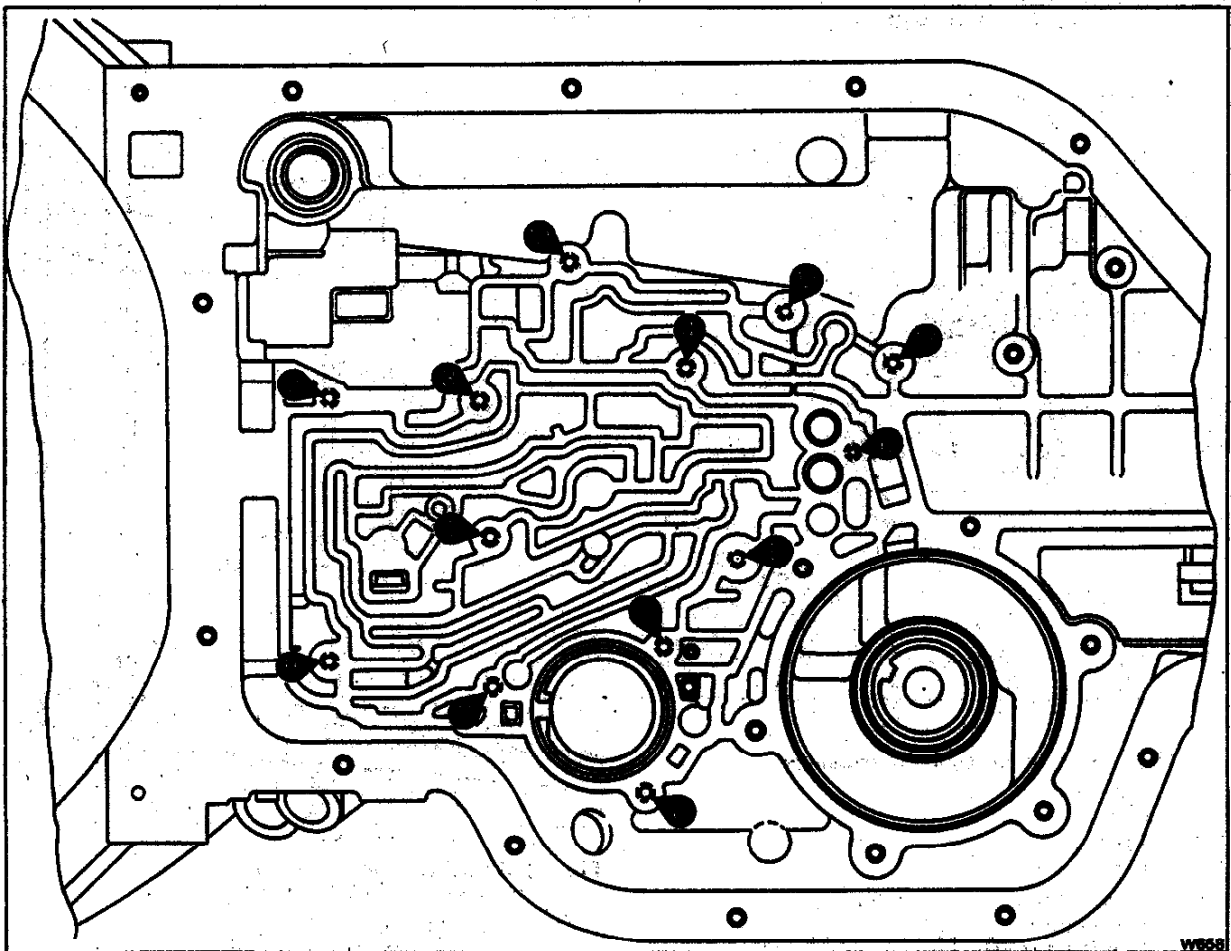


Fig. T129 Hell-coil identification - View of underside of transmission case

## Heli-coil information for Torque Converter Transmission

Transmission out of car and partially or completely dismantled				
Location	Hole number	Drill size	Tap size	Heli-coil size
Pump to case	All	8.33 mm. (0.328 in.)	1/4"-18 UNC-2B	1/4"-18 STI-NC
Valve body to case	1 to 4 (see Fig. T129)	8.33 mm. (0.328 in.)	1/4"-18 UNC-2B	1/4"-18 STI-NC
Valve body to case	5 and 6 (see Fig. T129)	6.76 mm. (0.266 in.)	1/4"-20 UNC-2B	1/4"-20 STI-NC
*Converter to flex plate	All	9.93 mm. (0.391 in.)	3/8"-16 UNC-2B	3/8"-16 STI-NC
*Converter to flex plate	All	10.30 mm. (0.406 in.)	M10-1.5	M10-1.5 x 1 1/2
Transmission in car and partially dismantled				
Location	Hole number	Drill size	Tap size	Heli-coil size
Rear extension to case	All	9.93 mm. (0.391 in.)	3/8"-16 UNC-2B	3/8"-16 STI-NC
Governor cover to case	All	8.33 mm. (0.328 in.)	1/4"-18 UNC-2B	1/4"-18 STI-NC
Modulator retainer to case	-	8.33 mm. (0.328 in.)	1/4"-18 UNC-2B	1/4"-18 STI-NC
*Speedometer driven gear assembly to case	-	8.33 mm. (0.328 in.)	1/4"-18 UNC-2B	1/4"-18 STI-NC
*Speedometer driven gear assembly to case	-	6.20 mm. (0.244 in.)	M6-1.0	M6-1.0 x 2D
Oil sump to case	All	8.33 mm. (0.328 in.)	1/4"-18 UNC-2B	1/4"-18 STI-NC
Rear servo cover to case	All	8.33 mm. (0.328 in.)	1/4"-18 UNC-2B	1/4"-18 STI-NC
Parking lock bracket to case	All	8.33 mm. (0.328 in.)	1/4"-18 UNC-2B	1/4"-18 STI-NC
Valve body to case	7 to 10 (see Fig. T129)	8.33 mm. (0.328 in.)	1/4"-18 UNC-2B	1/4"-18 STI-NC
Valve body to case	11 (see Fig. T129)	6.76 mm. (0.266 in.)	1/4"-20 UNC-2B	1/4"-20 STI-NC
Solenoid to case	12 and 13 (see Fig. T129)	6.76 mm. (0.266 in.)	1/4"-20 UNC-2B	1/4"-20 STI-NC
* Change from UNC to Metric threads early 1979				

hour to pass before starting the engine. Equivalent epoxy cements may take longer to cure, therefore, always check the manufacturer's instructions.

7. Finally, bring the transmission fluid up to the normal operating temperature of approximately 82°C (180°F) and check the transmission for leaks.

#### Intermediate clutch cup plug - To fit

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

#### Note

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

3. Stake the plug securely in the case.

#### Case bushing - To remove

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

#### Case bushing - To fit

1. Support the transmission case and using adapter (J-21465-9) on removal/fitting tool (J-21465-8), together with the drive handle (J-8092) and extension (J-21465-13), press or drive the bush into the case until between 1,02 mm. and 1,40 mm. (0,040 in. and 0,055 in.) above the selective thrust washer face (see Fig. T128).

#### Note

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

2. Stake the bushing in the oil groove using tool (J-21465-10).

#### Heli-coils

#### Note

Always refer to Figure T129 and the Heli-coil information chart, for the correct drill and tap sizes, before commencing any repair work.

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

#### Note

Drill out only to the depth of the original hole. When drilling hole No.4 (see Fig. T129), the drill may go through to the inside of the case; located just behind this hole are the intermediate clutch splines. Therefore, the burrs must be removed from the clutch splines.

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

## Section T21

## Fault diagnosis

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

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

1. Check the fluid level.
2. Warm up the engine and transmission.

3. Check the control linkage.
4. Check the kick-down micro-switch.
5. Check the vacuum lines and fittings.
6. Fit a pressure gauge and road test the car.

**Note**

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

Symptom	Possible cause	Action
1. No drive in Drive range	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2). Check for external leaks or the vacuum modulator diaphragm leaking.
	2. Control linkage.	2. Check and adjust the control linkage (see Section T17).
	3. Low oil pressure.	3. (a) Check for a restricted intake strainer, a leak at the intake pipe, grommet, or the 'O' ring damaged or missing. (b) Check that the oil pump assembly pressure regulator is not sticking. Also check the pump drive gear tang has not been damaged by the converter. (c) Check the case for porosity around the intake bore. (d) Check the items listed on Page T21-14.
	4. Control valve assembly.	4. Check for the manual valve being disconnected from the detent lever.
	5. Forward clutch.	5. (a) Check the forward clutch apply piston for cracks, the seals damaged or missing or the clutch plates burnt (see Page T21-15). (b) Check the oil seal rings (missing or broken) on the pump cover. (c) Check for a leak in the feed circuit or the pump to case gasket mis-positioned or damaged. (d) Check the clutch housing check ball is not sticking or missing.
	6. Roller clutch assembly.	6. Check the clutch assembly for broken springs or damaged cage.

Symptom	Possible cause	Action
1. No drive in Drive range (continued)	7. Actuator inoperative.	7. (a) Check the thermal cut-out switch on the fuseboard. (b) Check the charge condition of the battery. (c) Check the operation of the actuator (see Section T5).
2. (a) No drive in Reverse range. (b) Slips in Reverse range	1. Incorrect fluid level in transmission. 2. Actuator inoperative. 3. Control linkage. 4. Oil pressure. 5. Control valve assembly. 6. Rear servo and accumulator. 7. Forward clutch. 8. Direct clutch. 9. Rear band.	1. Top-up as necessary (see Section T2). 2. (a) Check the thermal cut-out switch on the fuseboard. (b) Check the charge condition of the battery. (c) Check the operation of the actuator (see Section T5). 3. Check and adjust the control linkage (see Section T17). 4. Check the items listed on Pages T21-13/14. 5. (a) Check that the valve body/spacer plate gaskets are not damaged or incorrectly fitted. (b) Check that the 2-3 valve train is not sticking open (this would also cause a 1-3 up-change in Drive range). (c) Low/Reverse check ball missing from the case (this will also cause no overrun braking in Low range). 6. (a) Check for a damaged rear piston seal. (b) Check for a short band apply pin (this may also cause no overrun braking or slipping in overrun braking - Low range). 7. Check that the clutch unit will release (if it does not release this will also cause drive in Neutral). 8. (a) Check the outer seal for damage. (b) Check the clutch plates (if burnt, it may be caused by the check ball sticking in the piston). (c) Check the items listed on Page T21-15. 9. Check the band for burnt or loose linings, apply pin or anchor pins not engaged, or the band broken.
3. Drive in Neutral	1. Control linkage.	1. Check and adjust the control linkage (see Section T17).

Symptom	Possible cause	Action
3. Drive in Neutral (continued)	2. Forward clutch.	2. (a) Check that the clutch is releasing, if the clutch does not release it will also cause 'no Reverse'. (b) Check the items listed on Page T21-15.
	3. Pump assembly.	3. Transmission fluid pressure leaking into the forward clutch apply passage.
4. Will not hold in Park	1. Control linkage.	1. Check and adjust the control linkage (see Section T17).
	2. Internal parking linkage.	2. (a) Check the parking brake lever and actuator assembly. (b) Check the chamfer on the actuator rod sleeve. (c) Check the parking pawl (broken or inoperative). (d) Check that the parking pawl return spring is not broken, missing or incorrectly hooked.
5. No engine braking in Intermediate range - 1st gear	1. Control valve assembly	1. Check the Low-Reverse check ball (missing from case).
	2. Rear servo.	2. (a) Check for a damaged oil seal ring, bore or piston; leaking. (b) Rear band apply pin short or improperly assembled.
	3. Rear band.	3. (a) Rear band broken or burnt (check for cause). (b) Check the rear band assembly engages correctly on the anchor pins and/or servo pin.
6. No engine braking in Intermediate range - 2nd gear	1. Front servo and accumulator.	1. (a) Check for leaking or broken oil sealing rings. (b) Check for scored bores. (c) Check for a sticking servo piston.
	2. Front band.	2. (a) Check to ensure that the front band is not burnt or broken. (b) Check to ensure that the front band is engaged correctly on the anchor pin and/or servo pin.
7. No detent down-changes <b>Note</b> Position the car on a ramp. Switch on ignition, but do not start engine	1. Transmission case electrical plug.  (d) Light off.	1. (a) Disconnect the electrical connections. (b) Connect a test lamp to the detent solenoid terminal of the disconnected wiring loom. (c) Depress the accelerator 'fully', from the normal driving position. (d) Incorrectly adjusted or faulty micro-switch. Faulty electrical circuit.

Symptom	Possible cause	Action
7. No detent down-changes (continued)	(e) Light on.	(e) Check the operation of the detent solenoid. If the solenoid cannot be heard to operate this may be due to. (i) Faulty electrical connection. (ii) Sticking detent valve train. (iii) Restricted oil passage.
	2. Control valve assembly.	2. (a) 3-2 valve sticking, spring missing or broken. (b) Detent valve train sticking.
8. Transmission noisy	1. Noise in Park, Neutral and all Drive ranges	1. (a) Check for pump cavitation. (i) Transmission fluid level low or high, top-up etc., as necessary (see Section T2). (ii) Restricted or incorrect strainer assembly. (iii) Intake 'O' ring damaged or intake pipe split. (iv) Porosity at pump face intake port. (v) Pump to transmission case gasket incorrectly fitted. (vi) Coolant in the transmission fluid. (b) Check pump assembly for. (i) Defective or damaged gears. (ii) Drive gear incorrectly assembled. (iii) Crescent interference. (iv) Seal rings damaged or worn. (c) Check converter for. (i) Damage. (ii) Loose bolts, converter to flywheel.
		2. (a) Check that the transmission does not contact the body. (b) Check planetary gear train for. (i) Gears or thrust bearings damaged. Thoroughly clean thrust bearings and thrust races. Closely inspect needles and surfaces for pitting and roughness. (ii) Front internal gear ring damaged.
	2. Noise in First, Second and Reverse.	3. (a) Check that the transmission fluid lines to and from the cooler are not fouling. (b) Check that the engine mounts are not loose or broken.
	3. Noise during acceleration in any gear.	4. Check the speedometer driven gear shaft seal (lubricate or replace).
	4. Squeak at low vehicle speeds.	

Symptom	Possible cause	Action
8. Transmission noisy (continued)	5. Slight creaking noise, when accelerating gently from the stationary position.	5. Check for the converter pilot spigot fretting in the crankshaft tail bore (lubricate the spigot liberally with Retinax 'A' grease).
	6. Clutch application during. (a) Neutral to Drive and/or Park to Drive. (b) 1-2 up-change in Intermediate and Drive ranges. (c) 2-3 up-change in Drive range, Neutral to Reverse and Park to Reverse.	6. (a) Check the condition of the forward clutch plates.  (b) Check the condition of the intermediate clutch plates.  (c) Check the condition of the direct clutch plates.
	7. Converter noise in Reverse, Drive, Intermediate and Low ranges. The noise level is generally lower in Park and Neutral.	7. Check for damaged needle bearings in the converter.
9. 1st and 2nd ranges only (no 2-3 up-change)	1. Incorrect vacuum.	1. Check the items listed on Page T21-14. (Incorrect vacuum at modulator).
	2. Governor system.	2. Check line pressure.
	3. Control valve assembly.	3. (a) Check for the 2-3 shift valve train sticking (valves should fall under their own weight). (b) Check for damaged, leaking or incorrectly fitted gaskets between the control valve unit, oil spacer plate and case.
	4. Direct clutch burnt.	4. (a) Check the modulator bellows. (b) Check the centre support for the oil seal rings missing or broken. (c) Check that the direct clutch piston seals are not missing, cut, or incorrectly assembled. (d) Check that the piston check ball is not sticking or missing.
	5. Kick-down micro-switch.	5. Check that the micro-switch is not sticking closed, causing the solenoid to be activated all the time.
	6. Detent solenoid.	6. Check that the solenoid is not sticking open.
10. (a) No 1-2 up-change. (b) Delayed up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).

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

Symptom	Possible cause	Action	
11. Rough 1-2 up-change (continued)	5. Control valve assembly.	5. (a) Check that the 1-2 accumulator valve train is not sticking. (b) Check that the valve body to case bolts are not loose. (c) Check that the valve body spacer plate gaskets are not damaged, incorrectly fitted or the wrong gasket fitted.	
	6. Case	6. (a) Check the intermediate clutch ball (missing or not sealing). (b) Check for porosity between channels.	
	7. Rear servo accumulator assembly.	7. (a) Check the oil seal rings for damage. (b) Check that the piston has not jammed. (c) Check that the spring is not broken or missing. (d) Check that the servo bore is not damaged.	
	8. Intermediate clutch.	8. (a) Check that only one waved plate has been fitted. (b) Check that the clutch plates are not burnt.	
	12. Slipping 1-2 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
		2. Check condition of engine.	2. Tune the engine.
		3. Vacuum line and components.	3. Check the vacuum system for response at the modulator.
		4. Line pressure.	4. (a) Check the oil pressure (it should vary and respond rapidly to quick changes in throttle openings). (b) Check the vacuum modulator for possible failure. (c) Check that the modulator valve is not sticking.
5. Control valve assembly.		5. (a) Check for the 1-2 accumulator valve train sticking. (b) Check for porosity in the valve body or case. (c) Check the valve body attaching bolts for tightness.	
6. Front accumulator.		6. Check the oil seal ring (damaged or missing).	
7. Rear accumulator.		7. Check the oil seal ring (damaged or missing) or the case bore damaged.	
8. Oil pump.		8. (a) Check that the pump to case gasket is not mispositioned or damaged. (b) Check that the pressure regulator valve is not sticking.	

Symptom	Possible cause	Action
12. Slipping 1-2 up-change (continued)	9. Case.	9. (a) Check that the intermediate clutch plug is not leaking excessively. (b) Check for porosity between channels.
	10. Intermediate clutch.	10. (a) Check the piston seals (damaged or missing). Also check for burnt clutch plates. (b) Check the centre support for leaks in the feed circuit (oil rings or grooves damaged). Also, for an excessive leak between the tower and the bush, or the orifice bleed hole blocked. (c) Check that the centre support bolt has seated properly in the case. (d) Check that only one waved plate has been fitted.
13. Rough 2-3 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Check condition of engine.	2. Tune the engine.
	3. Oil pressure - High.	3. (a) Check the vacuum modulator assembly. (b) Check that the modulator valve is not sticking. (c) Check that the oil pump regulator valve and boost valve are operating correctly.
	4. Front servo accumulator or assembly.	4. (a) Check that the accumulator spring is not missing or broken. (b) Check that the accumulator piston is not sticking.
	5. Direct clutch.	5. (a) Check that only one waved clutch plate has been fitted. (b) Check the direct clutch for leakage to the outer area of the clutch piston. (c) Check the centre support for damage.
14. Slipping 2-3 up-change	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Check condition of engine.	2. Tune the engine.
	3. Oil pressure - Low.	3. (a) Check the vacuum modulator assembly. (b) Check the modulator valve. (c) Check the oil pump pressure regulator valve and/or the boost valve for operation. (d) Check the oil pump to case gasket for damage or incorrect location

Symptom	Possible cause	Action	
14. Slipping 2-3 up-change (continued)	4. Control valve assembly.	4. (a) Check the front accumulator piston pin for a leak at the swaged end. (b) Check for sticking valves. (c) Check for damage or leaking oil passages. (d) Check the spacer plate for damage, blocked direct clutch feed orifice or mis-positioned gasket.	
	5. Case.	5. Check the case for porosity cross leaks etc.	
	6. Direct clutch.	6. (a) Check the piston seals and check ball for leaks. (b) Check the centre support oil seal rings for damage and for an excessive leak between the tower and bush. (c) Check that only one waved plate has been fitted.	
	7. Front servo.	7. (a) Check for a broken or missing front servo spring. (b) Check for a leak at the servo pin.	
	15. (a) Delayed up-changes. (b) No up-changes	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
		2. Detent system (kick-down) micro-switch.	2. Disconnect the white/green wire from the connector on the side of the transmission case. Test the up-changes (a) If the up-changes occur, the problem is in the micro-switch or wiring. (b) If the fault persists continue to Operation 3.
		3. Incorrect modulator vacuum.	3. Connect a gauge to the lower end of the modulator vacuum pipe and check for normal vacuum. (a) If the vacuum is low or not present, check for leaks and restrictions. (b) If the fault persists continue to Operation 4.
4. Incorrect line pressure.		4. Connect a gauge to the transmission adapter and check the line pressure in Drive range with an engine speed of 1 000 r.p.m. Normal pressure is between 4,57 kgf/sq.cm. and 5,27 kgf/sq.cm. (65 lbf/sq.in. and 75 lbf/sq.in.). <b>Note</b> Normal line pressure in Drive range with the car stationary should vary from approximately 4,57 kgf/sq.cm. (65 lbf/sq.in.) at idle speed to 10,55 kgf/sq.cm. (150 lbf/sq.in.) at full throttle. The pressure increases as the engine vacuum decreases.	

Symptom	Possible cause	Action
<b>15. (a) Delayed up-changes. (b) No up-changes (continued)</b>	<b>5. Line pressure between 6,68 kgf/sq.cm. and 7,73 kgf/sq.cm. (95 lbf/sq.in. and 110 lbf/sq.in.).</b>	<b>5. Check the complete detent system.</b>
	<b>6. Line pressure between 9,49 kgf/sq.cm. and 10,55 kgf/sq.cm. (135 lbf/sq.in. and 150 lbf/sq.in.).</b>	<b>6. With the correct vacuum at the modulator, check. (a) Modulator valve. (b) Pressure regulator components.</b>
	<b>7. Normal line pressure between 4,57 kgf/sq.cm. and 5,27 kgf/sq.cm. (65 lbf/sq.in. and 75 lbf/sq.in.).</b>	<b>7. Remove the governor assembly; check for freedom of operation and presence of dirt etc. Clean if necessary.</b>
	<b>8. Detent system.</b>	<b>8. (a) Check that the detent solenoid is not loose or defective. (b) Check that the solenoid feed orifice is not blocked. An incorrectly fitted gasket could block the hole. (c) Check that the detent valve spacer pin has been fitted. (d) Check that the detent valve bore plug has not been pushed too far and tilted. The plug should be seated against the retaining pin. (e) Check that the detent valve bore plug is not undersize or eccentric, causing an excessive leak at the detent valve.</b>
<b>16. 1-2 Up-change - Full throttle only</b>	<b>1. Kick-down micro-switch.</b>	<b>1. Check that the micro-switch is not sticking.</b>
	<b>2. Detent solenoid.</b>	<b>2. (a) Check that the solenoid securing bolts are torque tightened. (b) Check that the gasket (if fitted) is not leaking. (c) Check that the solenoid is not sticking open.</b>
	<b>3. Control valve assembly.</b>	<b>3. (a) Check the valve body spacer plate gasket for. (i) Leaks (ii) Damage (iii) Incorrectly fitted. (b) Check that the detent valve train has not jammed. (c) Check that the 3-2 valve has not jammed.</b>
	<b>4. Case.</b>	<b>4. Check the case for porosity.</b>

Symptom	Possible cause	Action
17. Slips in all ranges	1. Incorrect fluid level in transmission.	1. Top-up as necessary (see Section T2).
	2. Oil pressure.	2. (a) Check that the vacuum modulator valve is not sticking. (b) Check that the oil strainer assembly is not blocked or leaking, or the grommet or 'O' ring missing or damaged. (c) Check the oil pump assembly for the regulator or boost valve sticking, or for a cross leak. (d) Check that the oil pump to case gasket is not damaged or incorrectly fitted.
	3. Case.	3. Check the case for cross leaks or porosity.
	4. Forward and direct clutches slipping.	4. (a) If the clutches appear burnt, look for the cause in 'Burnt clutch plates' on Page T21-15. (b) Check the oil pump sealing rings on the pump cover for wear or damage.
18. No part throttle down-changes	1. Oil pressure.	1. Check the vacuum modulator assembly, modulator valve, and pressure regulator valve etc., for leaks, sticking valves and restrictions.
	2. Control valve assembly.	2. Check that the 3-2 valve is not sticking, or the spring missing or broken.
19. Low or High up-changes	1. Oil pressure.	1. (a) Check the engine vacuum at the transmission end of the modulator pipe. (b) Check for loose vacuum connections at the engine and transmission. Also, check the modulator valve, pressure regulator valve train etc., for leaks, sticking valves and restrictions.
	2. Governor.	2. (a) Check that the governor valve is not sticking. (b) Check the feed holes, lines etc., for leaks or restrictions, or the pipes damaged or mispositioned.
	3. Detent solenoid.	3. Check that the solenoid is not sticking open, or become loose etc., as this will cause late up-changes.
	4. Control valve assembly.	4. (a) Check the detent valve train for free movement or restrictions. (b) Check the 3-2 valve train.

Symptom	Possible cause	Action
19. Low or High up-changes (continued)		<p>(c) Check the 1-2 valve train, if the 1-2 regulator valve is sticking this would cause a constant 1-2 shift point, regardless of throttle opening.</p> <p>(d) Check that the valve body spacer plate gaskets are not mispositioned, or the spacer plate holes missing or blocked.</p>
	5. Case.	5. Check the case for porosity, intermediate plug leaking or missing.
20. Torque converter leaks	<p>1. Converter welding.</p> <p>2. Damaged or worn converter hub.</p>	<p>1. Check the converter welding and if at all suspect, fit a new converter.</p> <p>2. Inspect the converter hub for wear, also, scoring that can damage the seal.</p>
21. Torque converter vibrations	<p>1. Converter/flex-plate out of balance.</p> <p>2. Converter balance weight.</p> <p>3. Crankshaft pilot.</p>	<p>1. (a) Isolate the cause of the vibration. (b) Alter the position of the converter on the flexplate 120° at a time until the out of balance condition is corrected.</p> <p>2. Check the converter for the loss of balance weight(s), change the converter if a balance weight is lost.</p> <p>3. (a) Check to ensure that the converter to crankshaft pilot is not broken. (b) Change the converter if the pilot is broken.</p>
22. Torque converter slipping or noisy. (Most converter noise occurs under light throttle in Drive range with the brakes applied)	<p>1. Loose flexplate to converter set-screws.</p> <p>2. Cracked flexplate.</p> <p>3. Items listed under Operation 21 - Torque converter vibrations.</p> <p>4. 'Fretting' of the converter pilot spigot in the crankshaft tail bore.</p>	<p>1. (a) Check the flexplate and converter for damage. (b) If no damage is apparent, tighten the bolts. (c) If damage is apparent replace the components.</p> <p>2. (a) Check for a cracked flexplate (engine to case dowel pins missing can result in a cracked flexplate). (b) Replace the damaged components.</p> <p>3. See items listed under Operation 21 - Torque converter vibrations.</p> <p>4. Apply a liberal coating of Shell Retinax 'A' grease all over the spigot.</p>

Symptom	Possible cause	Action
22. Torque converter slipping or noisy (continued)	5. Converter balance weights lifting (spot welds breaking and one end lifting up and catching on the case).	5. (a) Check for welds breaking on the balance weights. (b) Change the converter if the balance weights have broken away.
	6. Internal damage to converter.	6. (a) Check the thrust roller bearing, thrust races and roller clutch for damage. Fit a new converter if damage is apparent.
	7. Converter fluid.	7. (a) Check the colour of the fluid, if it has the appearance of 'aluminium paint', the converter is damaged internally. (b) Check that anti-freeze has not contaminated the converter fluid. (c) Fit a new converter.

**Note**

It is not necessary to change the converter if a failure in some other part of the transmission has resulted in the converter containing dark discoloured fluid. The full flow strainer used in the transmission will remove all harmful residue from failures (other than converter to pump failures) before the oil is pumped into the converter.

Correct the transmission problem, then, change the intake strainer and fluid.

**High line pressure**

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

**1. Vacuum leak**

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

**2. Damaged Modulator**

- (a) Sticking valve.
- (b) Water in modulator.
- (c) Incorrect operation of modulator.

**3. Detent system**

- (a) Kick-down switch actuated (plunger sticking) or shorted.
- (b) Detent wiring shorted.
- (c) Detent solenoid sticking open.
- (d) Detent feed orifice in spacer plate blocked.
- (e) Detent solenoid loose.
- (f) Detent valve bore plug damaged.
- (g) Detent regulator valve pin short.

**4. Pump**

- (a) Pressure regulator and/or boost valve sticking.
- (b) Incorrect pressure regulator spring.
- (c) Excessive number of pressure regulator valve spacers.

- (d) Faulty pump casting.
- (e) Pressure boost valve installed incorrectly or otherwise defective.
- (f) Aluminium bore plug defective.
- (g) Pressure boost bush defective.

#### 5. Control valve assembly

- (a) Spacer plate-to-case gasket incorrectly fitted.
- (b) Incorrect plate-to-case gasket.

#### Low line pressure

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

#### 1. Transmission oil level low

#### 2. Modulator assembly

#### 3. Intake strainer

- (a) Blocked or restricted.
- (b) 'O' ring on intake pipe omitted or damaged.
- (c) Incorrect strainer fitted.

#### 4. Split or leaking intake pipe

#### 5. Pump

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

#### 6. Leaks in the internal circuit

- (a) Forward clutch leak (pressure normal in Neutral and Reverse - pressure low in Drive).
  - (i) Check pump rings.
  - (ii) Check forward clutch seals.
- (b) Direct clutch leak (pressure normal in Neutral, Low, Intermediate and Drive - pressure low in Reverse).
  - (i) Check centre support oil seal rings.
  - (ii) Check direct clutch outer seal for damage.
  - (iii) Check rear servo and front accumulator pistons and rings for damage or missing.

#### 7. Case assembly

- (a) Porosity in intake bore area.
- (b) Check case for intermediate clutch plug leak or blown out.
- (c) Low - Reverse check ball incorrectly positioned or missing (this condition will cause no Reverse and no overrun braking in Low range).

#### Note

When checking item 3 - Intake strainer, it should be noted that there is no approved method for either checking or cleaning the strainer. If the performance of the strainer is suspect a new strainer must be fitted.

#### Incorrect vacuum at modulator

#### 1. Engine

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

#### 2. Vacuum line to modulator

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

#### Oil leaks

#### 1. Transmission oil sump leaks

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

#### 2. Case extension leak

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

#### 3. Case leak

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

#### 4. Front end leak

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

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

- (a) Transmission over-filled.
- (b) Water in oil.
- (c) Strainer 'O' ring damaged or incorrectly assembled causing oil to foam.

- (d) Foreign material between pump and case or between pump cover and body.
- (e) Case porous, pump face incorrectly machined.
- (f) Pump porous.
- (g) Pump to case gasket mispositioned.
- (h) Pump breather hole blocked or missing.
- (i) Hole in intake pipe.
- (j) Check ball in forward clutch missing or sticking.

#### 6. Modulator assembly

- (a) Diaphragm defective.

#### Control valve assembly - Governor line pressure check

1. Install a line pressure gauge.
2. Install a tachometer.
3. Disconnect the vacuum line to the modulator.
4. With the car on a ramp (rear wheels off the ground), foot off the brake, in Drive, check line pressure at 1 000 r.p.m.
5. Slowly increase the engine revolutions to 3 000 r.p.m. and determine if a line drop occurs of 0.49 kgf/sq.cm. (7 lbf/sq.in.) or more.
6. If a pressure drop occurs, dismantle, clean and inspect the control valve assembly.
7. If no pressure drop occurs:
  - (a) Inspect the governor.
    - (i) Sticking valve.
    - (ii) Weight freeness.
    - (iii) Restricted orifice in governor valve.
  - (b) Governor feed system.
    - (i) Check screen in governor feed pipe hole in case assembly.
    - (ii) Check for restrictions in governor pipe.

#### Burnt clutch plates

##### Note

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

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

#### 2. Intermediate clutch

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

#### 3. Direct clutch

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

##### Note

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

#### Vacuum modulator assembly

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

##### 1. Vacuum diaphragm leak check

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

##### Note

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

##### 2. Atmospheric leak check

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

##### Note

Do not use any method other than human lung power

to apply air pressure, as pressures over 0,42 kgf/sq.cm.(6 lbf/sq.in.) may damage the modulator.

### 3. Bellows comparison check

Make a comparison gauge (see Fig. T130), and compare the load of a known good modulator with the assembly in question.

- Install the modulator that is known to be acceptable on either end of the gauge.
- Install the modulator in question on the opposite end of the gauge.
- Holding the modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the centre of the gauge. The gap between the opposite modulator sleeve end and the gauge line should then be 1,59 mm. (0.0625 in.) or less. If the distance is greater than this amount the modulator in question should be replaced.

### 4. Sleeve alignment check

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

### Detent (down-change) solenoid circuit - To check

#### Note

Before checking the detent solenoid circuit, make certain that the transmission kick-down switch is properly adjusted as described in Operation 5.

- With the transmission gear range selector lever in Park, turn the ignition switch to the 'ON' position but do not start the engine. Leave the ignition switch 'ON' throughout the checking procedure.

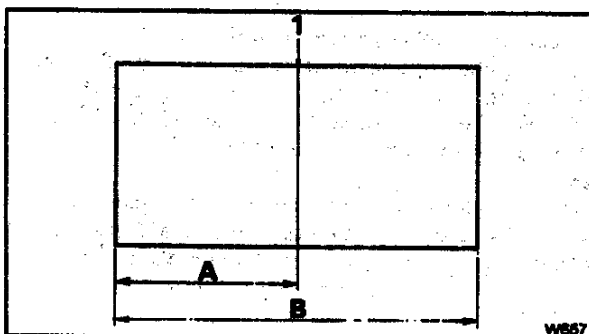


Fig. T130 Comparison gauge

1 Scribed centre line

A 12,70 mm. (0.50 in.)

B 25,40 mm. (1.0 in.)

#### Note

Round bar between 9,52 mm. and 10,32 mm. (0.375 in. and 0.406 in.) diameter.

Ends to be square within 0,39 mm. (0.015 in.).

- Working under the car, slowly advance the throttle position. One click should be heard from the transmission.

- Allow the throttle to return to the closed position. One click should be heard from the transmission.

- If the system performed as described above, the detent circuit is operating properly. If the system does not perform as described above, proceed to Operation 5.

- Disconnect the white/green cable from the detent solenoid terminal on the side of the transmission case, connect a test lamp into the circuit between the white/green cable and the terminal on the side of the transmission case. Ensure that the test lamp bulb illuminates when the throttle linkage is in the full throttle position, operated from the normal driving position. The bulb should be extinguished when the throttle is released.

- If the system operates as described above, but did not perform properly during Operations 1-3, replace the solenoid after first checking to see that the internal wiring is operational.

- If the test lamp bulb fails to illuminate with the throttle in the wide open position, the circuit is open, proceed to Operation 6.

- If the test lamp bulb illuminates with the throttle closed, the circuit is shorted, proceed to Operation 9.

- Remove the white/green cable from the transmission kick-down switch. Connect the test lamp between the switch terminal and a good earth; at full throttle ensure that the bulb of the test lamp illuminates:

- If the test lamp bulb illuminates, reconnect the white/green cable to the switch. Re-check the system.

- If the test lamp fails to illuminate, proceed to Operation 7.

- Check the white feed cable at the transmission kick-down switch, with the test lamp connected between the white cable and a good earth.

- If the test lamp bulb illuminates, replace the transmission kick-down switch. Re-check the system.

- If the test lamp fails to illuminate, proceed to Operation 8.

- Check the transmission thermal cut-out on the fuseboard.

- If it is necessary to reset or replace the cut-out, re-check the system.

- If the cut-out is correct it will be necessary to locate the fault in the wiring. Test for circuit continuity from the white feed cable at the kick-down switch to fuse No.2 at the fuseboard.

- Remove the white/green cable at the transmission kick-down switch. Connect the test lamp between the exposed terminal at the switch and a good earth, with the throttles closed.

- If the test lamp bulb does not illuminate the system is correct.

(b) If the test lamp bulb illuminates, proceed to Operation 10.

10. With the throttle in the closed position, connect the test lamp between the white feed cable at the transmission kick-down switch and a good earth.

(a) If the test lamp bulb illuminates, replace the transmission kick-down switch. Re-check the system.

(b) If the test lamp bulb fails to illuminate, it will be necessary to locate the short in the wiring. Test the circuit between the white feed cable from the kick-down switch and fuse No. 2 at the fuseboard.

## Section T22

## Workshop tools

Workshop tools with either R or RH prefix letters are obtainable from the Parts Distribution Centre at Crewe. However, certain other tools prefixed

with the letter 'J' may be obtained from the Kent-Moore or General Motors Organisation.

Tool Number	Description	Tool Number	Description
R 5244	Oil pressure gauge	(J-21409)	Outer seal protector - forward and direct clutches
R 5280	Adapter - air checking	(J-21427)	Removal tool - steel speedometer gear (used with J-9578)
RH 7674	Circlip and snap ring pliers	(J-21465-8)	Removal tool - case bush [used with J-21465-13 and RH 7794 (J-8092)]
RH 7794 (J-8092)	Universal handle - case bush	(J-21465-9)	Adapter - fitting case bush (used with J-21465-8 and J-21465-13)
RH 7914	Adapter - oil pressure tapping	(J-21465-10)	Staking tool - case bushing
RH 7952 (J-21366)	Retaining clamp - converter	(J-21465-13)	Extension - case bushing
RH 7953 (J-21359)	Insertion tool - oil pump and rear extension housing oil seals	(J-21795)	Removal tool - gear unit assembly
RH 7955 (J-8763)	Holding fixture - transmission	(J-21885)	Fitting and removal tool - control valve accumulator piston
RH 7956 (J-3289-20)	Base - holding fixture (used with RH 7955)	(J-23093)	Locating tool - centre support to case
(J-2590)	Spring compressor - forward and direct clutches		
(J-7004)	Slide hammers		
(J-9578)	Removal tool - steel speedometer gear (used with J-21427)		
(J-21362)	Inner seal protector - forward and direct clutches		
(J-21363)	Inner seal protector - intermediate clutch		
(J-21368)	Alignment band - oil pump body and cover		
(J-21370-5)	Selector pin - rear servo (used with J-21370-6)		
(J-21370-6)	Band apply pin selector gauge - rear servo (used with J-21370-5)		