FAULT DIAGNOSIS: ZF4HP22 Automatic Gearbox

Before refering to the fault diagnosis chart, ensure that the following static checks are firstly carried out:

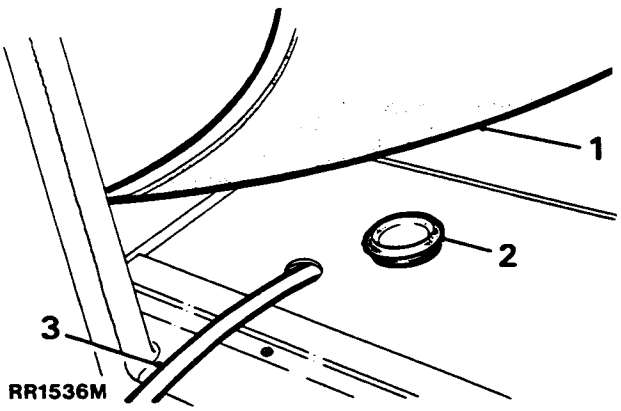
INITIAL STATIC CHECKS

Check start positions	'P' & 'N' only
Reverse lights	'R' only
Gear engagements	N–D, N–3, N–2, N–1, N–R
Full throttle	Engine switched off, check full travel at engine and at pedal
Oil level	'N' selected, engine running at normal running temperature
Pressure test	150 ± 5 lb/in² 2000 rev/min
Idle pressure	100 ± 5 lb/in² (see engine tune data for appropriate idle speeds applicable to model being tested)

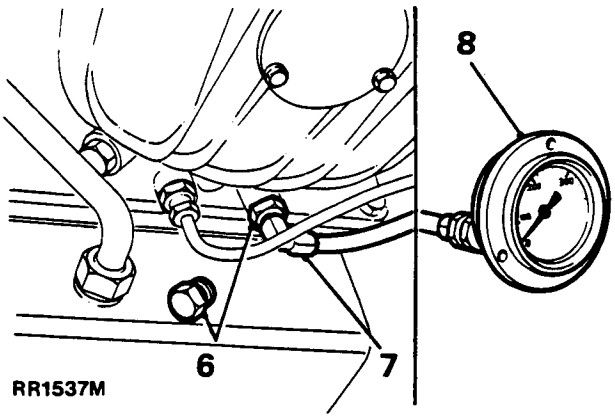
FIT PRESSURE GAUGE

Service tools:
18G502A–0–300 PSI (0–22 kg/cm²) pressure gauge
18G502K—Flexible hose
LST502–1—Hose adaptor

1. Lift the carpet and sound deadening material from the passenger side of the vehicle, to reveal the plastic grommet in the floor well.
2. Prise the grommet from its location.



3. Plug the end of the pressure gauge hose to prevent ingress of dirt. Feed the hose 18G502K through the hole and manoeuvre it between the floor well and top of the chassis, until it is visible from beneath the vehicle.
4. Drive the vehicle onto a suitable hydraulic ramp.
5. From beneath the vehicle, remove the plug from the hose.
6. Remove the plug from the bottom of the gearbox and fit the adaptor LST502–1 and tighten securely.
7. Fit the hose to the adaptor and tighten securely.
8. Fit the gauge 18G502A to the other end of the hose within the vehicle.

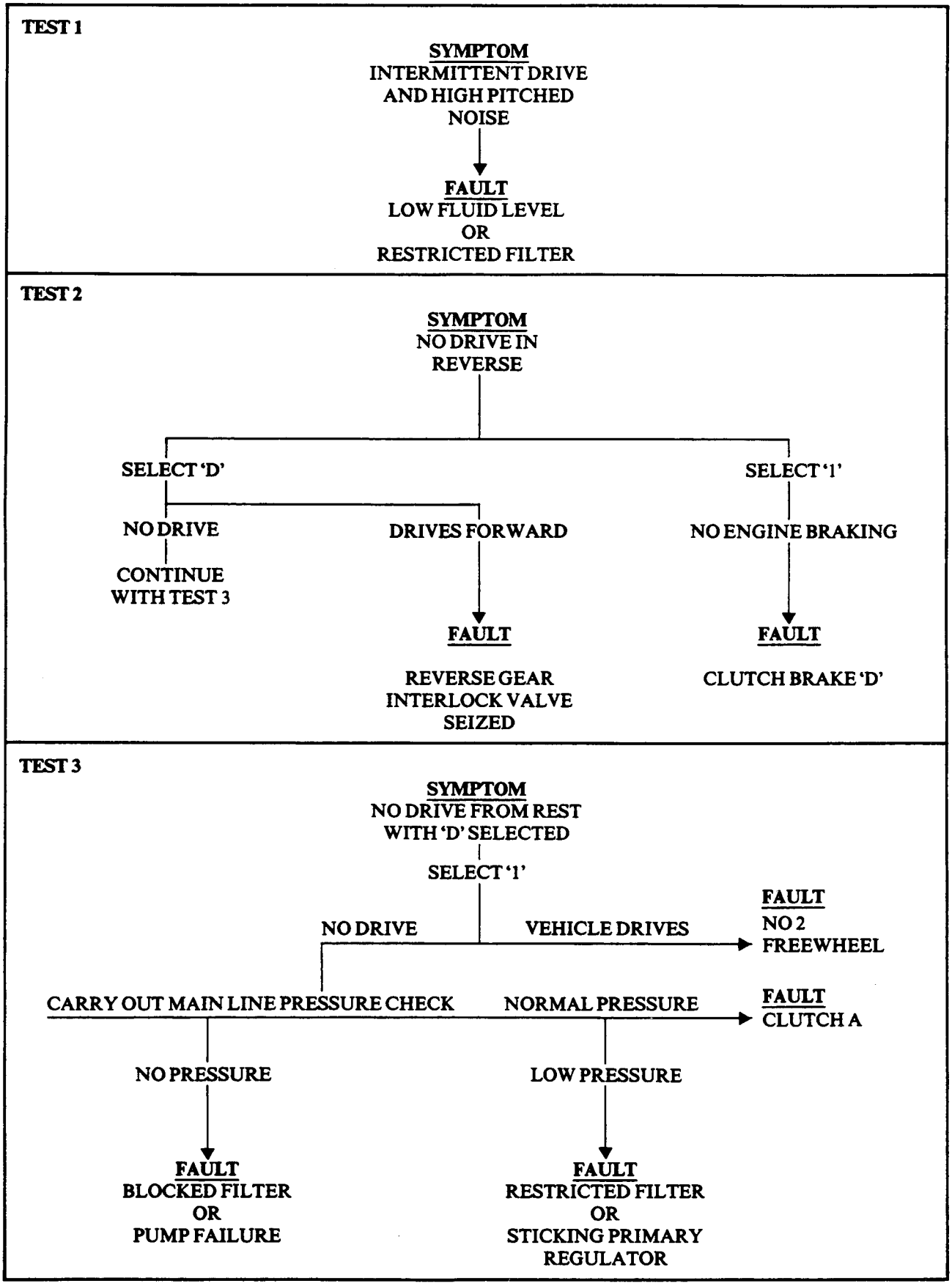


9. Remove the vehicle from the ramp and carry out road test.

Remove the pressure gauge

10. Reverse the instructions 1 to 8.

FAULT DIAGNOSIS—ZF4HP22 AUTOMATIC GEARBOX



TEST 4

SYMPTOM
SLIP IN ALL FORWARD GEARS

CARRY OUT MAIN LINE PRESSURE CHECK

NO PRESSURE	LOW PRESSURE	NORMAL PRESSURE
FAULT	**FAULT**	**FAULT**
BLOCKED FILTER OR PUMP FAILURE	RESTRICTED FILTER STICKING PRIMARY REGULATOR	CLUTCH 'A'

TEST 5

SYMPTOM
HARSH ENGAGEMENT 'N' TO 'D'

CHECK ENGINE IDLE SPEED

CARRY OUT MAIN LINE PRESSURE CHECK

HIGH PRESSURE	NORMAL PRESSURE
FAULT	**FAULT**
PRIMARY REGULATOR SEIZED	CLUTCH 'A' OR DAMPER FOR CLUTCH 'A'

TEST 6

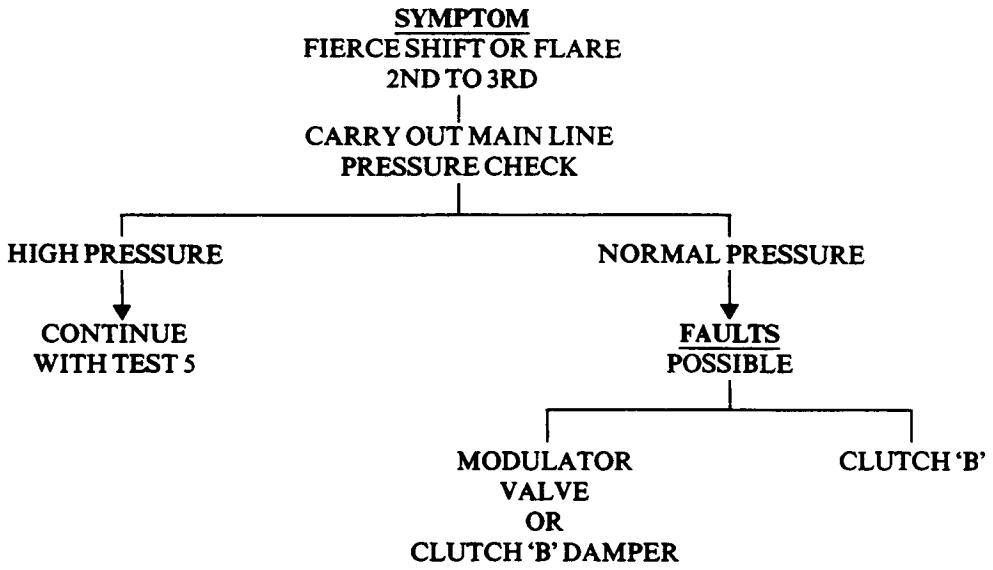
SYMPTOM
FIERCE SHIFT OR FLARE 1ST TO 2ND SHIFT

CARRY OUT MAINLINE PRESSURE CHECK

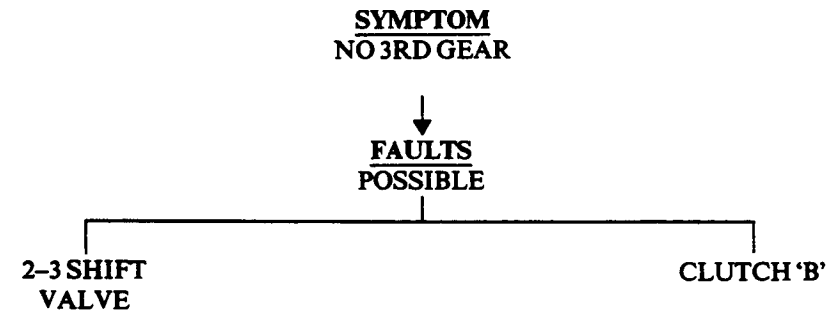
HIGH PRESSURE	NORMAL PRESSURE		
	FAULTS POSSIBLE		
CONTINUE WITH TEST 5	MODULATOR VALVE OR	DAMPERS FOR CLUTCH BRAKE 'C' AND/OR CLUTCH BRAKE 'C'	CLUTCH BRAKE 'C' AND/OR CLUTCH BRAKE 'C'

Continued

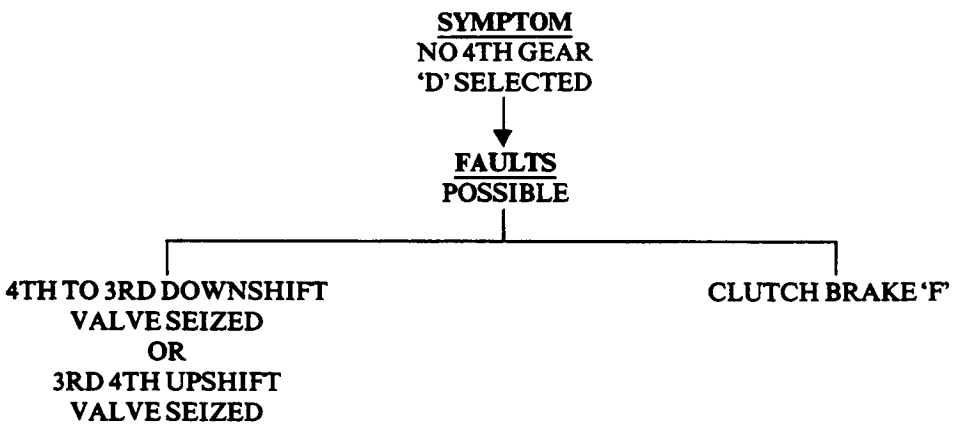
TEST 7



TEST 8



TEST 9



TEST 10

SYMPTOM
NONE OR HARSH ENGAGEMENT OF DIRECT DRIVE CLUTCH

NOTE: THE DIRECT DRIVE CLUTCH WILL ONLY ENGAGE IF 4TH GEAR IS ENGAGED AT 40 TO 44 MPH. DISENGAGEMENT OCCURS AT 39 TO 42 MPH.

CARRY OUT ROAD TEST PRESSURE CHECK WITH GAUGE CONNECTED TO TORQUE CONVERTER

PRESSURE NORMAL

FAULT
FAILED DIRECT DRIVE CLUTCH

PRESSURES CORRECT BUT REMAIN HIGH

FAULTS POSSIBLE

- DIRECT DRIVE CLUTCH AND TORQUE CONVERTER CONTROL VALVE SEIZED
- HYSTERESIS VALVE SEIZED
- DIRECT DRIVE CLUTCH CONTROL VALVE SEIZED

TEST 11

SYMPTOM
DIRECT DRIVE CLUTCH SHIFT POINT INCORRECT OR AT LOW SPEED

NOTE: DIRECT DRIVE CLUTCH ENGAGEMENT AT LOW SPEED WILL CAUSE VIBRATION IN THE TORQUE CONVERTER.

CARRY OUT MAIN LINE AND TORQUE CONVERTER PRESSURE CHECK

PRESSURE NORMAL

FAULT
GOVERNOR VALVE STICKING

LOW OR INCORRECT PRESSURE

FAULTS POSSIBLE

- DIRECT DRIVE CLUTCH CONTROL VALVE STICKING
- HYSTERESIS VALVE STICKING
- DIRECT DRIVE CLUTCH AND TORQUE CONVERTER CONTROL VALVE STICKING

TEST 12

SYMPTOM
DRIVES IN 'D' 1ST BUT IMMEDIATELY UPSHIFTS TO 3RD

FAULT
2ND TO 3RD SHIFT VALVE SEIZED

Continued

TEST 13

SYMPTOM
WITH 'D' SELECTED
VEHICLE STARTS
IN 2ND

↓

FAULTS POSSIBLE

- 1ST AND 2ND SHIFT VALVE SEIZED
- GOVERNOR SLEEVE STICKING

TEST 14

SYMPTOM
WITH 'D' SELECTED
VEHICLE STARTS
IN 3RD

↓

FAULTS POSSIBLE

- GOVERNOR SLEEVE STICKING
- 1ST TO 2ND AND 2ND TO 3RD SHIFT VALVES SEIZED

TEST 15

SYMPTOM
NO KICKDOWN
4TH TO 3RD

↓

FAULT
4TH TO 3RD KICKDOWN
VALVE SEIZED

TEST 16

SYMPTOM
UPSHIFTS/DOWNSHIFTS
AND KICKDOWN SHIFTS
AT INCORRECT ROAD SPEEDS

↓

CHECK THROTTLE KICK DOWN
CABLE ADJUSTMENT

↓

CARRY OUT MAIN LINE
PRESSURE CHECK

- INCORRECT PRESSURE
  - ↓
  - **FAULTS POSSIBLE**
    - INCORRECT THROTTLE VALVE ADJUSTMENT
    - PRIMARY REGULATOR STICKING
- NORMAL PRESSURE
  - ↓
  - **FAULT**
    GOVERNOR VALVE
    STICKING

TEST 17

SYMPTOM
NO UPSHIFTS AT LIGHT THROTTLE

↓

FAULTS POSSIBLE

- GOVERNOR VALVE STICKING
- SHIFT VALVES STICKING

TEST 18

SYMPTOM
NO ENGINE BRAKING '3' SELECTED 3RD GEAR

↓

FAULT
CLUTCH 'C'

TEST 19

SYMPTOM
DELAYED OR NO DOWNSHIFT OCCURS WHEN MAKING A MANUAL SELECTION FROM '3' TO '2'

↓

FAULTS POSSIBLE

- GOVERNOR VALVE STICKING
- '2' POSITION INTERLOCK VALVE STICKING
- 2ND AND 3RD UPSHIFT VALVE STICKING

TEST 20

SYMPTOM
AT SPEEDS BELOW 28 MPH WHEN MAKING A MANUAL SELECTION FROM '2' TO '1' 1ST, DOWNSHIFT IS DELAYED OR DOES NOT OCCUR

↓

FAULTS POSSIBLE

- GOVERNOR STICKING
- 1ST TO 2ND SHIFT VALVE STICKING
- '1' POSITION INTERLOCK VALVE STICKING

Continued

TEST 21

SYMPTOM
'1' SELECTED 1ST GEAR
NO ENGINE BRAKING

↓

FAULT
CLUTCH BAND 3

TEST 22

SYMPTOM
'2' SELECTED 2ND GEAR
NO ENGINE BRAKING

↓

FAULT
CLUTCH BAND 1

TEST 23

SYMPTOM
VEHICLE DRIVES
FORWARD IN 'N'

↓

FAULT
CLUTCH 'A' SEIZED

The following repair instructions for the ZF automatic gearbox are divided into three parts. Stage one covers repairs that can be made with the gearbox installed in the vehicle, stage two is with the gearbox removed and stage three a major overhaul procedure.

NOTE: Refer to transfer box section for removal of transfer gearbox.

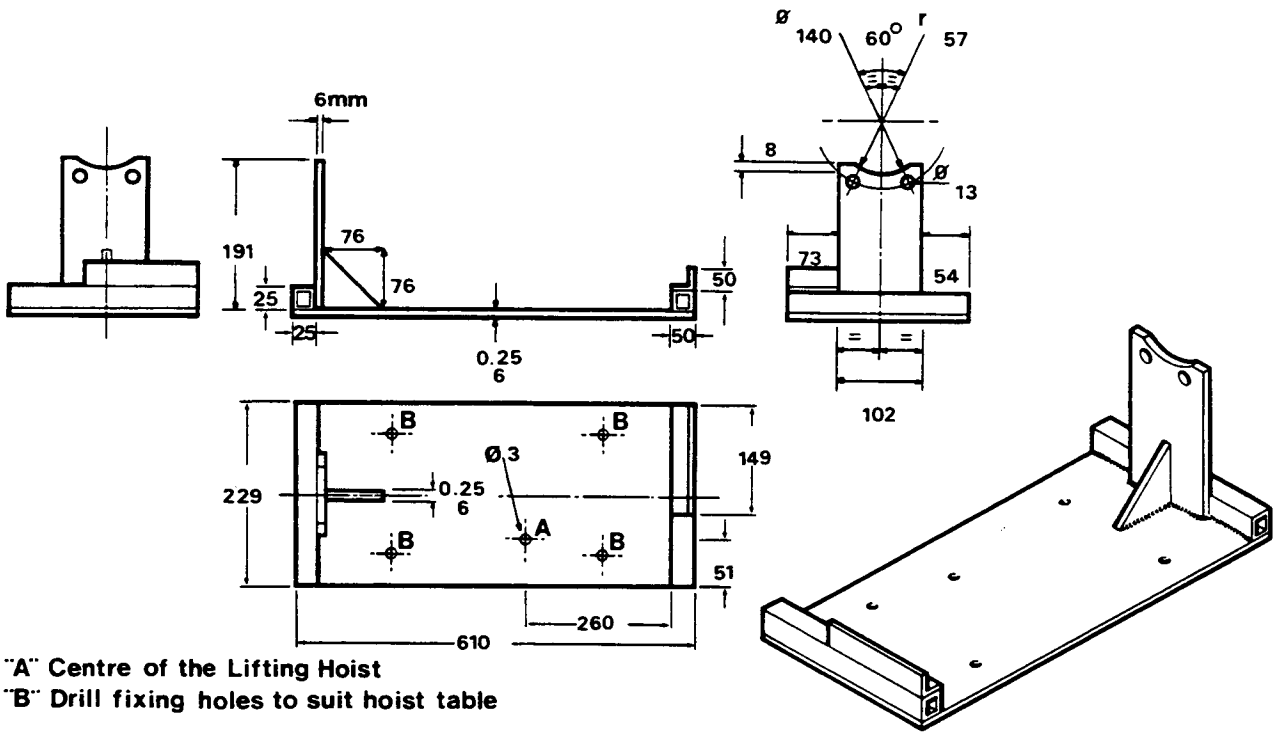
Service Tools

LST 108	**Rear oil seal replacer.**	**TX 30**	**Torx bit.**
LST 109	**Selector linkage setting gauge.**	**18G 1501**	**Torque converter remove/refit handles.**
LST 111	**Oil pump rotation sleeve and end float gauge.**	**LST 115**	**B clutch assembly puller hooks.**
LST 112	**Kickdown cable remover.**	**LST 116**	**B clutch 'O' ring and snap ring replacer.**
LST 113	**Control unit inlet oil seals remover/replacer.**	**LST 117**	**Gear train remover and replacer.**
LST 114	**Selector shaft oil seal replacer.**	**LST 118**	**Transmission holding fixture.**
TX 27	**Torx bit.**	**LST 1016-1**	**Adaptor clutch spring compressor.**

Gearbox Data

Axial end float 0,2 mm to 0,4 mm (0.008 in. to 0.016 in.).
From torque converter boss to torque converter housing face 50 mm (1.96 in.).
Freewheel cage assembly to ring gear; minimum clearance 0,1 mm (0.0039 in.).
Output shaft above cylinder F assembly; dimension 10,00 mm (0.394 in.).
A cylinder protrusion above gearbox front face not more than 8,5 mm (0.33 in.).

In addition to the above service tools, the following items should be manufactured locally to facilitate dismantling and reassembly of the gearbox.

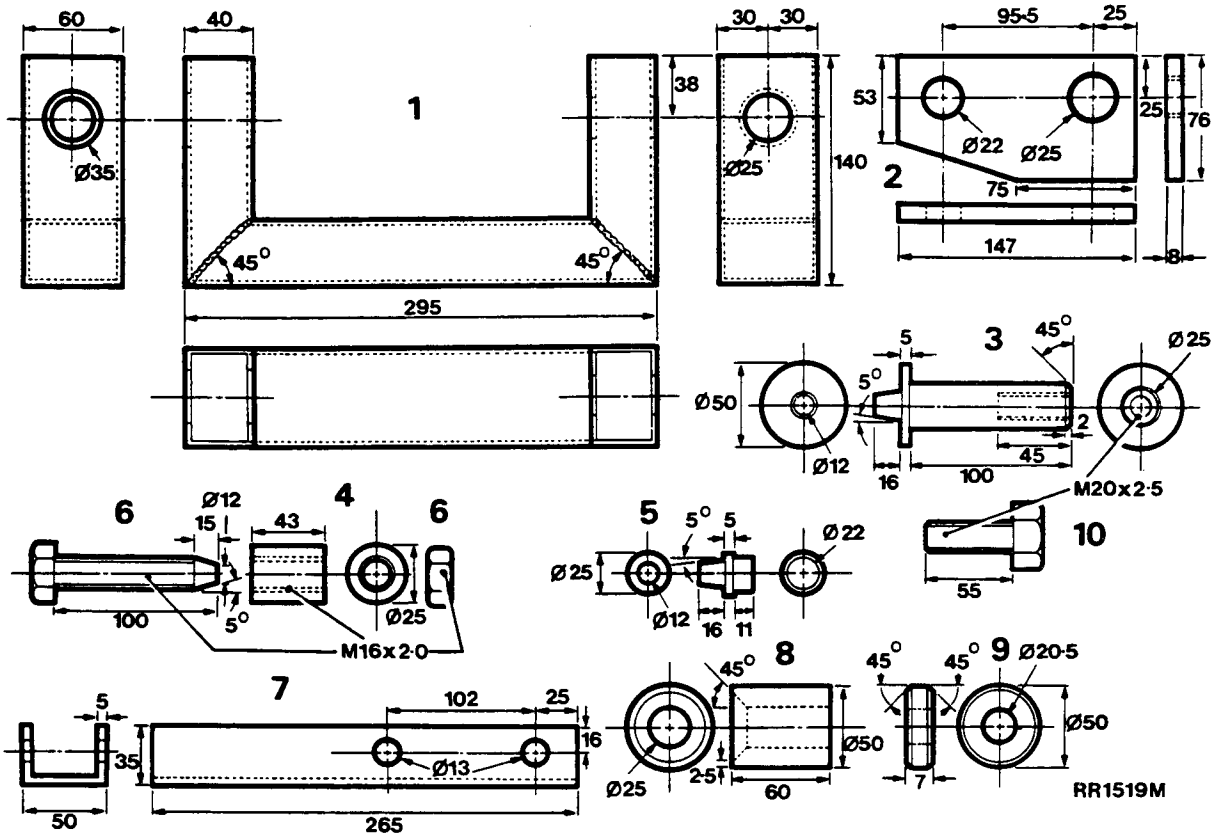


"A" Centre of the Lifting Hoist
"B" Drill fixing holes to suit hoist table

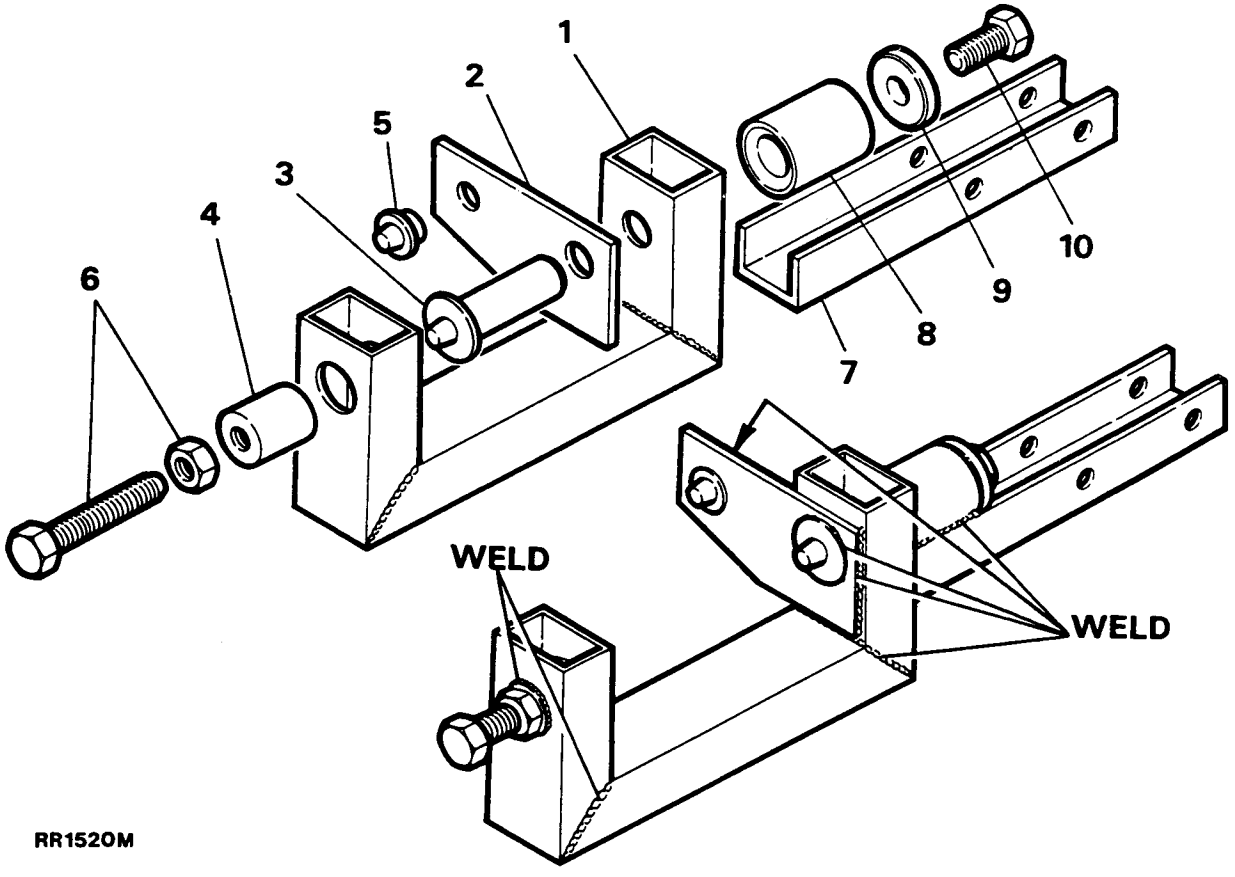
RR739M

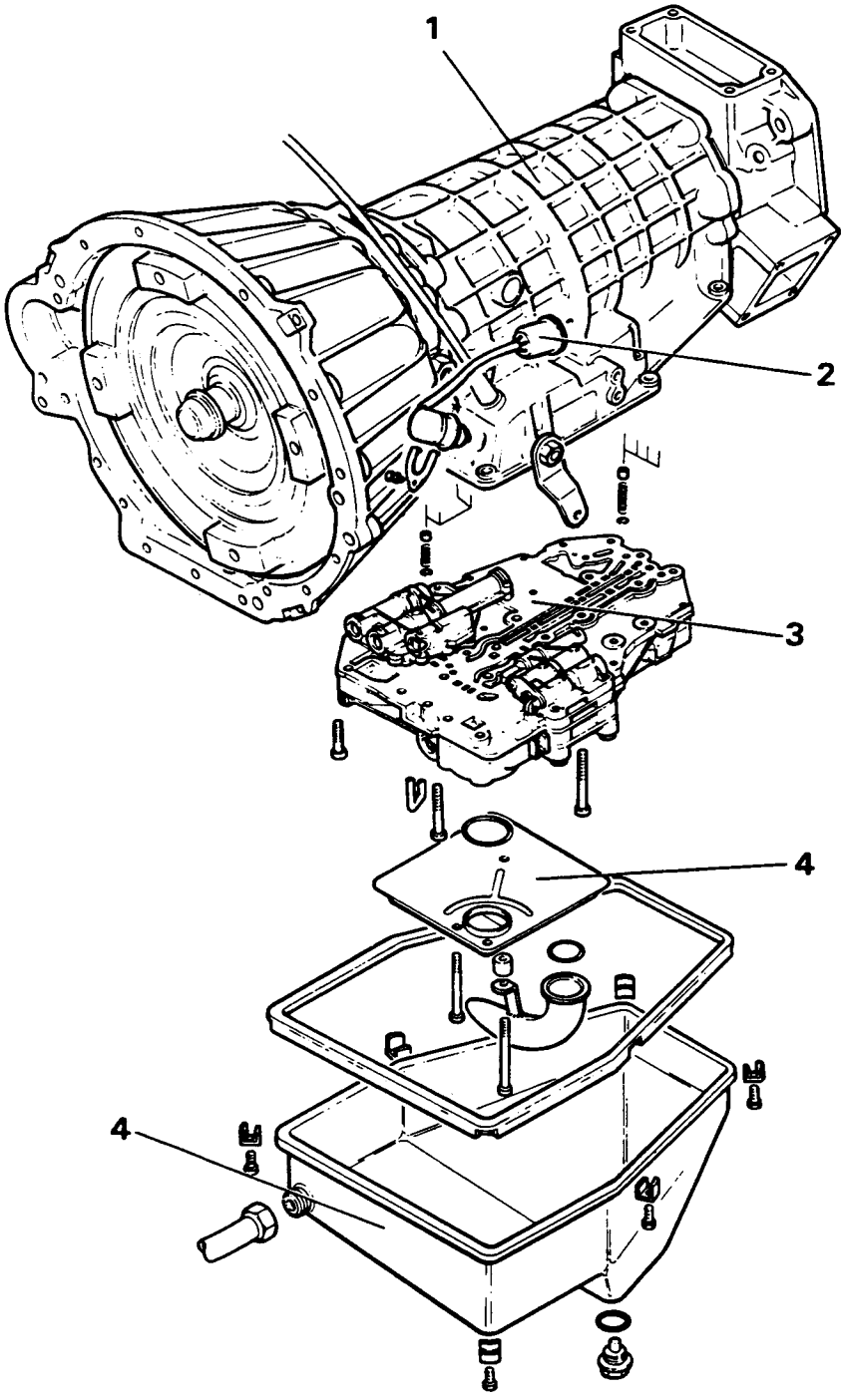
TRANSFER AND AUTOMATIC GEARBOX ADAPTOR PLATE

NOTE: The fixture below can either be manufactured or purchased; fixture number LST 118.



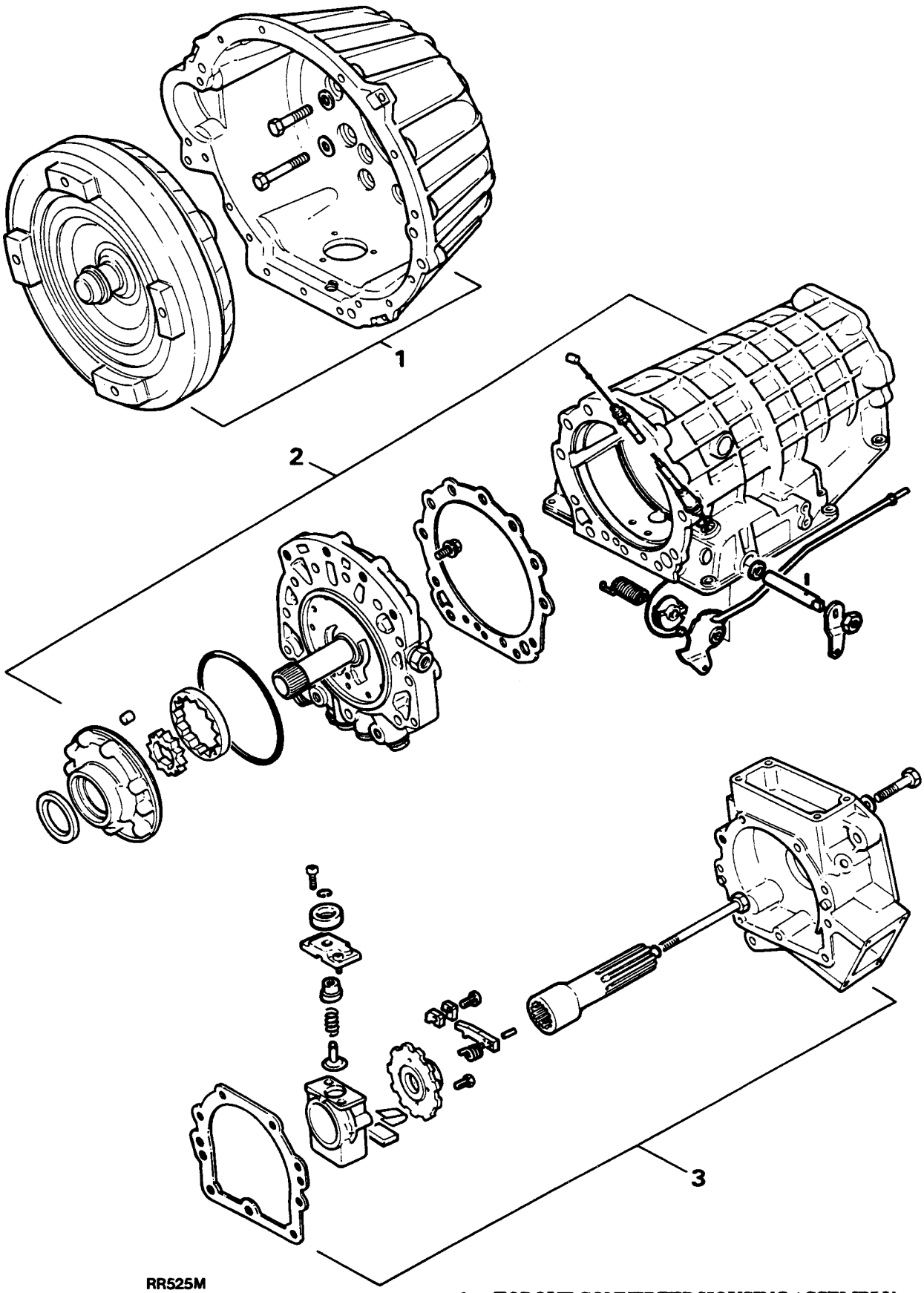
AUTOMATIC GEARBOX HOLDING FIXTURE





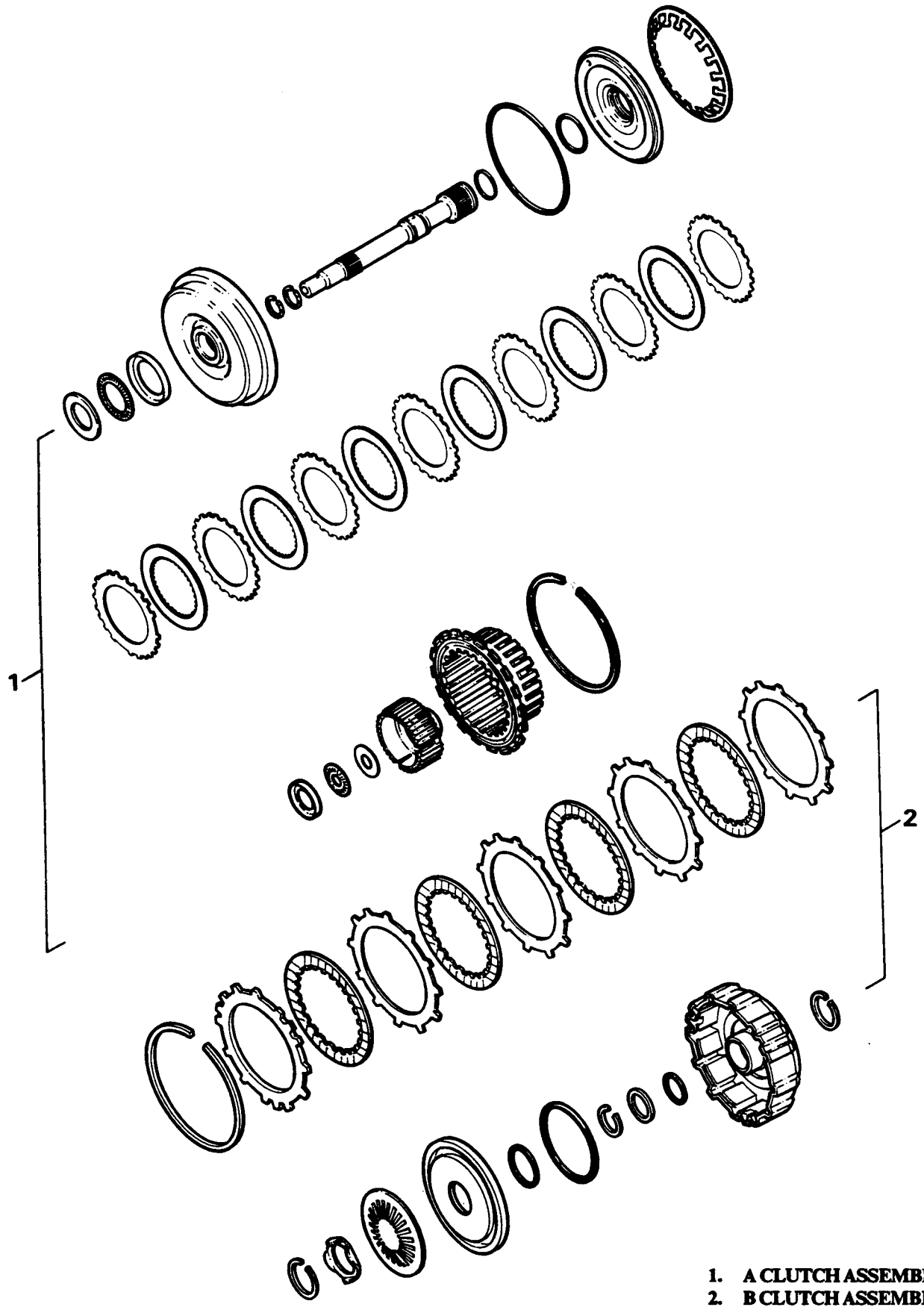
RR524M

1. GEARBOX ASSEMBLY
2. INHIBITOR SWITCH ASSEMBLY
3. CONTROL UNIT ASSEMBLY
4. FILTER AND SUMP ASSEMBLY



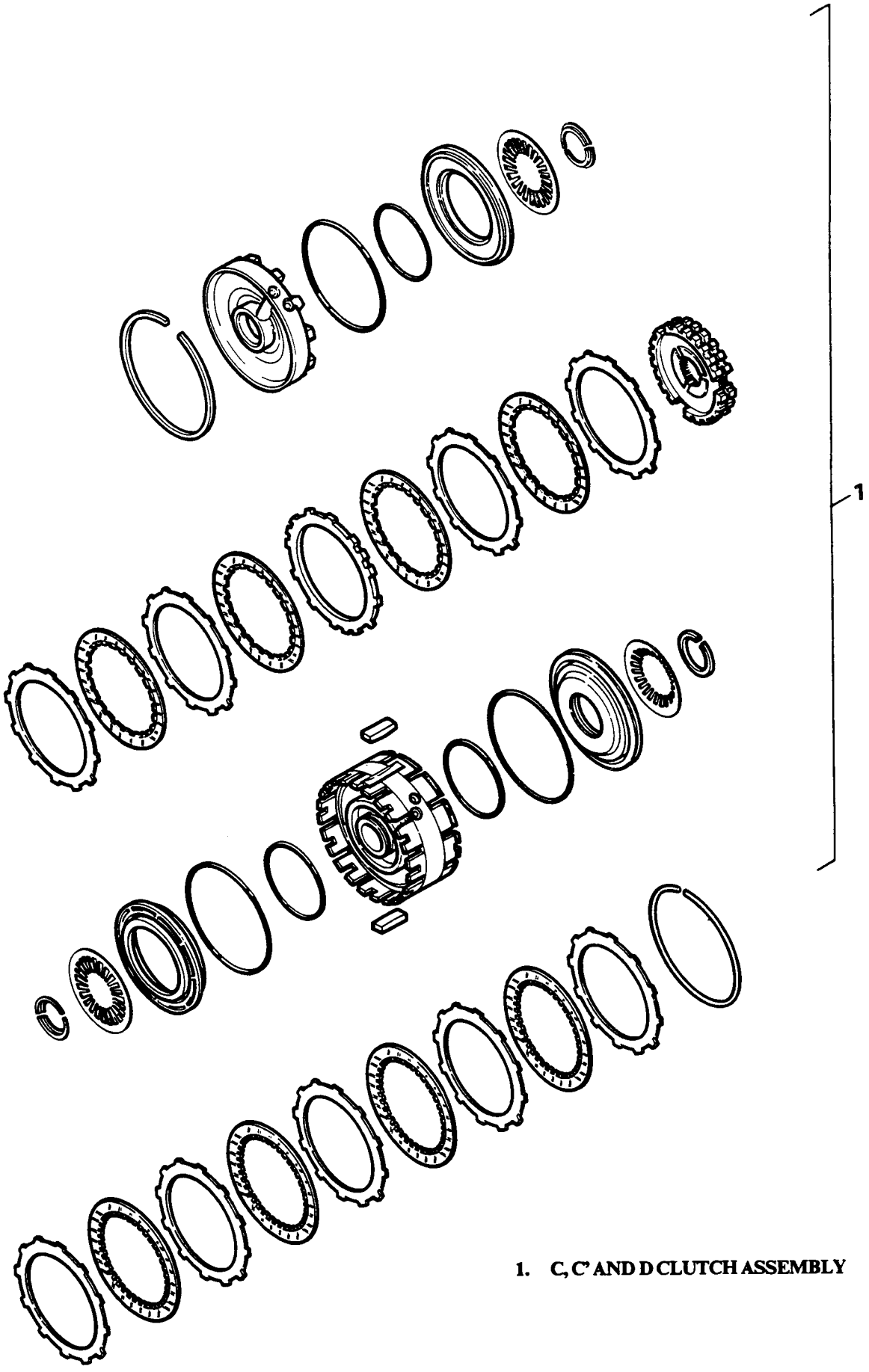
RR525M

1. TORQUE CONVERTER HOUSING ASSEMBLY
2. GEARBOX PUMP AND CASING ASSEMBLY
3. GOVERNOR AND ADAPTOR HOUSING ASSEMBLY



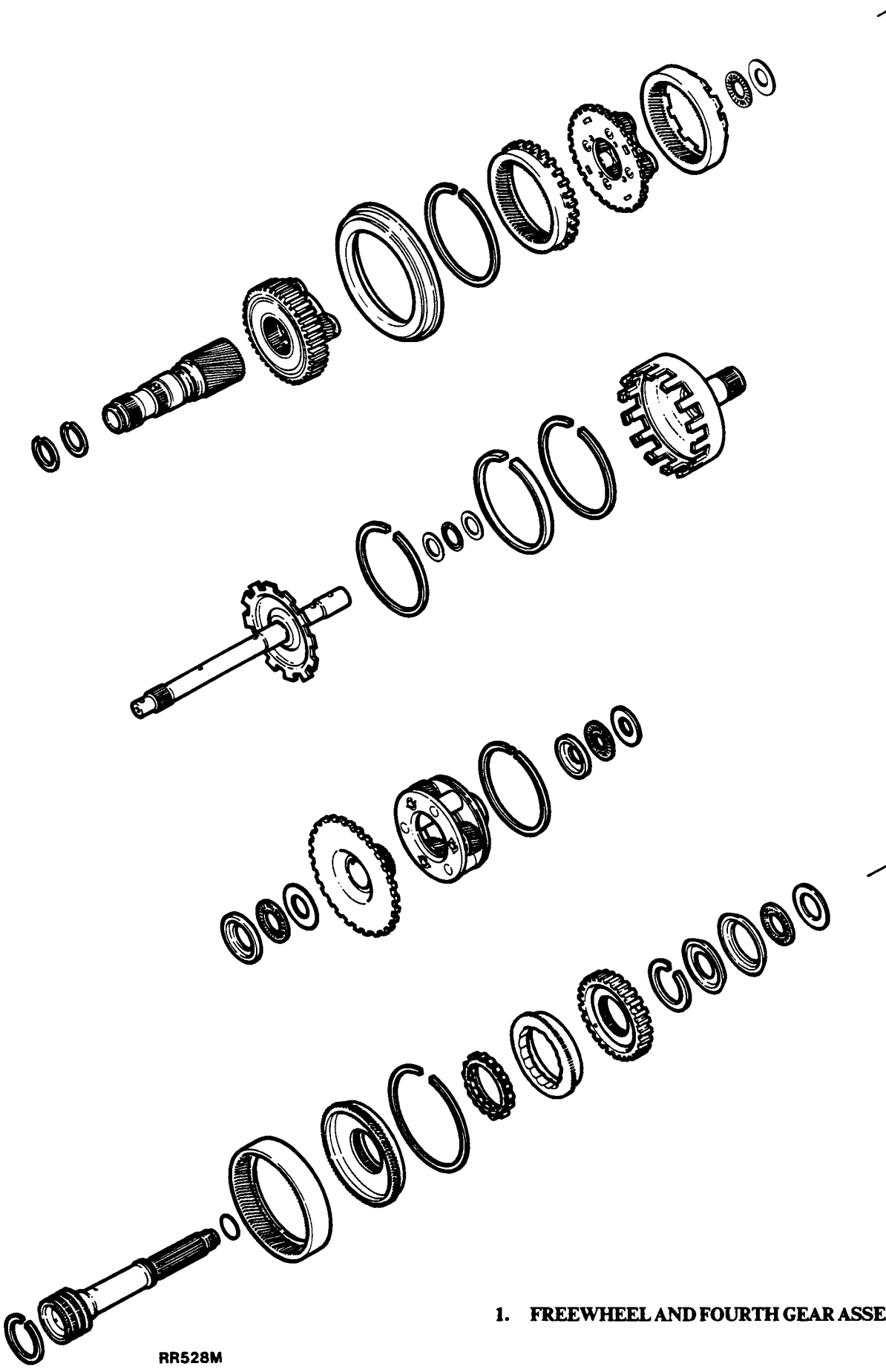
1. A CLUTCH ASSEMBLY
2. B CLUTCH ASSEMBLY

RR526M

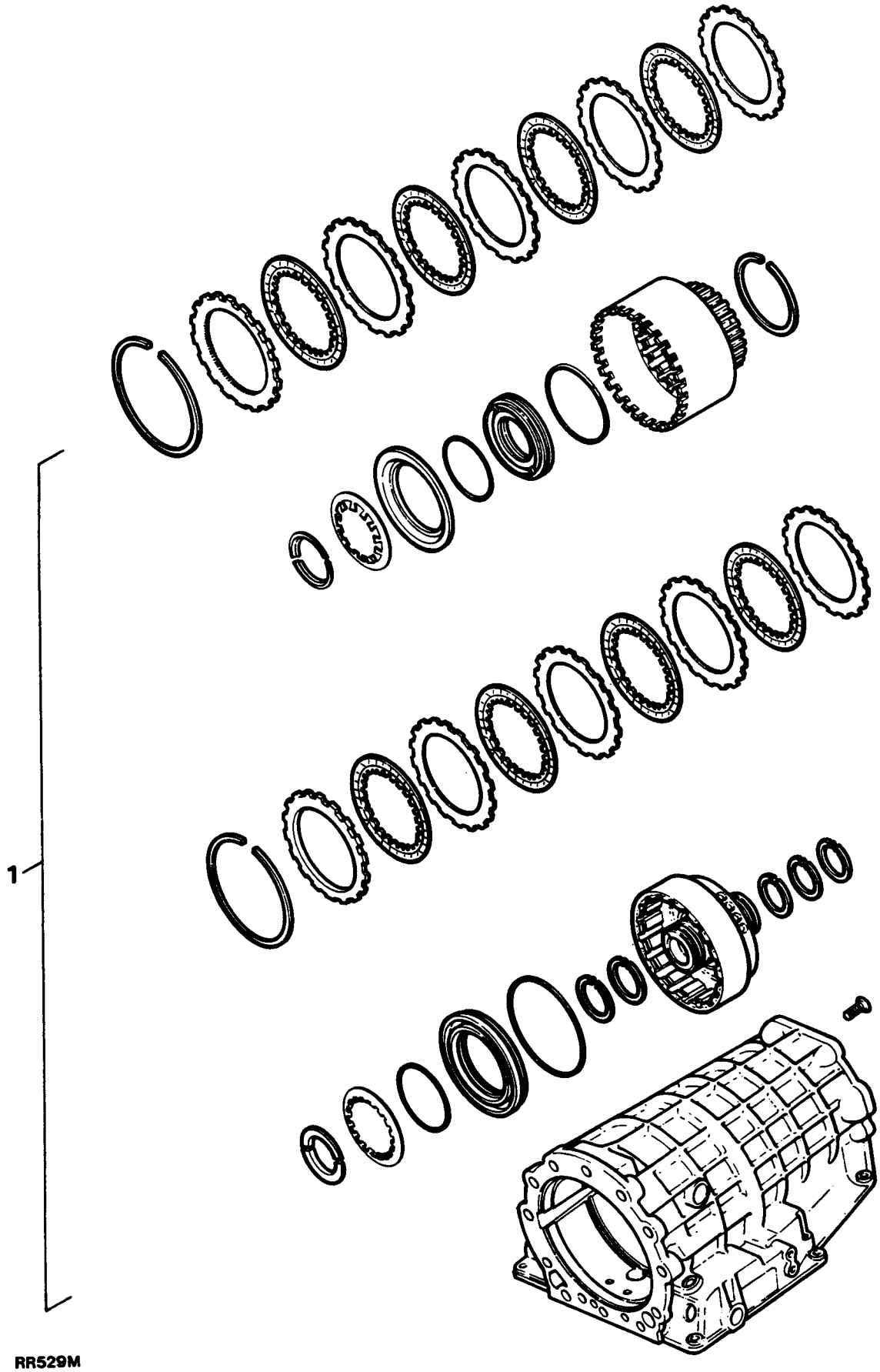


1. C, C' AND D CLUTCH ASSEMBLY

RR527M



1. FREEWHEEL AND FOURTH GEAR ASSEMBLY

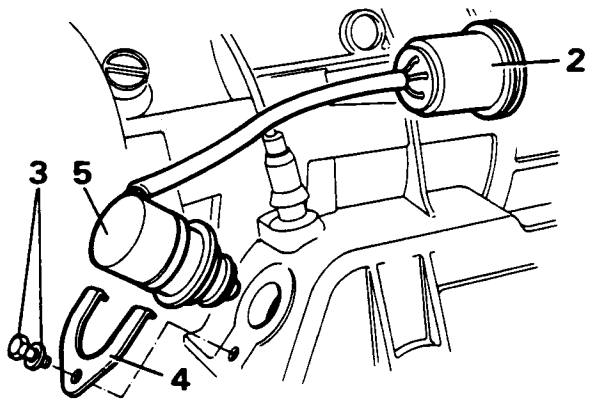


1. E AND F CLUTCH ASSEMBLY

STAGE I

Inhibitor switch leak elimination and replacement

1. Place vehicle on a ramp or over a pit, open the bonnet and disconnect the battery leads.
2. From underneath the vehicle disconnect the inhibitor lead.
3. Undo and remove the bolt and spring washer.
4. Remove the retaining plate.
5. Using a suitable tool remove the inhibitor switch from the casing.
6. Fit a new inhibitor switch, retaining plate if existing one is damaged, spring washer and bolt.
7. Reconnect the inhibitor leads.

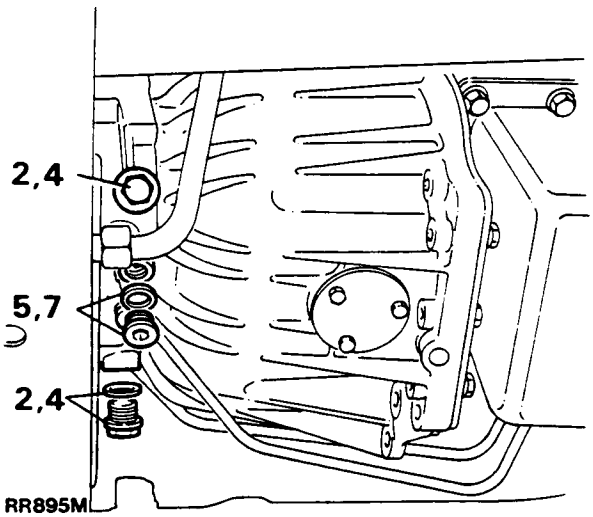


RR579M

Intermediate plate screw plugs leak elimination

NOTE: The following procedure is for all four plugs on the plate. Only one of these plugs may be leaking therefore the procedure will only apply to that particular plug or plugs if more than one are faulty.

1. Place the vehicle on a ramp or over a pit, open the bonnet and disconnect the battery leads.
2. From underneath the vehicle, using a suitable spanner remove the two hexagon headed plugs situated in the intermediate plate, catching any oil that may leak from the plate.

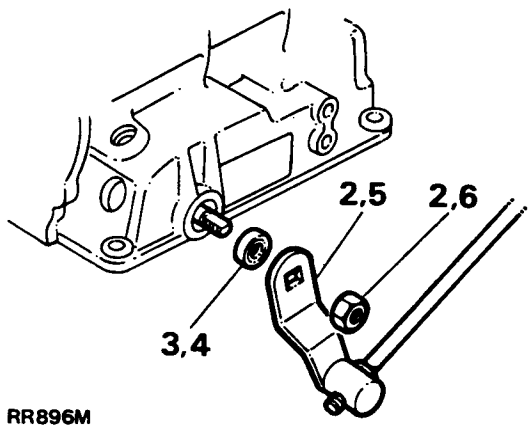


RR895M

3. Remove and discard the sealing rings.
4. Fit new sealing rings and refit the plugs to the specified torque.
5. Using a suitable hexagon shaped tool, remove the two hexagon socket plugs, catching any oil that may leak from the plate.
6. Remove and discard the sealing rings.
7. Fit new sealing rings and refit the plugs to the specified torque.
8. Connect the battery.
9. Top up the gearbox with the correct oil through the filler level tube located within the engine bay. (See Data section.)
10. Ensuring the vehicle is on level ground with the hand-brake applied check oil level while engine is running at idle with neutral selected after selecting each gear.

Selector shaft leak elimination

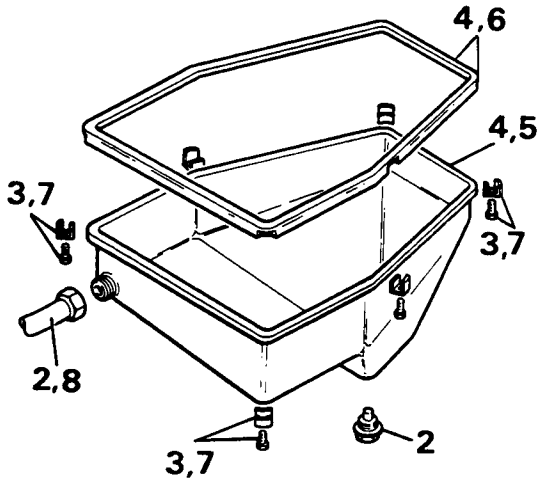
1. Place vehicle on a ramp or over a pit, open the bonnet and disconnect the battery leads.
2. From underneath the vehicle remove the nut and gear-change lever.
3. Using a suitable tool remove the oil seal.
4. Fit the new oil seal using the selector shaft oil seal replacer LST 114. For ease of fitment use a light grease or vaseline.
5. Refit gear-change lever, ensure that it is located correctly.
6. Fit and tighten nut to the specified torque.



RR896M

Oil pan leak elimination and replacement

1. Place vehicle on a ramp or over a pit open the bonnet and disconnect battery leads.
2. From underneath the vehicle drain the gearbox using a suitable container and remove the oil filler level tube.
3. Remove the six retaining plates and bolts.
4. Remove the oil pan and discard the gasket.
5. Inspect oil pan for wear or damage. Replace if necessary.
6. Fit new gasket onto oil pan.
7. Refit oil pan using the six retaining plates and screws (two straight and four corner plates).

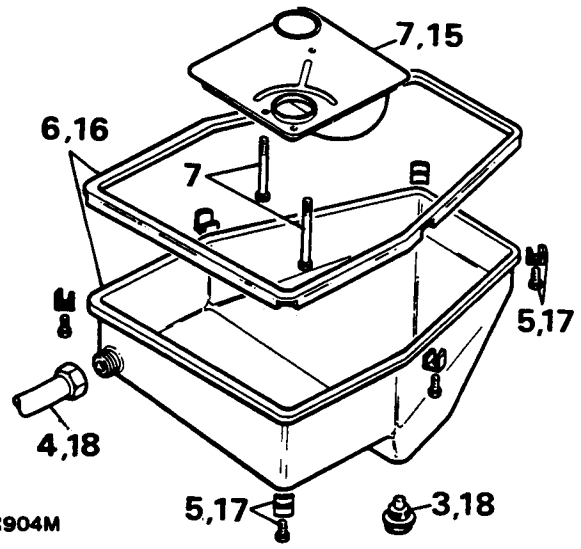


RR903M

8. Reconnect oil filler level tube, oil pan plug with a new seal.
9. Connect the battery leads.
10. Fill the gearbox with the correct oil. (See data section.)
11. Ensuring the vehicle is on level ground with the handbrake applied check oil lever while engine is running at idle with neutral selected after selecting each gear.
    NOTE: If leak persists and old oil pan has been refitted, change the oil pan using the same procedure as above.

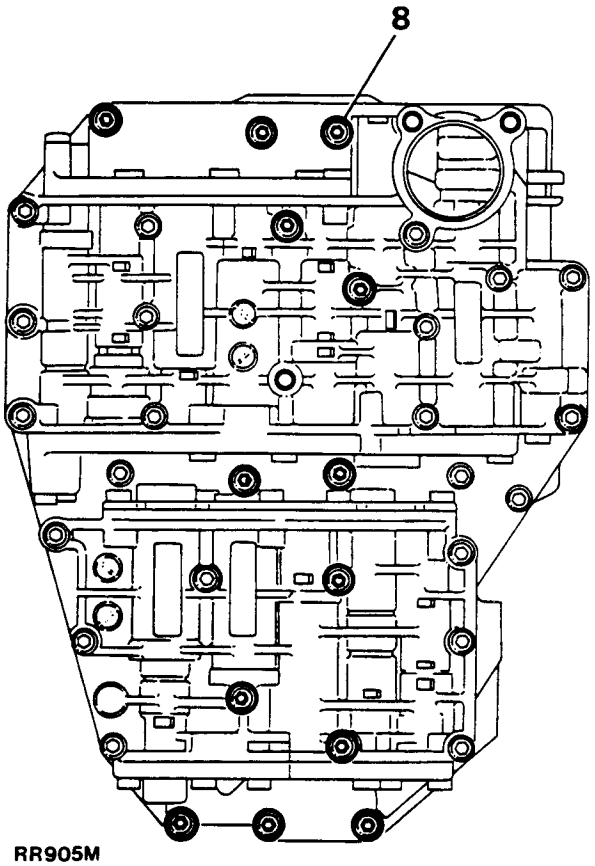
Kickdown cable leak elimination

1. Place the vehicle on a ramp or over a pit, open the bonnet and disconnect the battery leads.
2. Disconnect the kickdown cable from the rear of the engine.
3. From underneath the vehicle, using a suitable container drain the gearbox and discard the gearbox oil pan seal.
4. Remove the oil filler level tube.
5. Remove the six retaining plates and bolts.
6. Remove the oil pan and discard the gasket.



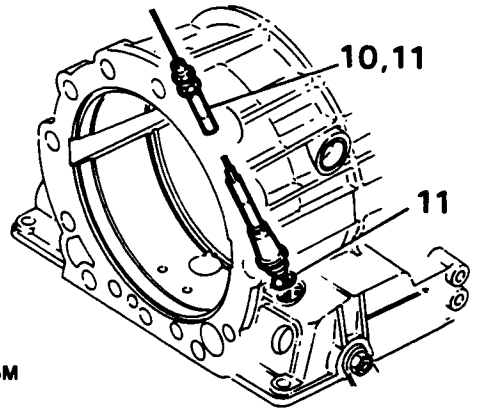
RR904M

7. Remove the oil screen, undoing the three bolts using a TX27 Torx bit.
8. Remove the control unit, undoing the thirteen remaining bolts using a TX27 Torx bit.



RR905M

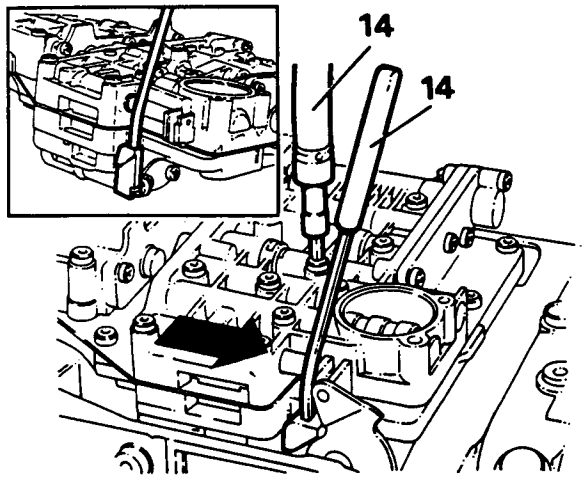
9. Locate the selector cam and remove the nipple holding the kickdown cable from it's seat.
10. Using the kickdown cable remover LST112 remove the cable and it's housing from the casing and discard.
11. Fit new throttle cable with new 'O' ring into the casing.



RR906M

12. Fit the nipple into the cam seat ensuring that the cam has been turned once before fitment. This will spring load the cam.
13. Fit the control unit after cleaning the face with a lint free rag, ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.

14. Place the selector linkage setting gauge LST109 in position and gently press the control unit against the tool and tighten all thirteen bolts using TX27 torx bit to the specified torque.

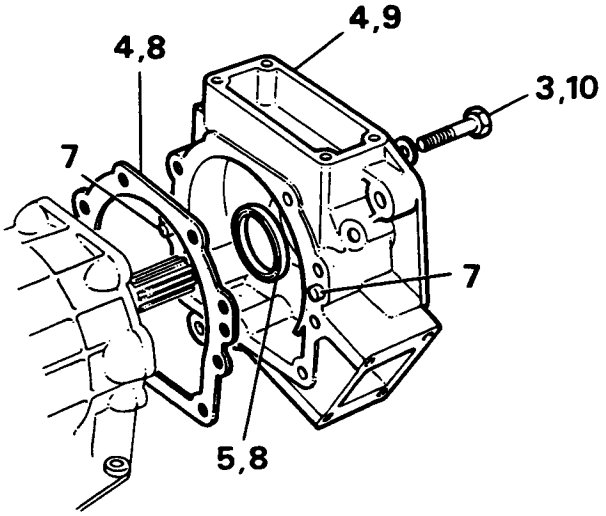


RR907M

15. Remove setting gauge and fit oil screen using TX27 torx bit to the specified torque.
16. Refit oil pan with new gasket.
17. Refit the six retaining plates and screws (two straight and four corner plates).
18. Reconnect oil filler tube and oil pan, plug with a new seal.
19. Connect the battery leads.
20. Fill the gearbox with the correct oil (see 'Data section').
21. Connect the kickdown cable to the rear of the engine.
22. Adjust the outer cable to achieve a crimp gap of 0,25 to 1,25mm (.006 to .031 in).
23. Hold the outer cable while tightening the locknuts. **NOTE: The kickdown cable must be adjusted while the vehicle is running at idle.**
24. Ensuring the vehicle is on level ground with the handbrake applied, check oil level while engine is running at idle with neutral selected, after selecting each gear.

Extension case leak elimination and replacement

1. Remove the transfer box as described in section 37.
2. Using a suitable tool release the four bolts from inside the vehicle holding the transfer gear selector housing and adaptor bracket.
3. From underneath the vehicle using a suitable tool release the nine bolts holding the extension housing.
4. Remove the extension housing and discard the gasket.
5. Place extension housing on the bench and remove the oil seal.
6. Ensure that all the surfaces are clean and the case is free from damage. If damage has been found on the case, replace the case.
7. If the case has to be replaced, fit the two dowels to the case.
8. Fit a new gasket and oil seal using the rear oil seal replacer LST108.

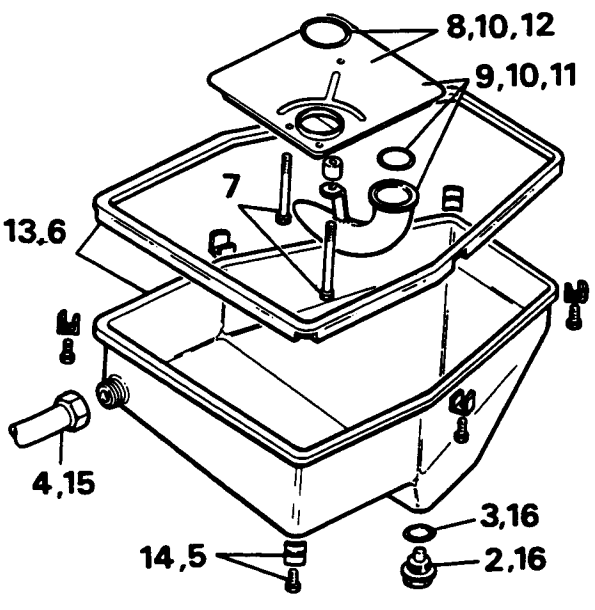


RR908M

9. Fit the extension case onto the gearbox ensuring the oil seal does not get damaged by the extension shaft.
10. Fit and tighten the nine bolts to the specified torque.
11. From inside the vehicle refit the four bolts which hold the transfer gear selector housing and adaptor bracket.
12. Secure the four bolts to the specified torque.
13. Refit the transfer box as described in section 37.

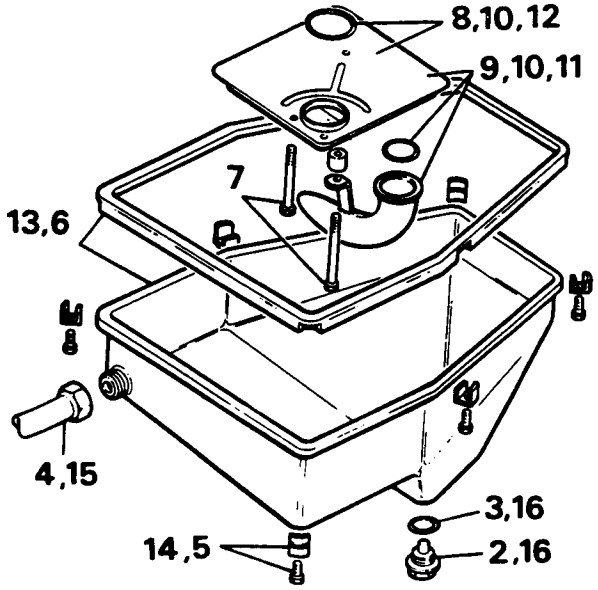
Oil Screen Replacement

1. Place the vehicle on a ramp or over a pit, open the bonnet and disconnect the battery leads.
2. From underneath the vehicle drain the gearbox using a suitable container.
3. Discard the oil pan plug seal ring.
4. Remove the filler/level tube from the oil pan.
5. Remove the six retaining plates and bolts.
6. Remove the oil pan and discard the gasket.
7. Using TX27 torx bit undo the three screws which hold the oil screen.



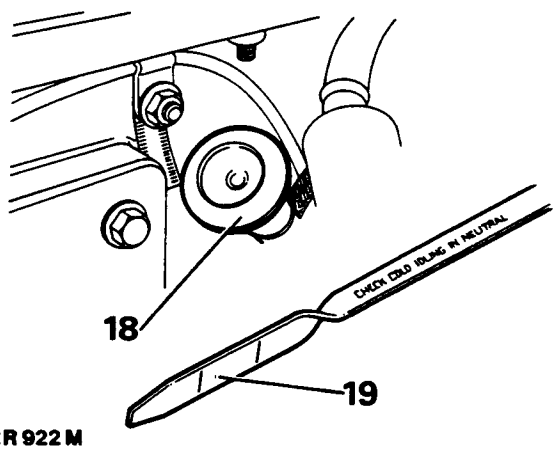
RR691M

8. Remove the oil screen and discard the 'O' rings.
9. Separate the oil screen from the suction tube and discard the 'O' ring and oil screen.



RR691M

10. Fit two new 'O' rings to the oil screen using a light grease for ease of assembly.
11. Fit the suction tube to the oil screen.
12. Fit the oil screen to the control unit and secure with three bolts using TX27 torx bit tighten to the specified torque.
13. Refit the oil pan using a new gasket.
14. Secure using the six retaining plates and bolts (two straight and four corner plates), tighten to the specified torque.

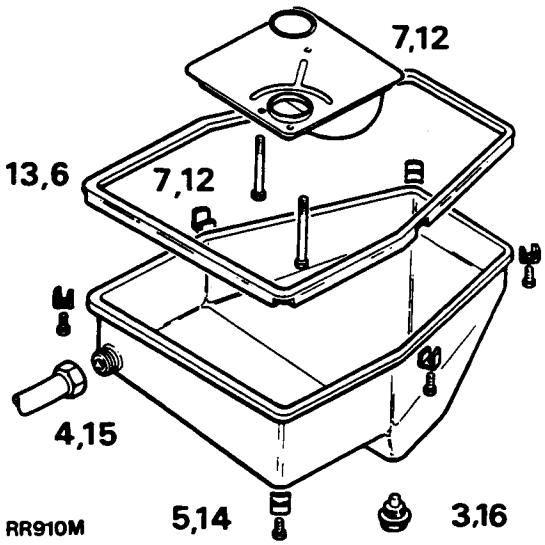


RR922M

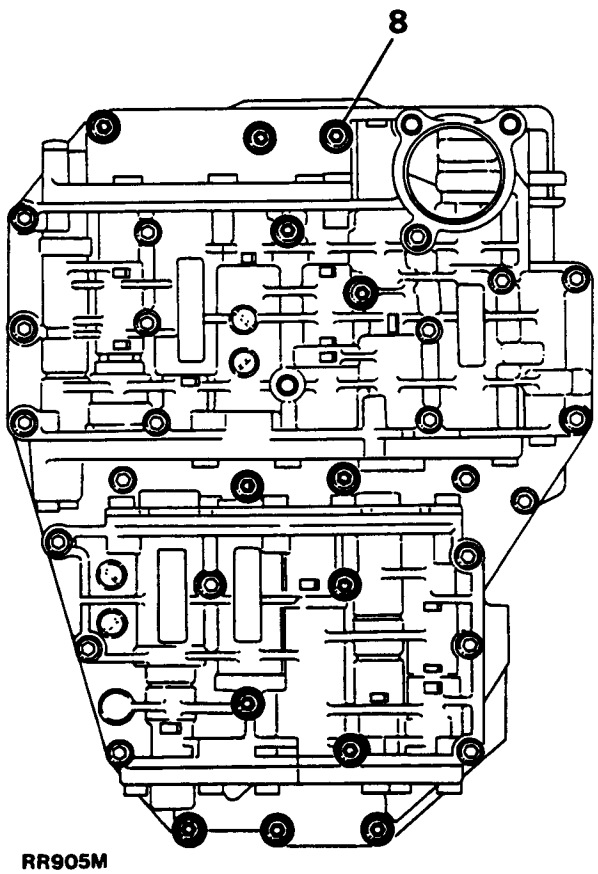
15. Reconnect the oil level/filler tube.
16. Fit oil pan plug using a new seal.
17. Connect the battery leads.
18. Fill the gearbox with the correct oil through the filler/level tube located within the engine bay. (See Data section.)
19. Ensuring the vehicle is on level ground with the hand-brake applied, check oil level while engine is running at idle with neutral selected.

Control Unit Replacement

1. Place the vehicle on a ramp or over a pit, open the bonnet and disconnect the battery leads.
2. From underneath the vehicle drain the gearbox using a suitable container.
3. Discard the oil pan plug seal ring.
4. Remove the oil filler/level tube from the oil pan.
5. Remove the six retaining plates and bolts.
6. Remove the oil pan and discard the gasket.
7. Using a TX27 torx bit undo the three bolts which hold the oil screen.

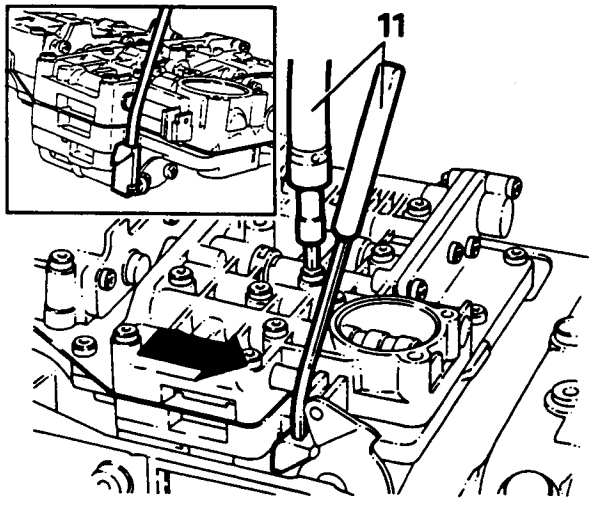


RR910M



RR905M

8. Using a TX27 torx bit undo the remaining thirteen bolts retaining the control unit.
9. Clean the surfaces ensuring no damage has occurred to the mounting face of the case, using a lint-free rag.
10. Fit the new control unit ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.
11. Place the selector linkage setting gauge LST 109 in position and gently press the control unit against the tool and tighten all thirteen bolts using TX27 torx bit to the specified torque.

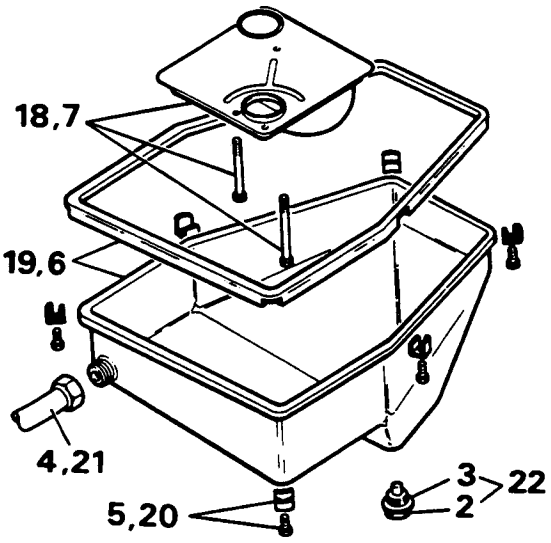


RR585M

12. Remove the setting gauge and fit the oil screen using TX27 torx bit to the specified torque.
13. Refit the oil pan using a new gasket.
14. Secure with the six retaining plates and bolts (two straight and four corner plates), tighten to the specified torque.
15. Reconnect the oil filler/level tube.
16. Fit oil pan plug using a new seal.
17. Connect the battery leads.
18. Fill the gearbox with the correct oil through the filler/level tube located within the engine bay. (See 'Data' section.)
19. Ensuring the vehicle is on level ground with the hand-brake applied, check oil level while engine is running at idle with neutral selected, after selecting each gear.

Oil Inlet Sealing Rings Renewal

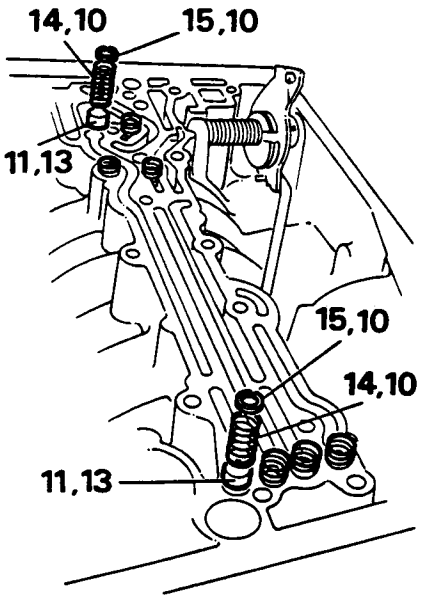
1. Place the vehicle on a ramp or over a pit, open the bonnet and disconnect the battery leads.
2. From underneath the vehicle drain the gearbox using a suitable container.
3. Discard the oil pan plug seal ring.
4. Remove the oil filler/level tube from the oil pan.
5. Remove the six retaining plates and bolts.
6. Remove the oil pan and discard the gasket.
7. Using a TX27 torx bit undo the three bolts which hold the oil screen.



RR913M

8. Using a TX27 torx bit undo the remaining thirteen bolts retaining the control unit and remove the control unit.
9. Clean the surfaces ensuring no damage has occurred to the mounting face of the case, using a lint-free rag.
10. Using circlip pliers remove the eight circlips and springs from the gearbox.
11. Using control unit inlet oil seals remover/replacer LST 113 remove the eight oil seals.
12. Clean the orifices and check for damage.

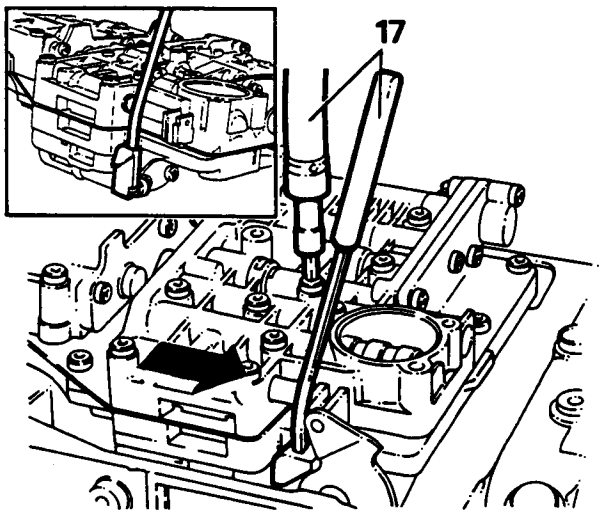
NOTE: If damage has occurred replace the box as described in Stage II.



RR580M

13. Using the control unit inlet oil seal remover/replacer LST 113 fit the new seals ensuring they are seated fully home.

14. Fit the eight compression springs, the four short ones at the front and the four long ones at the rear of the box.
15. Using the circlip pliers fit the eight circlips which retain the compression springs.
16. Fit the control unit ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.
17. Place the selector linkage setting gauge LST 109 in position and gently press the control unit against the tool and tighten all thirteen bolts using TX27 torx bit to the specified torque.



RR909M

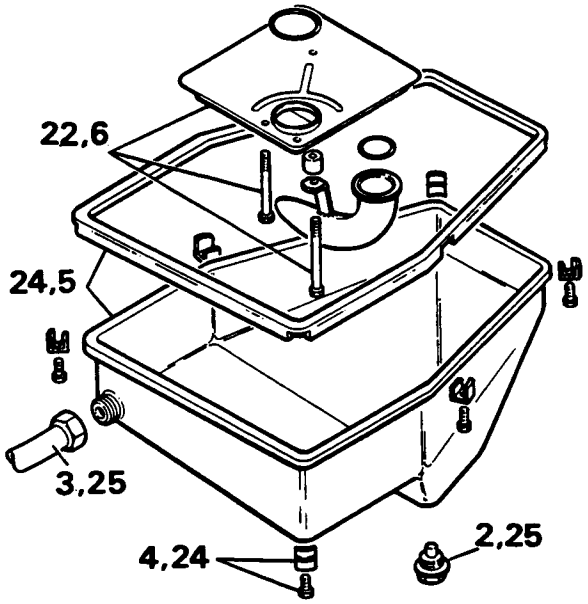
18. Remove the setting gauge and fit the oil screen using TX27 torx bit to the specified torque.
19. Refit the oil pan using a new gasket.
20. Secure with the six retaining plates and bolts (two straight and four corner plates), tighten to the specified torque.

21. Reconnect the oil filler/level tube.
22. Fit oil pan plug using a new seal.
23. Connect the battery leads.
24. Fill the gearbox with the correct oil through the filler/level tube located within the engine bay. (See 'Data' section.)
25. Ensuring the vehicle is on level ground with the hand-brake applied, check oil level while engine is running at idle with neutral selected, after selecting each gear.

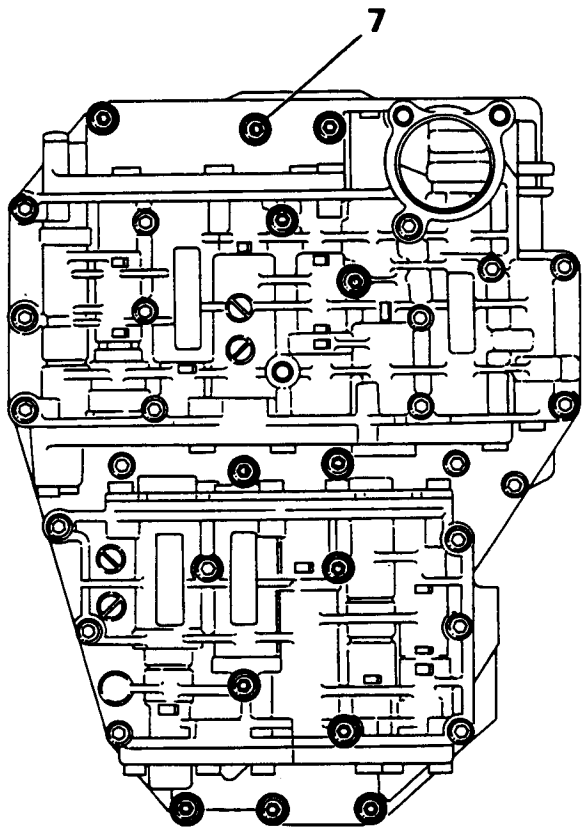
Manual Valve Operating Mechanism

1. Place the vehicle on a ramp or over a pit, open the bonnet and disconnect the battery leads.
2. From underneath the vehicle, using a suitable container drain the gearbox and discard the gearbox oil pan seal.
3. Remove the oil filler level tube.
4. Remove the six retaining plates and bolts.
5. Remove the oil pan and discard the gasket.
6. Remove the oil screen, undoing the three bolts using a TX27 torx bit.

7. Remove the control unit, undoing the thirteen remaining bolts using a TX27 torx bit.



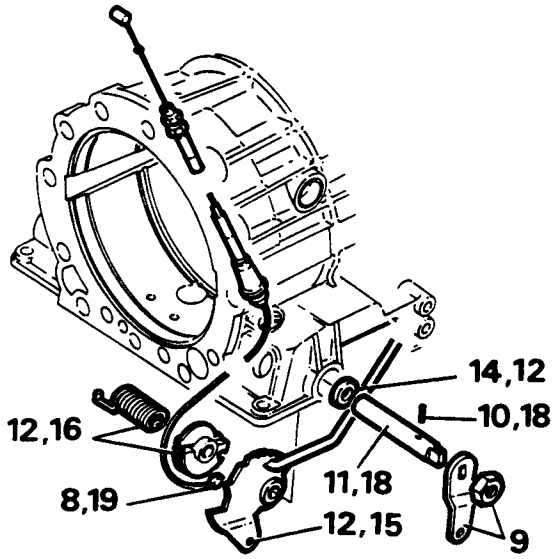
RR582M



RR914M

8. Locate the selector cam and remove the nipple holding the kick-down cable from its seat.
9. Remove the nut and gear change lever.
10. Using a suitable punch drift out the roll pin from the selector shaft and discard it.
11. Using a suitable tool remove the selector shaft from the box, noting the position of the detent plate.

12. Remove the connecting rod complete with detent plate; accelerator cam, spring and using a suitable tool remove the oil seal and discard.
13. Check all parts for wear or damage and replace as necessary.

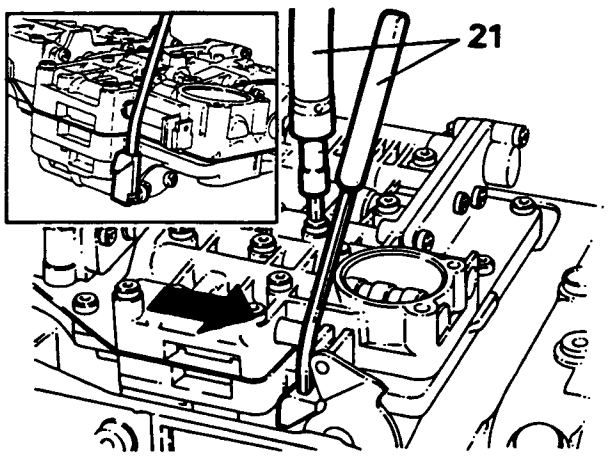


RR581M

14. Using selector shaft oil seal replacer LST114, fit the oil seal. For ease of fitment use a light grease or vaseline.
15. Fit connecting rod to detent plate and locate in the box by pushing the selector shaft through from outside of the casing.

NOTE: The detent plate should go back into the box in the same position as noted earlier.

16. Fit the accelerator cam with the spring.
17. Fit the assembly into the box and secure it by pushing the selector shaft through.
18. Align the hole in the selector shaft with the hole in the detent plate and secure with a new roll pin, using a suitable punch.



RR917M

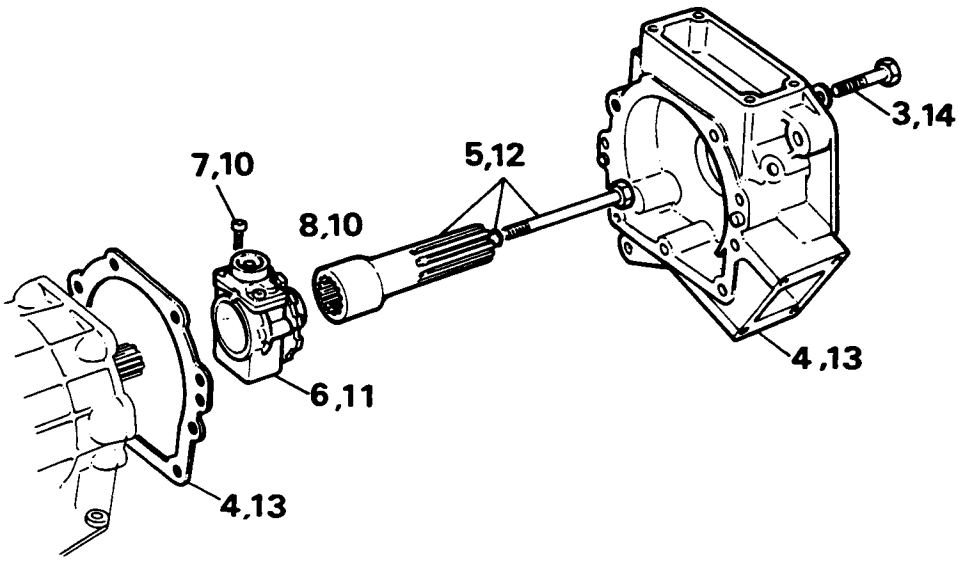
19. Fit kickdown cable nipple into the cam seat ensuring that the cam has been turned once before fitment. This will spring load the cam.
20. Fit the control unit ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.
21. Place the selector linkage setting gauge LST109 in position and gently press the control unit against the tool and tighten all thirteen bolts using TX27 torx bit to the specified torque.
22. Remove the setting gauge and fit oil screen using TX27 torx bit to the specified torque.
23. Refit the oil pan with a new gasket.
24. Refit the six retaining plates and screws (two straight and four corner plates).
25. Reconnect the oil filler/level tube, oil pan plug with new seal.
26. Connect the battery leads.
27. Fill the gearbox with the correct oil. (See Data section.)
28. Ensuring the vehicle is on level ground with the handbrake applied, check oil level while engine is running at idle with neutral selected, after selecting each gear.

Governor Housing Renewal

1. Remove the transfer box as described in section 37.
2. Using a suitable tool release the four bolts from inside the vehicle holding the transfer gear selector housing and adaptor bracket.
3. From underneath the vehicle using a suitable tool release the nine bolts holding the extension housing.
4. Remove the extension housing ensuring that the seal is not damaged and discard the gasket.
5. Remove the extension shaft and retaining bolt with 'O' ring.
6. Remove the governor assembly with parking wheel.
7. Remove the two screws holding the governor housing using TX27 torx bit.
8. Remove the governor housing complete and discard.
9. Inspect the governor hub and parking wheel for damage, if satisfactory, clean.
10. Fit new governor housing complete to governor hub and parking wheel using TX27 torx bit to the specified torque.
11. Refit the governor assembly with parking wheel onto the output shaft and push the assembly till fully seated.

    NOTE: To avoid damage to 'O' ring use a light grease or vaseline. Ensure the seal rings are snapped together and are seated correctly.

12. Fit the extension shaft and retaining bolt using a new 'O' ring.
13. Fit new gasket onto rear of gearbox and fit the extension housing, taking care not to damage the seal on assembly.
14. Secure the extension housing using the nine bolts to the specified torque.
15. From inside the vehicle refit the four bolts which retain the transfer gear selector housing and adaptor bracket.
16. Secure the four bolts to the specified torque.
17. Refit the transfer box as described in section 37.



RR586M

Governor Hub Renewal

1. Remove the transfer box as described in section 37.
2. Using a suitable tool release the four bolts from inside the vehicle holding the transfer gear selector housing and adaptor bracket.
3. From underneath the vehicle using a suitable tool release the nine bolts holding the extension housing.
4. Remove the extension housing ensuring that the seal is not damaged and discard the gasket.
5. Remove the extension shaft and retaining bolt with 'O' ring.
6. Remove the governor assembly with parking wheel.
7. Remove the two screws holding the governor housing using TX27 torx bit.
8. Using a TX27 torx bit unscrew the two bolts and remove the parking wheel and discard governor hub.
9. Remove the security clip and counter-weight.
10. Remove the 'O' ring from off the output shaft and discard.
11. Remove the three seal rings from the 'F' clutch housing shaft.
12. Inspect all parts for damage or wear, replace if necessary.

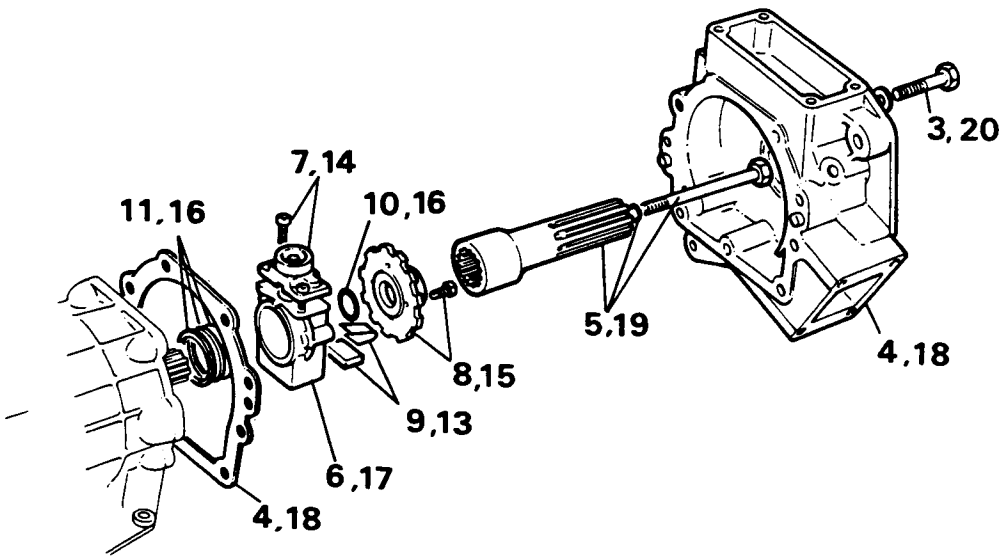
13. Fit the counterweight and security clip into the new governor hub.
14. Secure governor housing onto governor hub using TX27 torx bit to the specified torque.
15. Fit the parking wheel to the governor hub using TX27 torx bit to the specified torque.
16. Fit three new seal rings onto the F clutch housing shaft and fit 'O' ring onto output shaft.

    NOTE: For ease of fitment of the 'O' ring use a light grease or vaseline.

17. Fit governor assembly and parking wheel onto the output shaft and push the assembly till fully seated.

    NOTE: To avoid damage to 'O' ring use a light grease or vaseline. Ensure the seal rings are snapped together and are seated correctly.

18. Fit new gasket onto rear of gearbox and fit the extension housing taking care not to damage the seal or assembly.
19. Fit the extension shaft and retaining bolt using a new 'O' ring.
20. Secure the extension housing using the nine bolts to the specified torque.
21. From inside the vehicle refit the four bolts which retain the transfer gear selector housing and adaptor bracket. Secure the four bolts to the specified torque. Refit the transfer box as described in section 37.



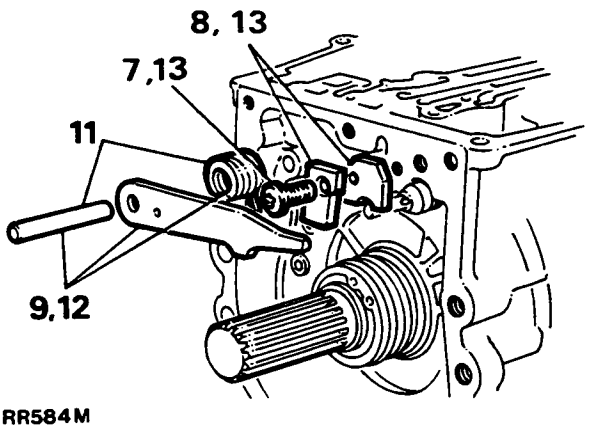
RR919M

Parking Brake Mechanism Renewal

1. Remove the transfer box as described in section 37.
2. Using a suitable tool, release the four bolts from inside the vehicle holding the transfer gear selector housing and adaptor bracket.
3. From underneath the vehicle, using a suitable tool, release the nine bolts holding the extension housing.
4. Remove the extension housing ensuring that the seal is not damaged and discard the gasket.
5. Remove the extension shaft and retaining bolt with 'O' ring.
6. Remove the governor assembly with parking wheel.
7. Remove guide plate bolt, using TX27 torx bit.
8. Remove the plate and guide plate from the gearbox case.
9. Remove the pin, pawl and the spring.

   NOTE: Take care when removing park assembly as spring tension will be reduced.

10. Inspect all parts for wear or damage and replace if necessary.



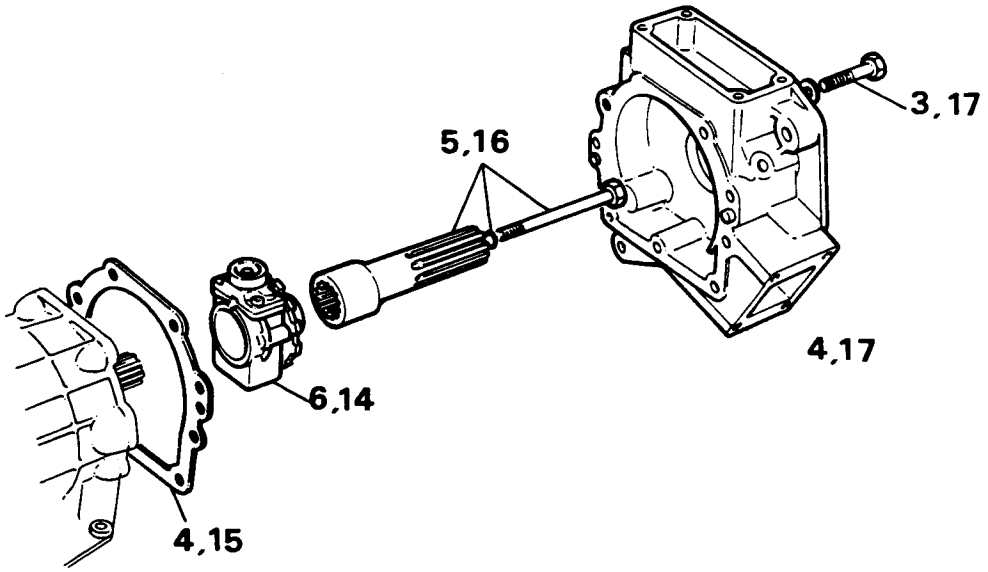
RR584M

11. Fit the pin and the leg spring ensuring that the spring is located correctly.
12. Fit the pawl onto the pin and the spring leg into the hole in the pawl. This creates tension in the spring.
13. Fit the plate and guide plate using TX27 torx bit to the specified torque.

14. Refit the governor assembly with parking wheel onto the output shaft and push the assembly till fully seated.

    NOTE: To avoid damage to 'O' ring use a light grease or vaseline. Ensure the seal rings are snapped together and are seated correctly.

15. Fit new gasket onto rear of gearbox and fit the extension housing, taking care not to damage the seal or assembly.
16. Fit the extension shaft and retaining bolt using a new 'O' ring.
17. Secure the extension housing using the nine bolts to the specified torque.
18. From inside the vehicle refit the four bolts which retain the transfer gear selector housing and adaptor bracket.
19. Secure the four bolts to the specified torque.
20. Refit the transfer box as described in section 37.



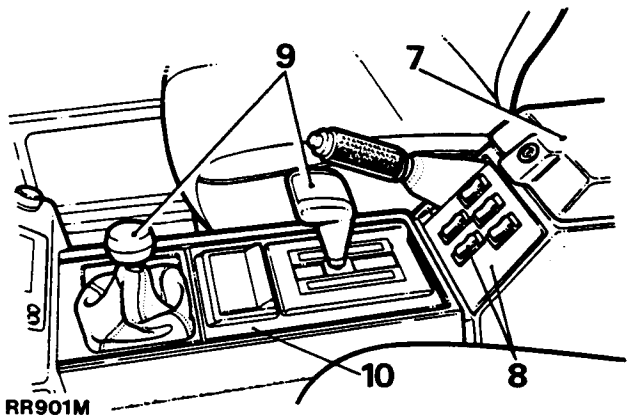
RR920M

STAGE II

ZF Gearbox—Remove and Refit

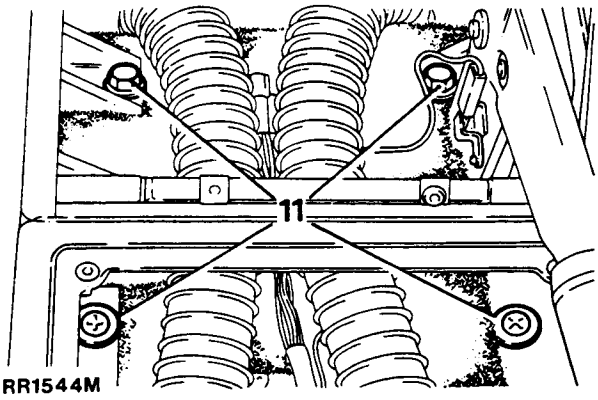
Removing

1. Install the vehicle on a hydraulic ramp.
2. Open the bonnet.
3. Disconnect the battery leads.
4. **Fuel Injection models only**—release the airflow meter to plenum chamber hose.
   Carburetter models only—Remove the air intake elbows and withdraw the air cleaner from its location.
5. Disconnect the kickdown cable from throttle linkages.
   Fuel injection models: located on the throttle lever bracketry at the rear of the plenum chamber.
   Carburetter models: located at the rear of the right-hand carburetter. Remove the transmission dipstick.
6. Remove the fan cowl from the radiator.
7. From inside the vehicle remove the four screws securing the cubby box liner to the cubby box and lift out the liner.
8. Carefully prise the window lift, switch panel away from the front of the cubby box. Identify each switch connection for reassembly, disconnect the plugs and remove the switch panel.
9. Remove the main and transfer gearbox knobs.
10. Carefully prise the centre panel out of the floor mounted console and remove it from the vehicle.



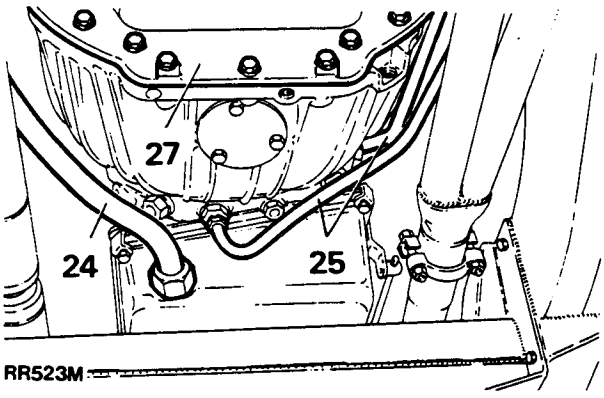
RR901M

11. Release the two bolts and two screws securing the console assembly to the gearbox tunnel.
12. Release the handbrake and remove the split pin, clevis pin and washer securing the handbrake cable to the handbrake lever.
13. Carefully manoeuvre the console assembly away from the radio housing and remove it from the vehicle.
14. Release the large nut retaining the handbrake outer cable to the top of the gearbox tunnel.
15. Remove the nut and feed the cable through the hole in the tunnel to the underside of the vehicle.
16. Raise the vehicle on the ramp and drain the gearbox.
17. Release the nut and clamp securing the speedometer cable to the rear of the transfer box.
18. Withdraw the cable from the speedometer drive pinnion.



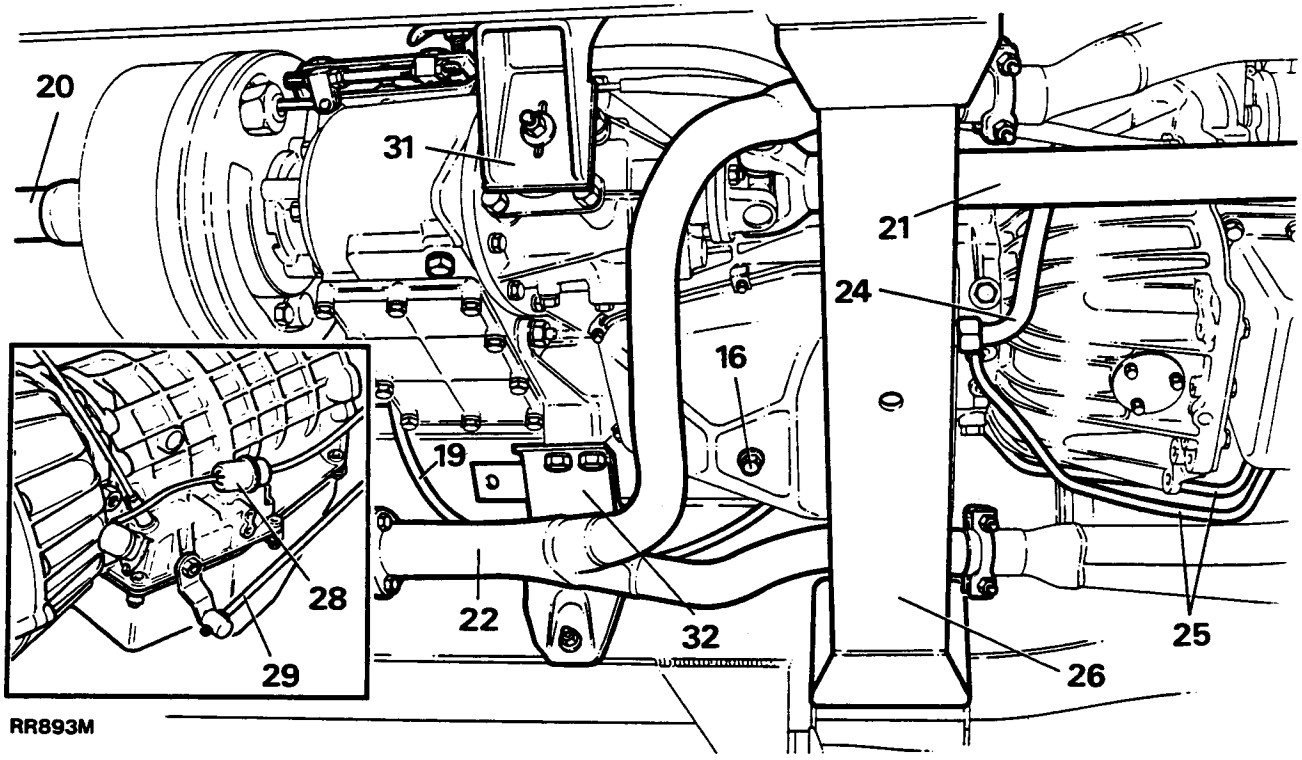
RR1544M

19. Release the cable from the clips at the side of the gearbox.
20. Release the four nuts and bolts securing the rear propeller to the rear output flange and tie the shaft to one side.
21. Remove the four nuts and bolts securing the front propeller shaft to the front output flange and tie the shaft to one side.
22. Release the nuts and bolts securing the front down-pipe to the front silencer.
23. Release the nut at the rear tailpipe bracket, disconnect the silencer from the downpipe, and tie the rear tail pipe and silencer to one side.
24. Disconnect the oil filler tube from the front of the gearbox oil pan.
25. Disconnect the two oil cooler pipes from the rear of the gearbox bellhousing.



RR523M

26. Remove the bolts securing the cross-member in position, using suitable equipment expand the chassis and withdraw the cross-member.
27. Remove the front cover from the bottom of the torque converter housing and from inside the housing remove the converter drive-bolts.
28. Disconnect the inhibitor switch.
29. Disconnect the selector linkage.
30. Manufacture an adaptor plate in accordance with the drawing (RR739M), to attach to the gearbox hoist and transfer box to facilitate removal.
31. Remove the nuts and bolts holding rear left-hand side, mounting bracket to chassis.
32. Remove the nuts and bolts holding right-hand side mounting bracket to chassis.



RR893M

33. Lower the hoist until the rear brake drum clears the rear passenger footwell.
34. Remove the split pin and washers securing the differential lock lever to the connecting rod, and disconnect the lever from the rod.
35. Disconnect the electrical leads from the differential lock switch.
36. Remove the breather pipe from the top of the transfer gearbox.
37. Using a suitable jack support the rear of the engine.
38. Remove the torque converter housing to engine bolts.
39. Carefully withdraw the gearbox and transfer box from the engine taking care not to damage any seats.

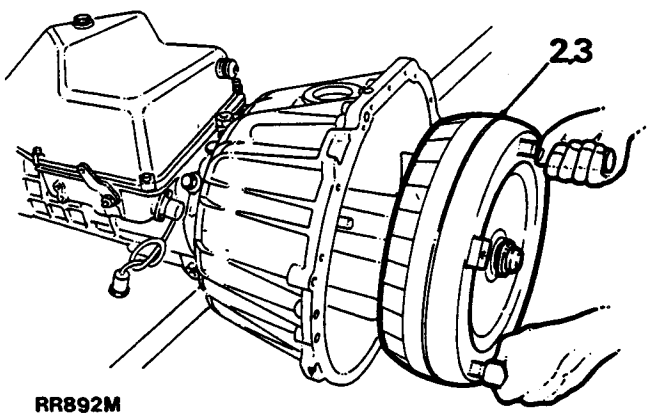
Refitting

40. Reverse the removal instructions.
41. Refill the gearbox with the correct grade and quantity of oil. See data section.
42. Ensuring the vehicle is on level ground with the handbrake applied, check oil level whilst engine is running at idle with neutral selected, after selecting each gear.

There are several places where leaks can occur at the front of the gearbox. The following are remedies for curing any one of these problems.

Eliminating leaks/replacing Torque Converter

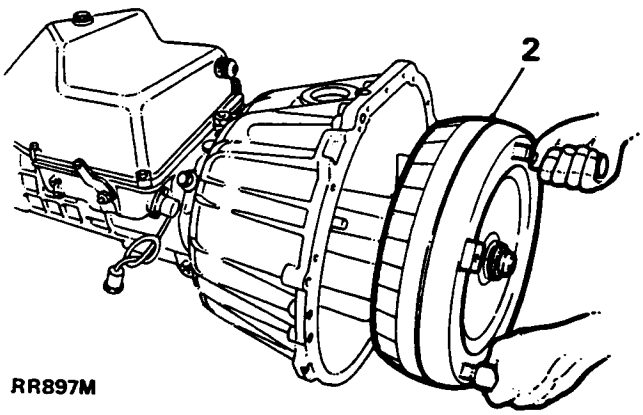
1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench using the torque converter handles 18G1501, remove the torque converter, taking care not to damage the torque converter/oil pump housing oil seal.
3. Replace with new torque converter using torque converter handles 18G1501, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.
4. Refit the gearbox and transfer box assembly as previously described.



RR892M

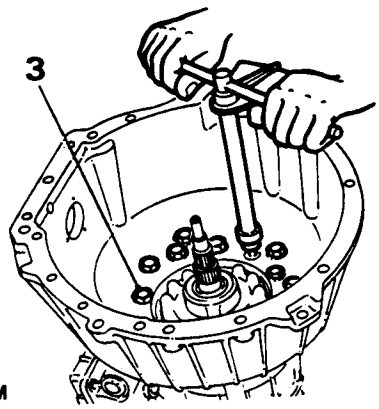
Eliminating Leaks on the Pump Housing

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench and remove the torque converter using torque converter handles 18G1501, taking care not to damage the converter/oil pump housing oil seal.

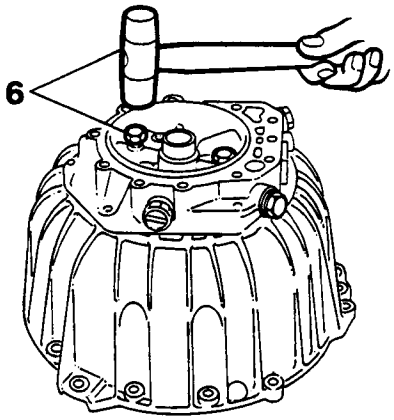


RR897M

3. Remove the twelve hexagonal bolts (inner ring pattern).

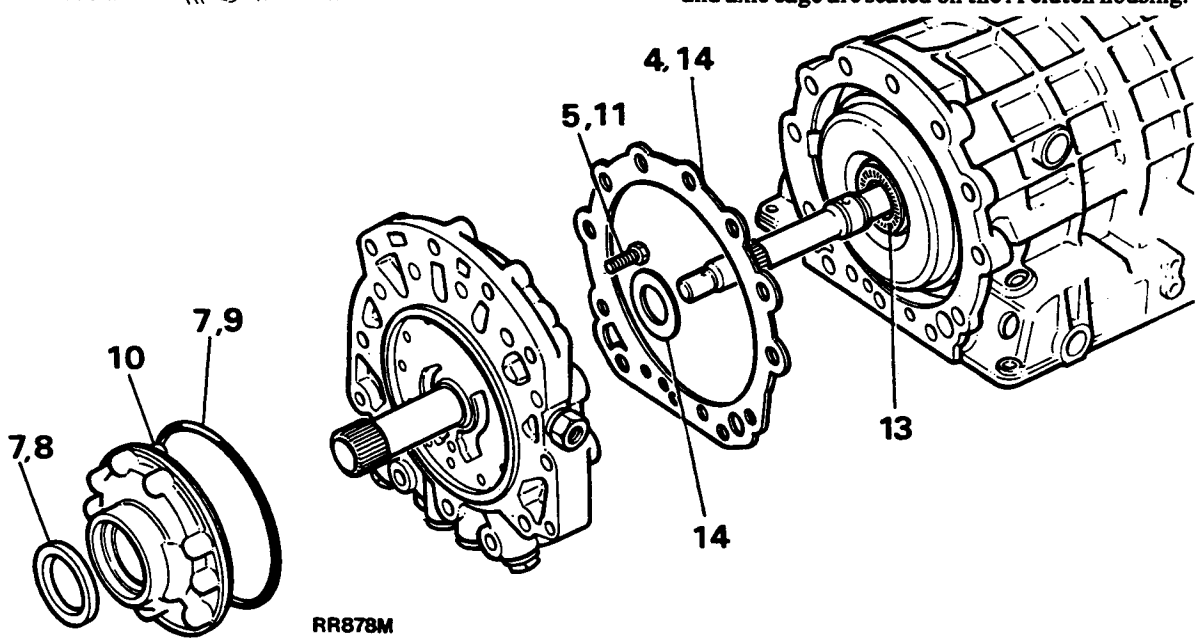


RR577M



RR578M

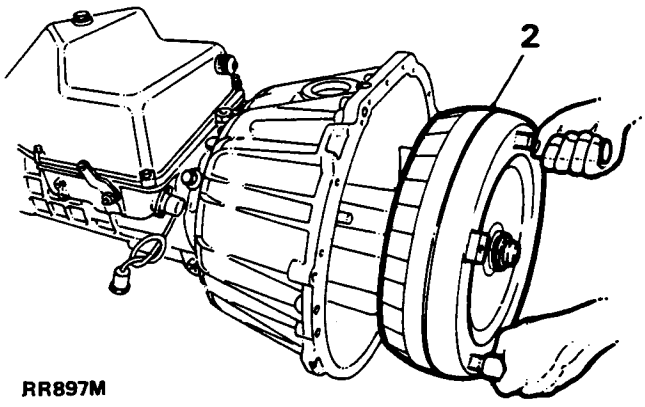
4. Remove bellhousing and pump assembly from gearbox case and discard the gasket.
5. Remove the eight hexagonal bolts on the rear of the pump.
6. Screw in two of the bolts, diagonally opposite each other, tap lightly using a soft headed mallet; this will free the pump assembly from the intermediate plate.
7. Remove the shaft sealing ring and 'O' ring from the pump housing and discard.
8. Using oil seal replacer LST108 fit the shaft seal ring into the pump housing.
9. Fit the 'O' ring onto the circumference of the pump housing.
10. Align the dowel with its hole in the intermediate plate and press the pump housing home.
11. Secure the pump housing to the intermediate plate using the eight hexagonal bolts and tighten to their specified torque.
12. Place the bellhousing and intermediate plate assembly on the bench, front face up. Using the oil pump rotation sleeve LST111, check that the pump gears rotate freely.
13. Before replacing the intermediate plate and bellhousing assembly, check that the thrust washer and axle cage are seated on the A clutch housing.



RR878M

14. Place the gasket and disc washer onto the bellhousing and intermediate plate assembly using a light grease or vaseline.

15. Fit bellhousing and intermediate plate assembly onto gearcase and secure with the twelve hexagonal bolts tightened to the specified torque.
16. Place the end float gauge LST111 onto the pump housing and check that the axial play is between 0,2–0,4 mm. (0.008 in to 0.016 in). If the end float is excessive or tight, replace existing washer, situated at the rear of the intermediate plate, with a suitable washer to give the required end float as stated above.
17. Refit torque converter into housing using torque converter handles 18G1501, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.
18. Refit the gearbox/transfer box assembly as previously described.

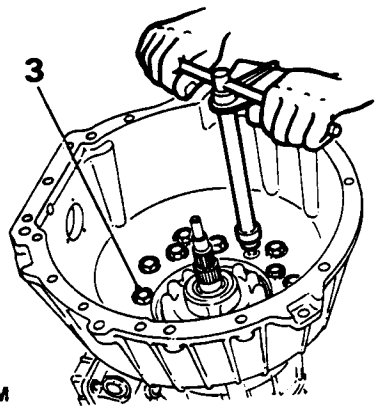


RR897M

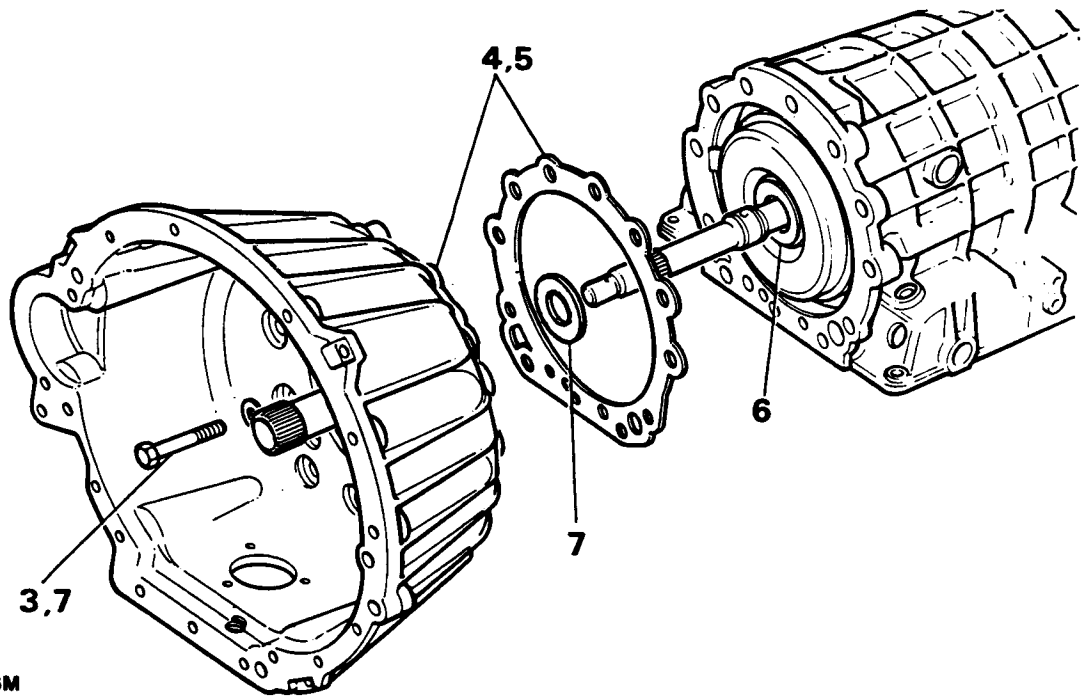
5. Place new gasket onto intermediate plate using a light grease or vaseline.
6. Before replacing the intermediate plate/bellhousing assembly check that the thrust washer and axle cage are seated on the A clutch housing.
7. Fit bellhousing/intermediate plate assembly with disc washer onto gearcase and secure with the twelve hexagonal bolts tightened to the specified torque.

Eliminating leaks between Gearbox Housing and Intermediate Plate

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench and remove the torque converter using torque converter handles 18G 1501, taking care not to damage the converter/oil pump housing oil seal.
3. Remove the 12 hexagonal bolts (inner ring pattern).
4. Remove the bellhousing intermediate plate assembly from gearbox case and discard the gasket.



RR577M

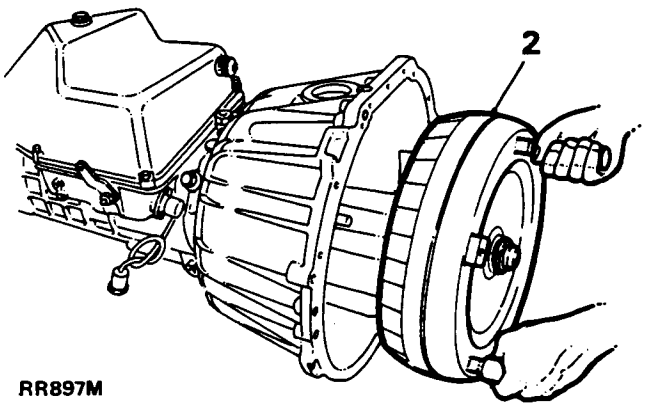


RR576M

8. Place the end-float gauge LST 111 onto the pump housing and check that the axial play is between 0,2–0,4 mm (0.008 in to 0.016 in). If the end-float is excessive or tight, replace existing washer, situated at the rear of the intermediate plate, with a suitable washer to give the required end-float as stated above.
9. Refit torque converter into housing using torque converter handles 18G 1501, checking that the dimension from the converter fixing bolt boss to the converter housing case is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.
10. Refit the gearbox/transfer box assembly as previously described.

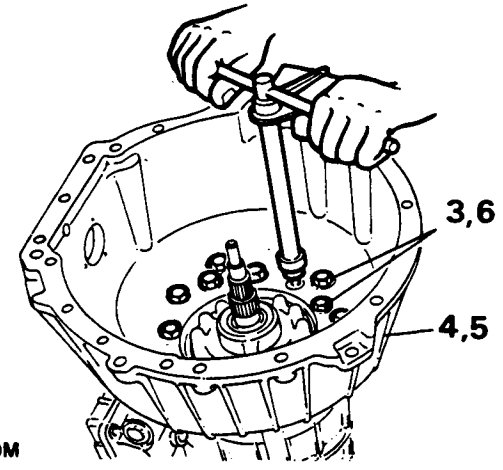
Replacing Bellhousing

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench and using the torque converter handles 18G 1501 remove the torque converter, taking care not to damage the converter/oil pump housing oil seal.



RR897M

3. Remove the eighteen hexagonal bolts.
4. Remove bellhousing.
5. Fit new bellhousing.
6. Secure bellhousing with the eighteen hexagonal bolts to the specified torque.

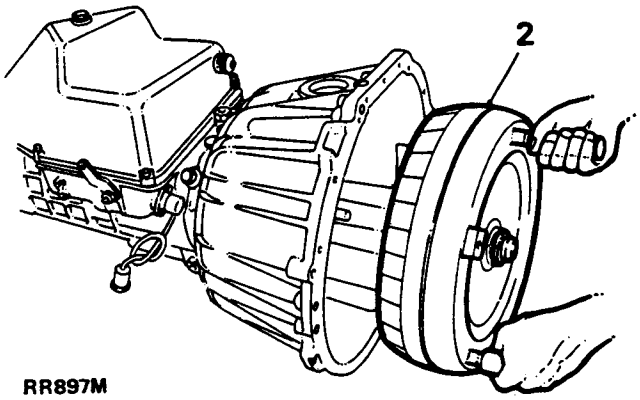


RR899M

7. Refit the torque converter into the housing using torque converter handles 18G 1501, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.
8. Refit the gearbox/transfer box assembly as previously described.

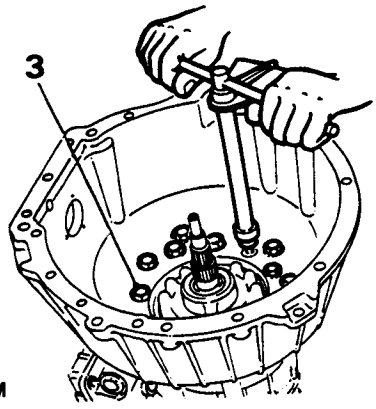
Replacing Pump

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench and remove the torque converter using torque converter handles 18G 1501, taking care not to damage the converter/oil pump housing oil seal.



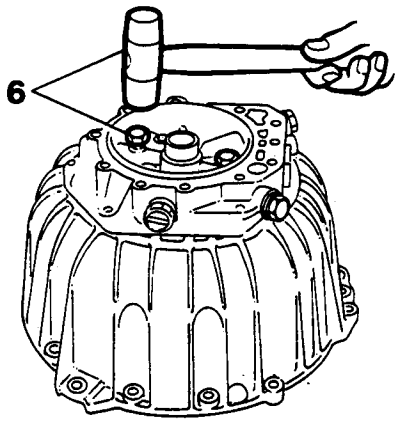
RR897M

3. Remove the twelve hexagonal bolts (inner ring pattern).



RR577M

4. Remove bellhousing and pump assembly from gearbox case and discard the gasket.
5. Remove the eight hexagonal bolts on the rear of the pump.
6. Screw in two of the bolts, diagonally opposite each other, tap lightly using a soft headed mallet; this will free the pump assembly from the intermediate plate.

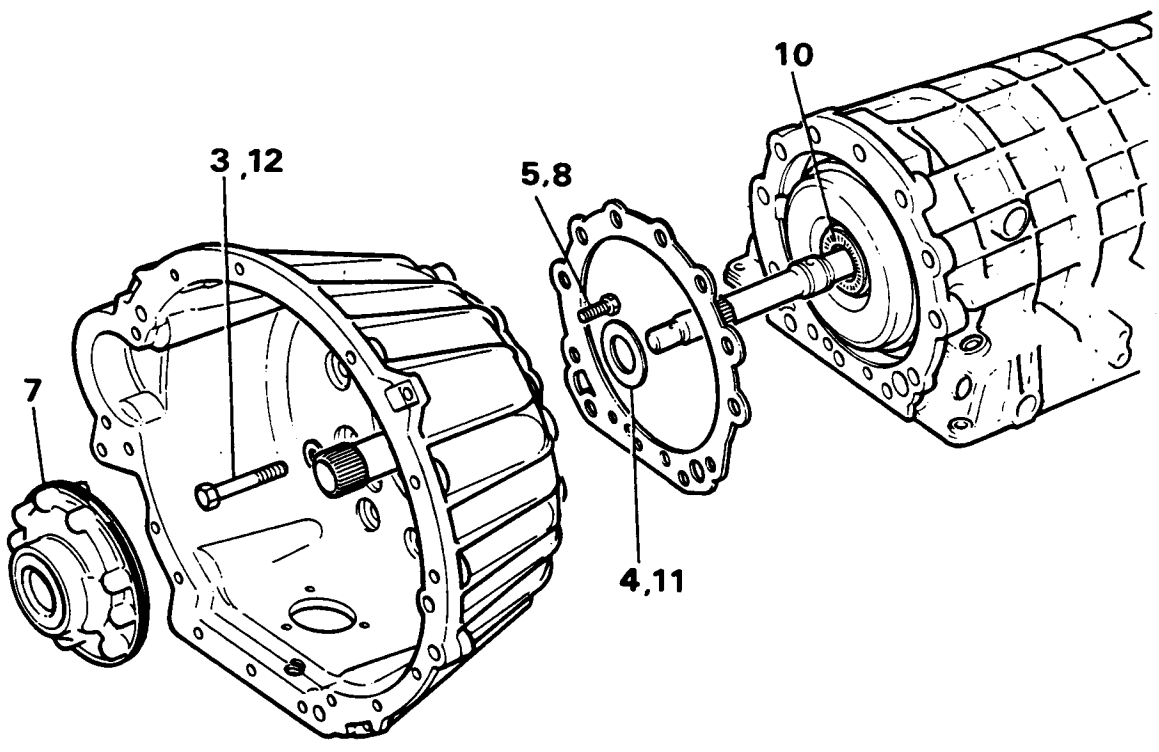


RR578M

7. Fit new pump assembly aligning the dowel with its hole in the intermediate plate and press the pump housing home.
8. Secure the pump housing to the intermediate plate using the eight hexagonal bolts and tighten to their specified torque.
9. Place the bellhousing and intermediate plate assembly on the bench, front face up. Using the oil pump rotation sleeve LST 111, check that the pump gears rotate freely.
10. Before replacing the intermediate plate and bellhousing assembly check that the thrust washer and axle cage are seated on the A clutch housing.
11. Place the gasket and disc washer onto the bellhousing and intermediate plate assembly using a light grease or vaseline.
12. Fit bellhousing and intermediate plate assembly onto gearcase and secure with the twelve hexagonal bolts tightened to the specified torque.
13. Place the end-float gauge LST-111 onto the pump housing and check that the axial play is between 0,2–0,4 mm (0.008 in to 0.016 in). If the end-float is excessive or tight, replace existing washer, situated at the rear of the intermediate plate, with suitable washer to give required end-float as stated above.

NOTE: If damage is apparent to the bolts they should be replaced.

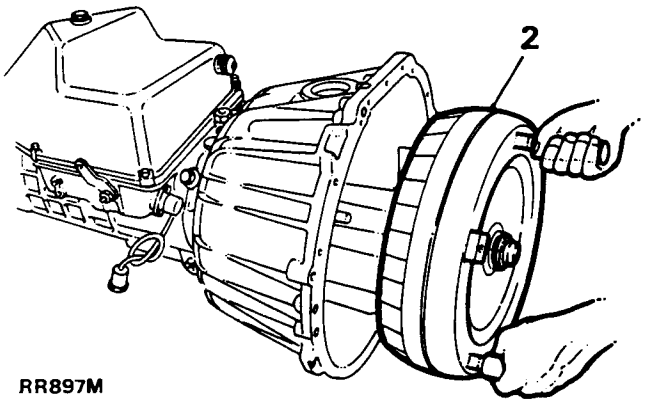
14. Refit the torque converter into the housing using torque converter handles 18G 1501, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved, the converter is properly seated in the housing.
15. Refit the gearbox/transfer box assembly as previously described.



RR891M

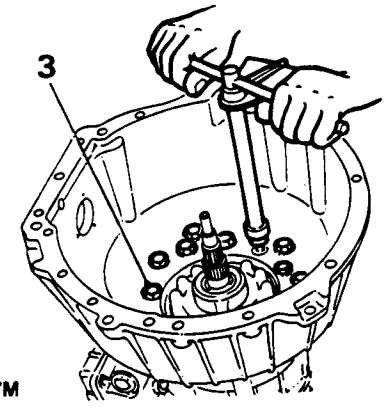
Replacing Intermediate Plate

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench, and remove the torque converter using torque converter handles 18G1501, taking care not to damage the torque converter/oil pump housing oil seal.



RR897M

3. Remove the twelve hexagonal bolts (inner ring pattern).
4. Remove bellhousing and pump assembly from gearbox case and discard the gasket.
5. Remove the eight hexagonal bolts on the rear of the pump.
6. Screw in two of the bolts, diagonally opposite each other, tap lightly using a soft headed mallet; this will free the pump assembly from the intermediate plate.



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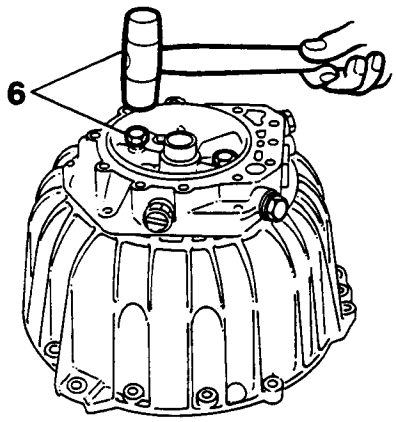
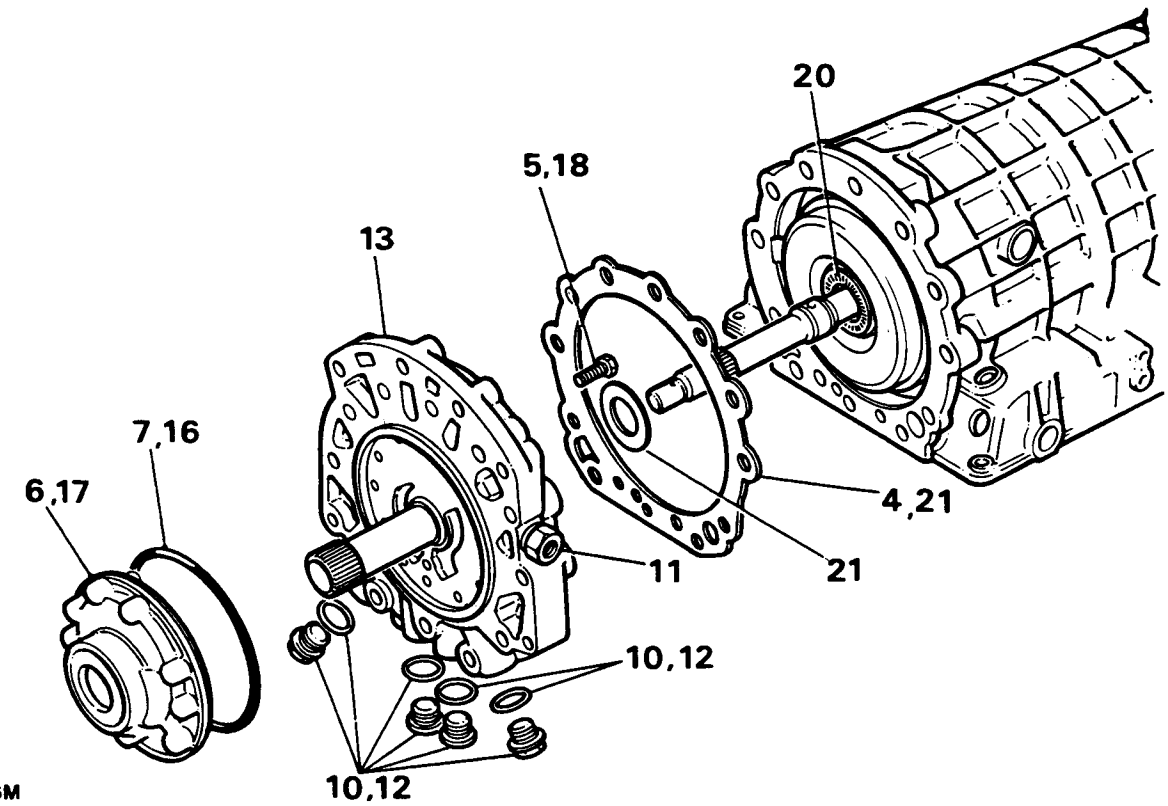


RR578M

7. Remove the 'O' ring from the pump housing and discard.
8. Place the bellhousing and intermediate plate assembly on the bench, front side up.



RR876M

9. Remove the six remaining hexagon bolts and remove the bellhousing from the intermediate plate assembly.
10. Remove the four screw plugs and seal rings from the intermediate plate, discard the seal rings.
11. Remove the oil cooler pipe adaptors and fit them into the new intermediate plate.
12. Fit plugs and new seal rings into the new intermediate plate.
13. Fit intermediate plate assembly onto the bellhousing.
14. Secure with six hexagonal bolts (outer ring pattern) and tighten to the specified torque.
15. Place intermediate plate and bellhousing assembly on bench, front face up.
16. Fit the 'O' ring onto the circumference of the pump housing.
17. Align the dowel with its hole in the intermediate plate and press the pump housing home.
18. Secure the pump housing to the intermediate plate using the eight hexagonal bolts and tighten to the specified torque.
19. Place the bellhousing and intermediate plate assembly on the bench, front face up. Using the oil pump rotation sleeve LST111, check that the pump gears rotate freely.
20. Before replacing the intermediate plate and bellhousing assembly check that the thrust washer and axle cage are seated on the A clutch housing.
21. Place the gasket and disc washer onto the bellhousing and intermediate plate assembly using a light grease or vaseline.
22. Fit bellhousing and intermediate plate assembly onto gearcase and secure with the twelve hexagonal bolts tightened to the specified torque.
23. Place the end float gauge LST111 onto the pump housing and check that the axial play is between 0,2–0,4 mm. (0.008–0.016 in.). If end float is excessive or tight, replace existing washer, situated at the rear of the intermediate plate, with suitable washer to give required end float as stated above.
24. Refit the torque converter into the housing using torque converter handles 18G1501, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in.). If this dimension is achieved the converter is properly seated in the housing.
25. Refit the gearbox/transfer box assembly as previously described.

AUTOMATIC GEARBOX—OVERHAUL

Remove Torque Converter

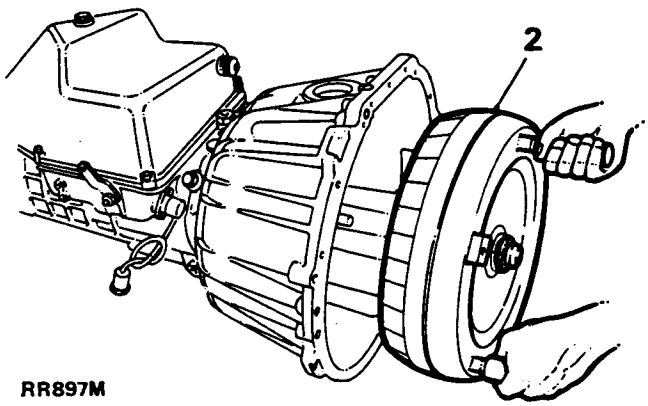
NOTE: Refer to Stage II Section for removal of the gearbox from the vehicle.

1. Place gearbox into transmission holding fixture LST118 and tighten.

   NOTE: Care must be taken not to over-tighten as casing will distort.

2. Using the torque converter handles 18G1501 remove the converter from the bell housing.

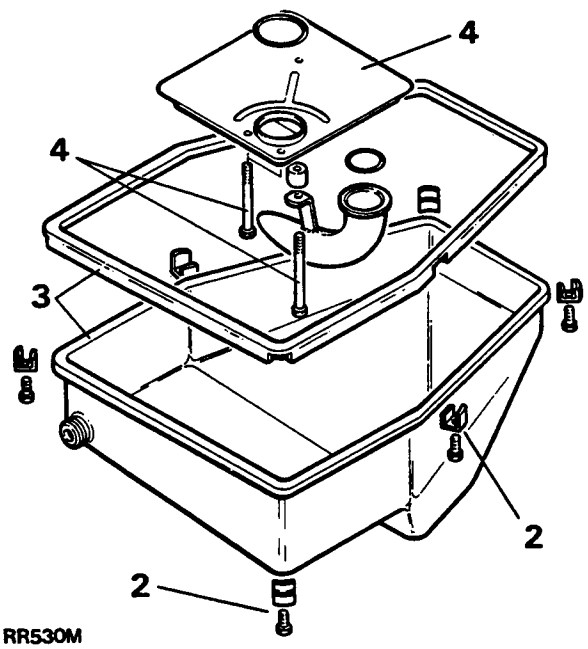
   CAUTION: Ensure no damage occurs to the pump bush and seal ring lip when removing the torque converter. The converter is still full of oil even after the gearbox has been drained, so care should be taken when removing the unit.



RR897M

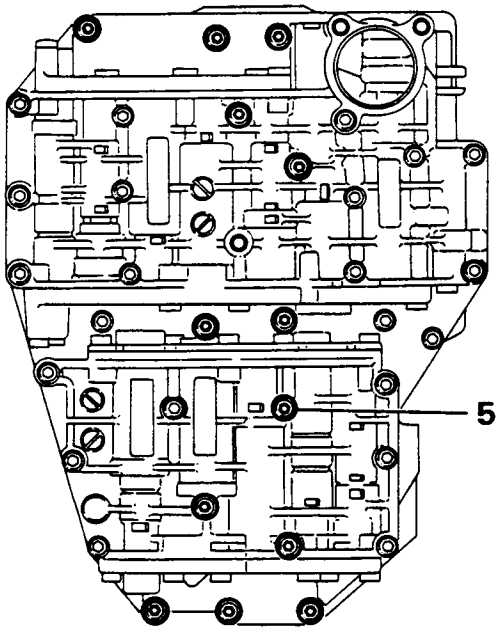
Remove Valve Body

1. Turn the gearbox upside down in the fixture.



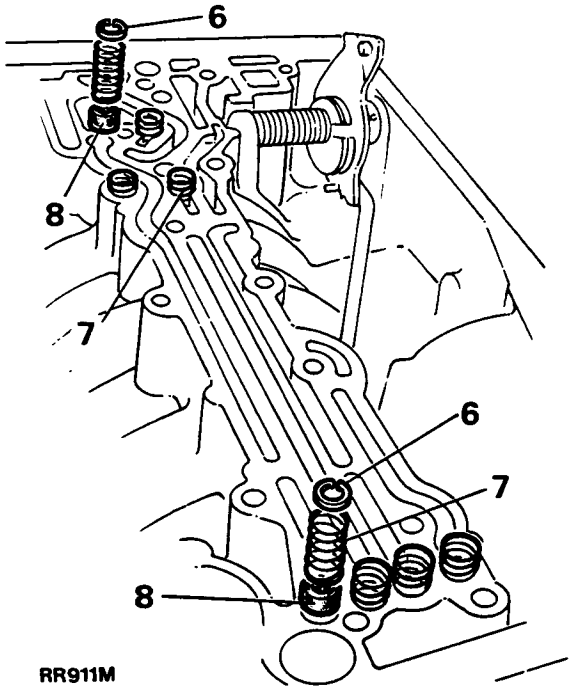
RR530M

2. Remove the six bolts and retaining plates which hold the oil pan.
3. Remove the oil pan and rubber seal and discard seal.
4. Using torx bit TX27, unscrew the three torx headed bolts which hold the oil screen and remove. Separate the oil screen from the suction tube and discard the two 'O' rings and oil screen.
5. Using torx bit TX27, unscrew the thirteen torx headed bolts which retain the valve block to the gearbox.



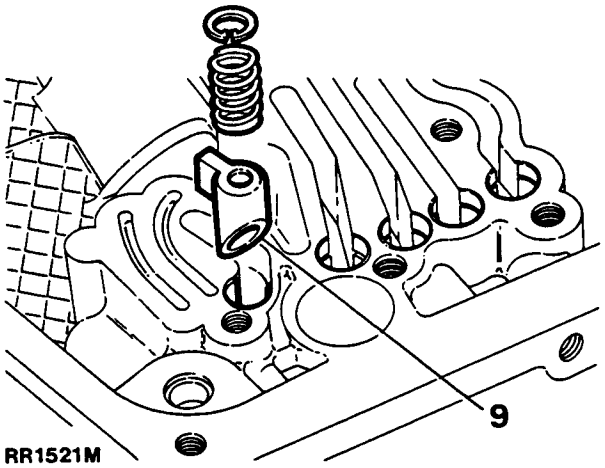
RR531M

6. Using circlip pliers remove the eight circlips.
7. Remove the eight springs (four short springs at the front of the gearbox and four long springs at the rear of the gearbox).



RR911M

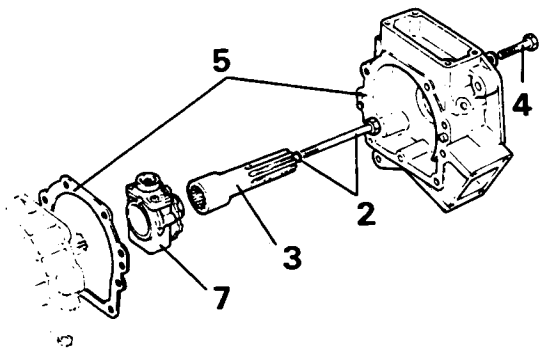
8. Remove the eight sealing rubbers using tool LST113 and discard.
9. Remove the circlip and spring, using tool LST113 remove the restrictor at the rear of the gearbox.



RR1521M

Remove Parking Pawl and Governor

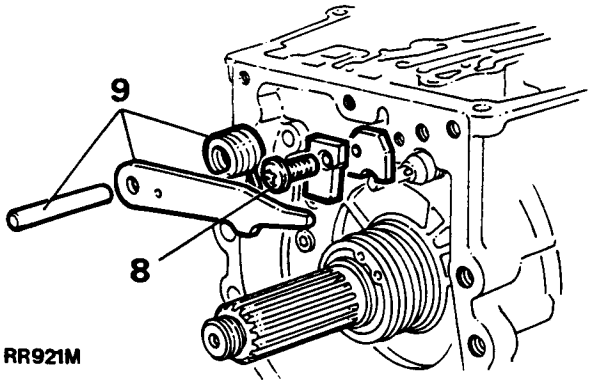
1. Engage 'Park' position.
2. Using a suitable spanner unscrew the coupling shaft bolt and remove the 'O' ring.
3. Remove the coupling shaft.
4. Remove the nine bolts and washers from the extension housing.
5. Remove the extension housing and gasket from the gearbox and discard the gasket.
6. Disengage 'Park' position.
7. Withdraw the parking wheel and governor hub.



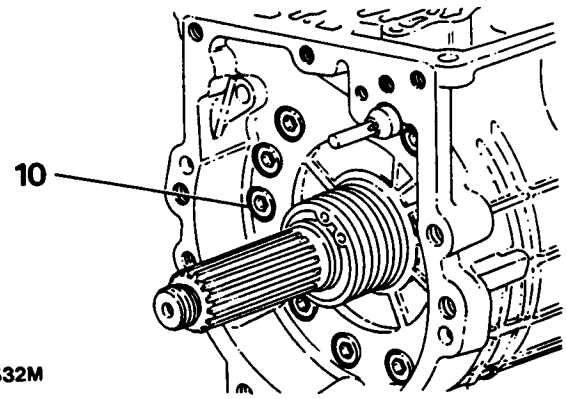
RR918M

8. Unscrew the bolt which retains the guide plate using torx bit TX27.
9. Disengage the spring and remove, also the pin and pawl.

NOTE: When pawl is removed the tension on the spring is reduced.

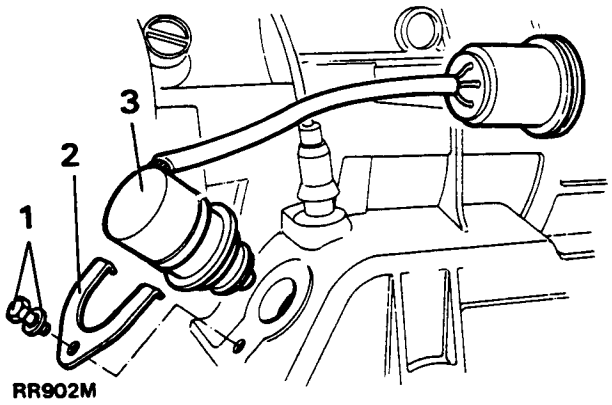


10. Using torx bit TX30 remove the ten torx bolts from rear of casing.



Remove Inhibitor Switch

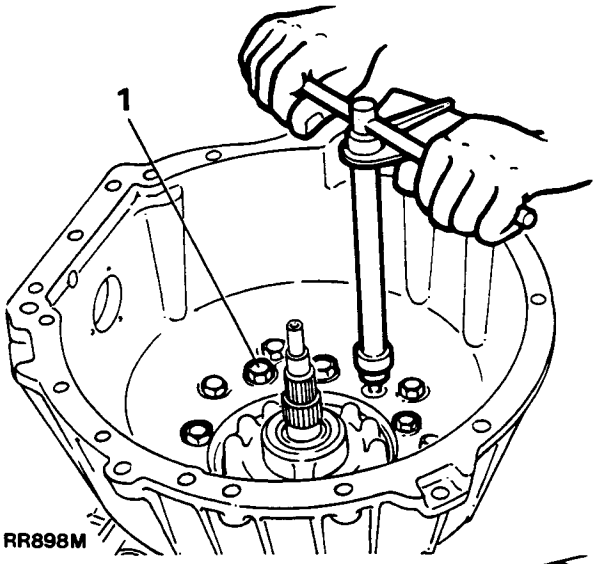
1. Using a suitable spanner remove the bolt and spring washer.
2. Remove the retaining plate.
3. Using a suitable tool remove the inhibitor switch from the casing.
4. Discard switch if damaged.

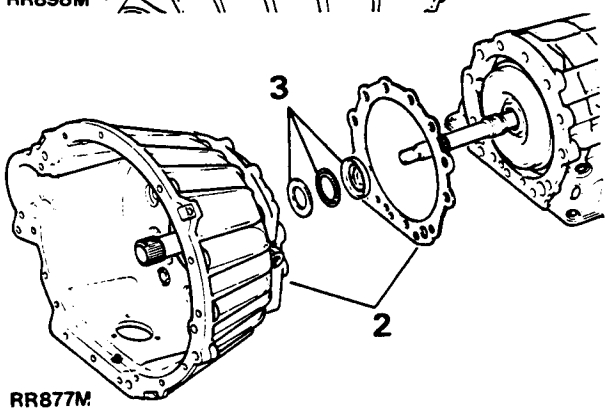


Remove Bell Housing and Intermediate Plate

1. Using a suitable socket spanner remove the twelve bolts (inside diameter bolt pattern) holding the bell housing.
2. Remove the bell housing and intermediate plate assembly complete, and discard the gasket.
3. Remove the thrust washer, axle bearing and disc washer from the input shaft.

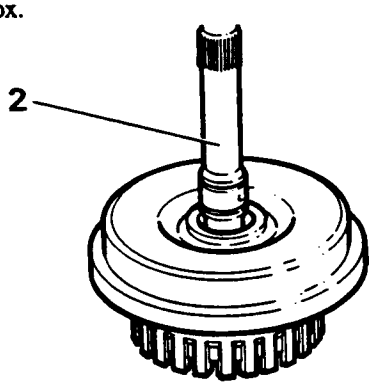
NOTE: Under normal working conditions there is no need to separate the bell housing from the intermediate plate assembly. If damage has occurred to either the bell housing or intermediate plate see appropriate section.

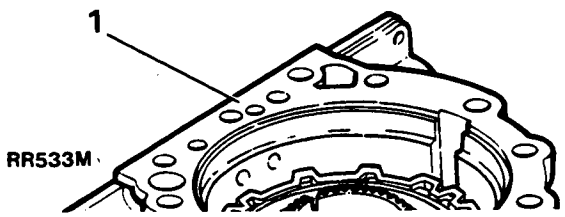




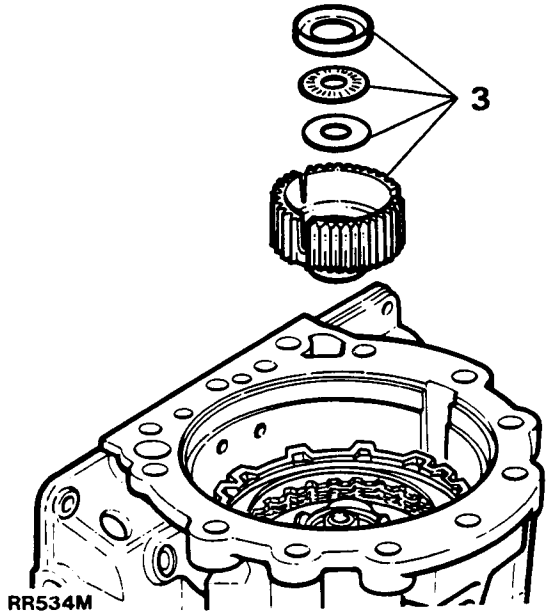
Remove A Clutch Assembly

1. Turn gearbox with front facing upwards.
2. Remove input shaft and A clutch assembly from gearbox.



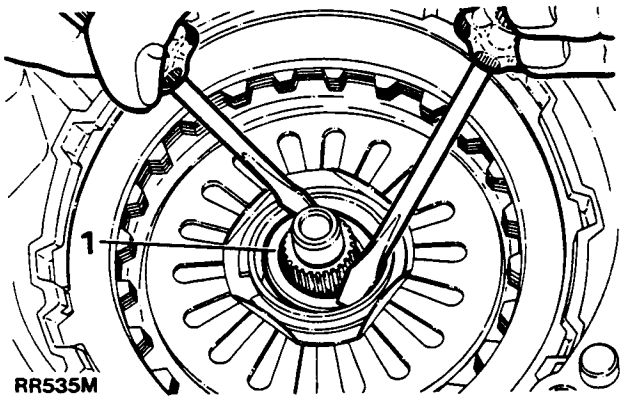


3. Remove inner carrier A, disc, axial bearing and thrust washer.



Remove B Clutch Assembly

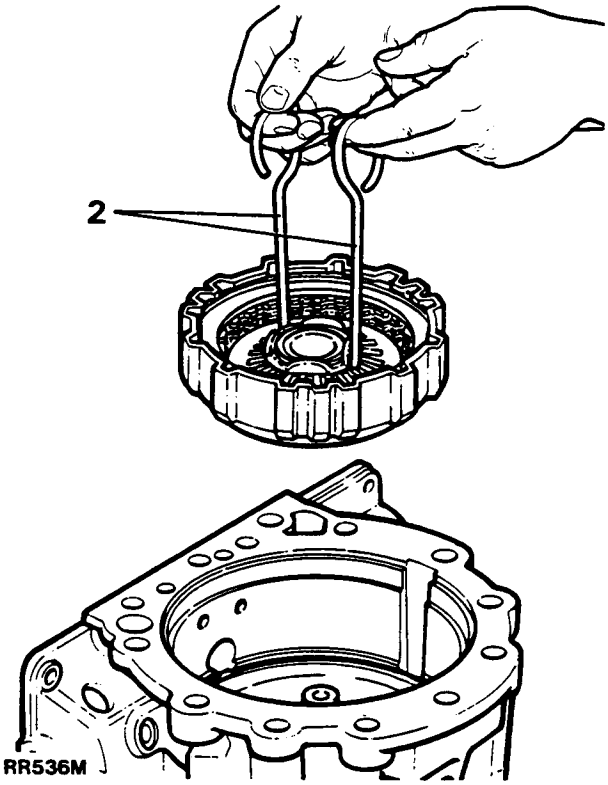
1. Using two suitable screwdrivers remove the small snap ring in cylinder B.



2. Using the B clutch assembly puller hooks LST115 remove the B clutch assembly.

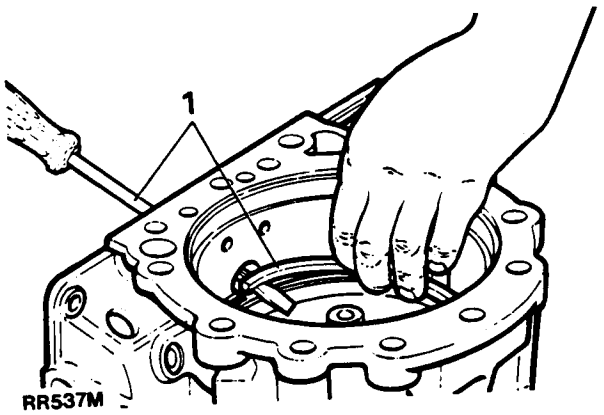
NOTE: To remove assembly, lift up cylinder B until it stops, push assembly back down and lift up again using more weight.

3. Remove support ring and 'O' ring.

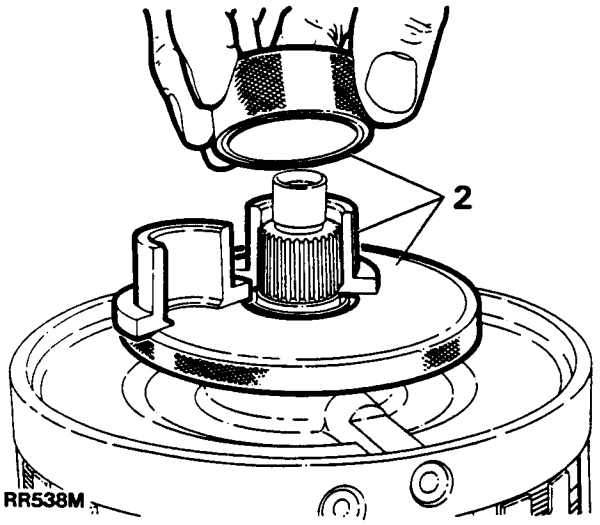


Remove C, C' and D Clutch Assembly

1. Using a suitable screwdriver remove centreplate snap ring via a hole in the casing.



2. Using tool LST117 attached to intermediate shaft remove C, C' and D clutch assembly.
3. Remove disc, axial bearing and thrust washer.



Remove 4th Gear Assembly

1. Turn gearbox to the horizontal position.
2. Push assembly out from the rear, guiding it from the front of the casing.

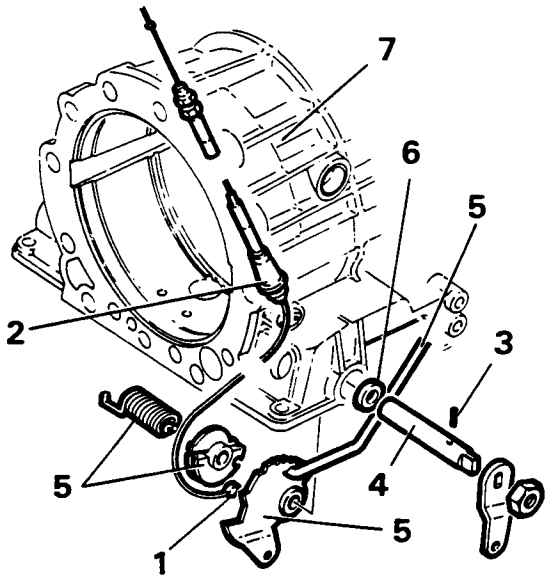
Transmission Gear Selector Assembly

Remove and overhaul

1. Remove the kickdown cable from the cam.
2. Using kickdown cable remover LST112, remove the kickdown cable from the casing.
3. Using a punch remove the roll pin from the selector shaft.
4. Using a pair of pliers or grips pull the selector shaft from the casing.
5. Remove the stop washer, connection rod, cam and leg spring.
6. Using a screwdriver prise out the seal ring located in the gearbox casing and discard.

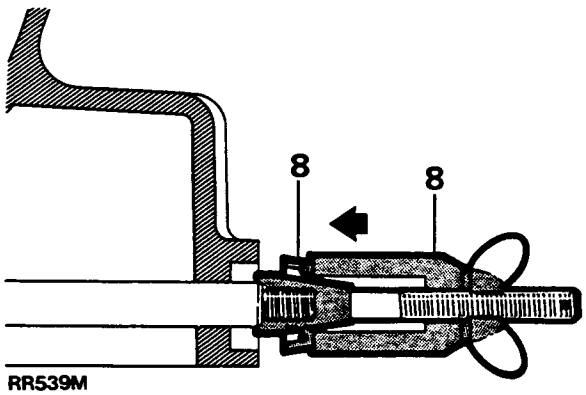
NOTE: At this stage the gearbox is totally stripped.

7. Inspect and clean casing ensuring no damage has occurred.

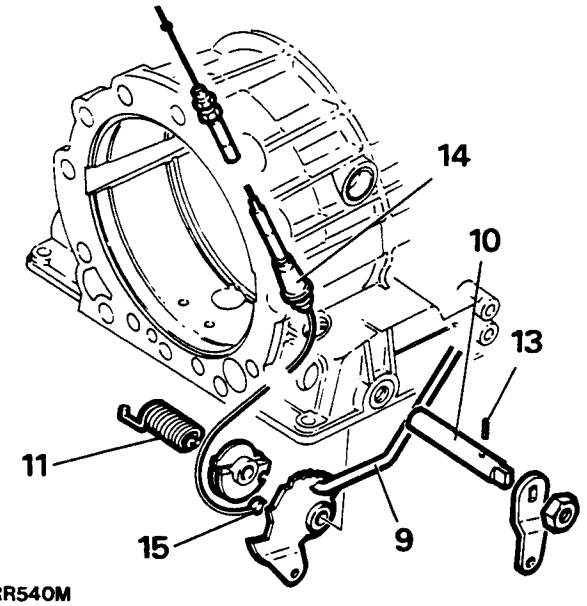


Assemble

8. Fit new seal ring into gearbox casing using selector shaft oil seal replacer LST114.



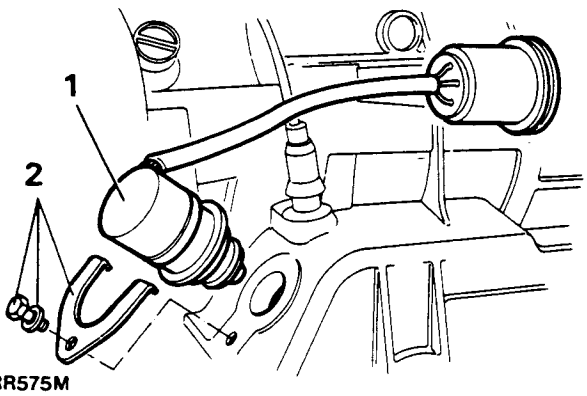
9. Fit connection rod into the stop washer.
10. Place stop washer with connection rod into the gearbox casing and then feed the selector shaft into the casing.
11. Fit the leg spring onto the cam.
12. Place the assembly into the gearbox casing and push the selector shaft through until the hole in the shaft aligns with the hole in the stop washer.
13. Using a suitable punch, fit roll pin with the open side facing the rear of the gearbox casing.
14. Fit new kickdown cable assembly into its seat on the gearbox casing.
15. Fit the nipple of the kickdown cable into the cam seat ensuring the cam has been turned once to load the spring.



RR540M

Fit inhibitor switch

1. Fit new inhibitor switch if existing one was damaged.
2. Replace retaining plate and fix with spring washer and bolt.



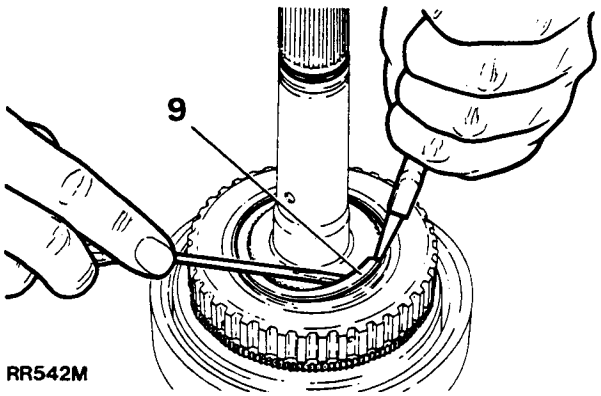
RR575M

4th Gear Assembly Overhaul

1. Using soft-jawed vice secure the 4th gear assembly by gripping the output shaft.
2. Remove the sungear.
3. Remove the planet gear assembly.

NOTE: Removal of snap-ring on assembly is not necessary unless damage has occurred.

4. Remove the disc washer, axial bearing and thrust washer.
5. Remove assembly from the vice and turn upside down onto the bench.
6. Remove cylinder F from cylinder E.
7. Remove cylinder E from the freewheel 3rd.
8. Remove axial disc, cage and two thrust washers.
9. Using pliers and screwdriver remove the snap-ring on carrier E.



RR542M

10. Turn the assembly around and remove the output shaft from ring gear by pushing the gear downwards.

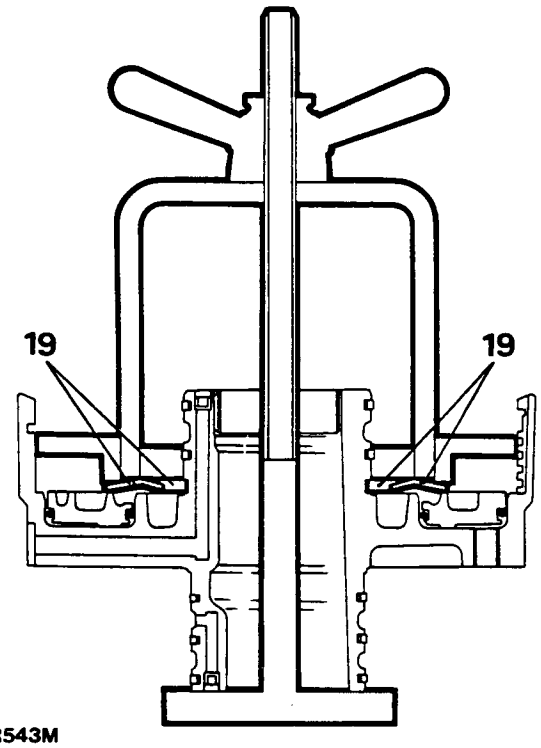
NOTE: Do not remove the snap-ring on output shaft.

11. Place ring gear on bench, teeth side down.
12. Remove carrier E from the ring gear assembly.
13. Remove the freewheel cage assembly from the ring gear by using an upward turning motion.
14. Remove the snap-ring retaining the freewheel ring (inner) to the hollow gear.
15. Remove the freewheel ring (inner) from the hollow gear.
16. Remove freewheel cage from freewheel ring (outer).

NOTE: Care should be taken when removing the freewheel ring, which due to the rollers and springs becoming loose may fall out.

17. Remove the snap-ring retaining the clutch plates and steel plates in cylinder F.
18. Remove four clutch plates and five steel plates from cylinder F.

19. Using clutch spring compressor LST1016-1, press down on the spring plate and remove the split rings.
20. Remove the spring plate.
21. Turn the cylinder upside down, using two small punches placed in the holes (diametrically opposite each other), push down and remove the piston.
22. Remove and discard the two 'O' rings from the piston.



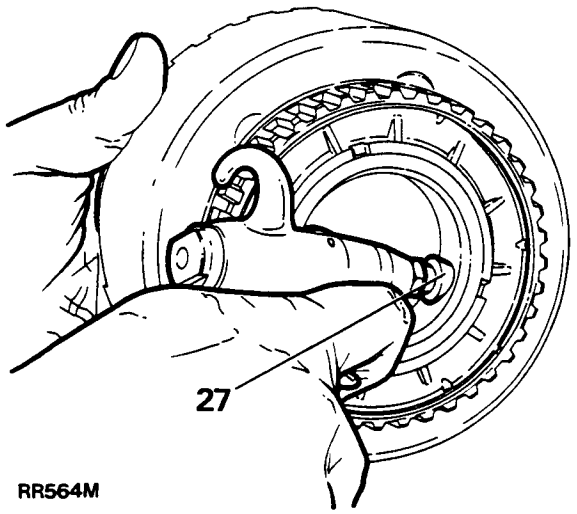
RR543M

NOTE: The five sealing rings do not need to be removed on the cylinder unless any damage has occurred to them.

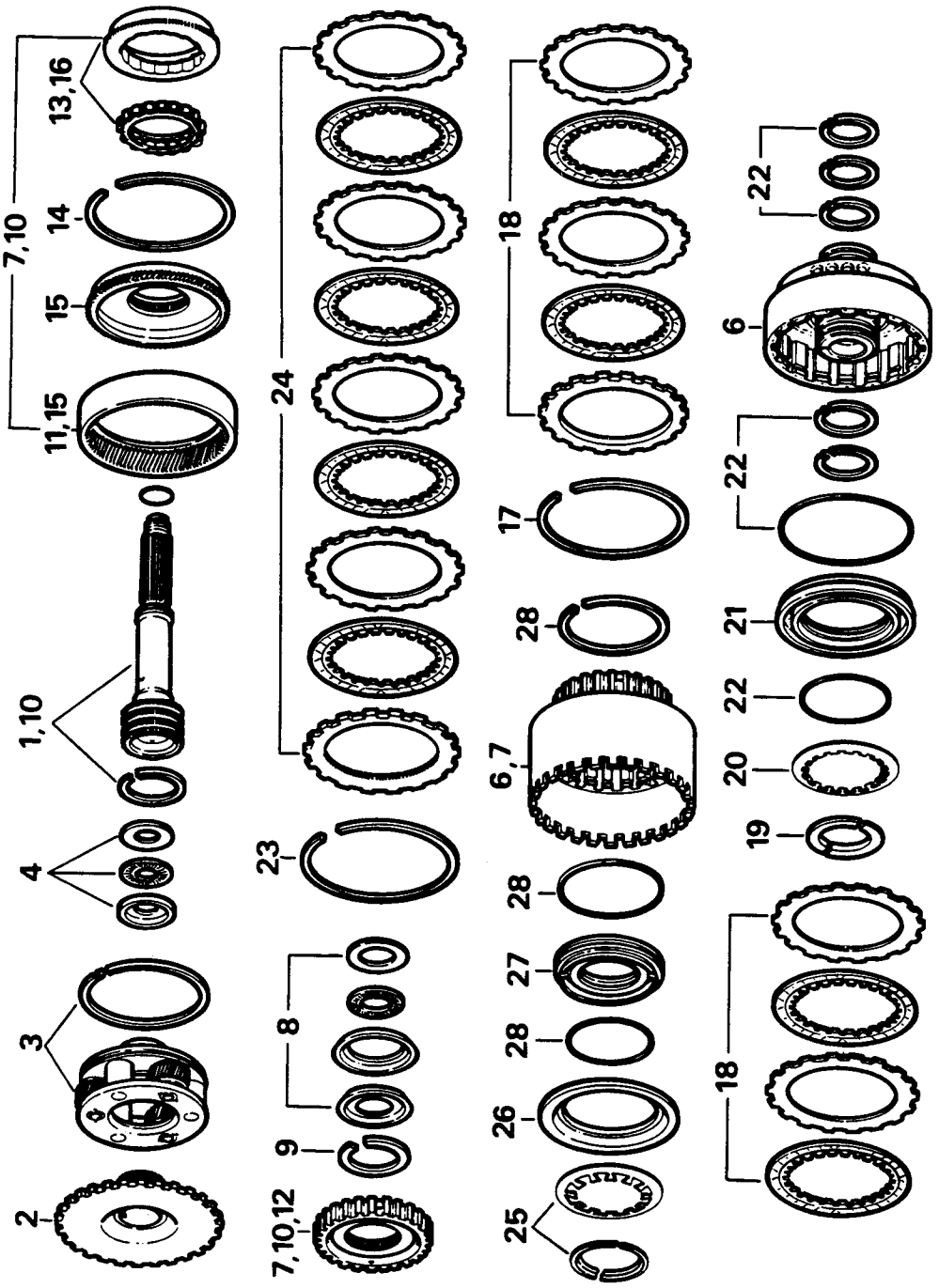
23. Remove the snap ring from cylinder E.
24. Remove the four clutch plates and five steel plates from cylinder E.
25. Using clutch spring compressor LST1016-1, press down on the spring plate and remove the split rings.
26. Remove the pressure plate.
27. Remove piston E by using air pressure directed into the oil feed hole.
28. Remove and discard the two 'O' rings from the piston.

WARNING: Care should be taken using air pressure when removing the piston.

NOTE: Do not remove the snap-ring at the bottom of the E cylinder, unless damaged.



RR564M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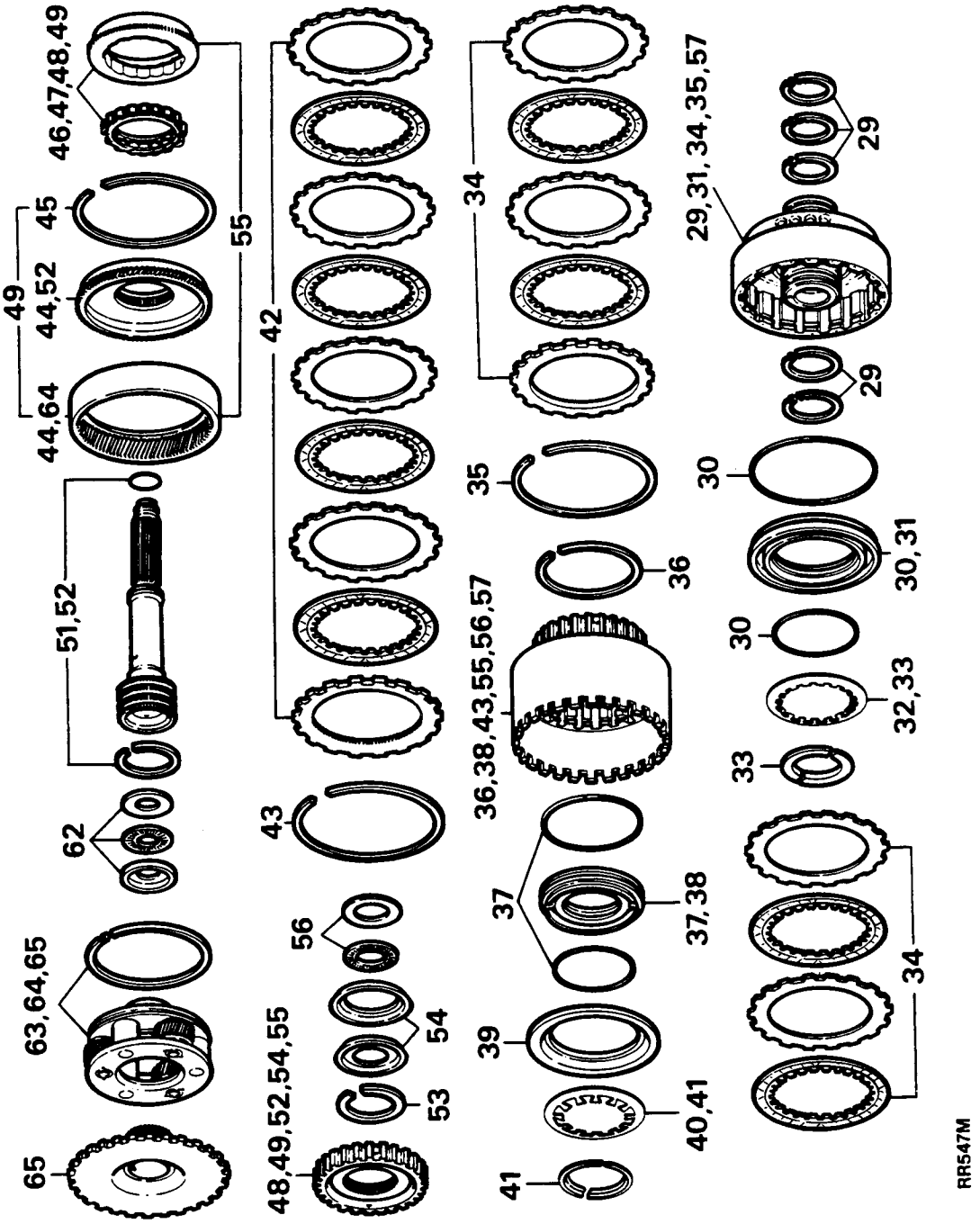
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RR547M

Assemble

29. Fit three seal rings on the outside hub and two seal rings on inside hub of cylinder F if they have been removed.

    NOTE: Ensure each seal ring is snapped together.

30. Fit new 'O' rings onto the F piston.

    NOTE: For ease of assembly apply petroleum jelly on 'O' rings and stretch the inner 'O' ring to avoid damage on installation.

31. Fit piston F into cylinder F.
32. Fit spring plate using clutch spring compressor LST1016-1.
33. Fit the two halves of the split ring to secure the spring plate in position, then remove the clutch spring compressor.
34. Install the clutch plates and steel plates into the F cylinder starting with a steel plate then clutch plate finishing up with the end plate which is thicker than the normal steel plates.
35. Fit the snap-ring into cylinder F to retain the clutch plate assembly.

    NOTE: Do not confuse the steel plates of F clutch with that of the E clutch. The differences are thus:
    F clutch—steel plates are thicker and the end plate has no inner teeth.

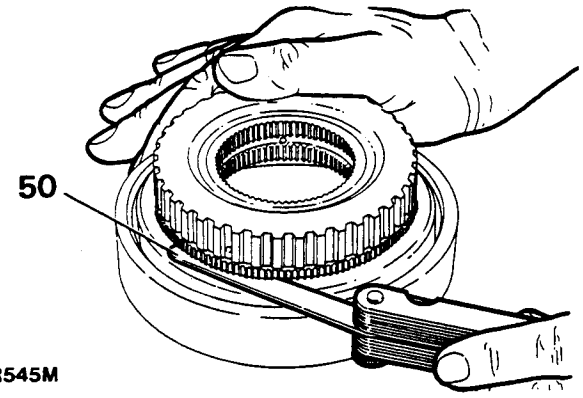
36. Fit new snap-ring at bottom of cylinder E if it has been removed.
37. Fit the two 'O' rings onto the E piston.

    NOTE: For ease of assembly apply petroleum jelly.

38. Fit E piston into cylinder E.
39. Fit the pressure plate with 'depression' facing downwards.
40. Fit spring plate using clutch spring compressor LST1016-1.
41. Fit the two halves of the split ring to secure the spring plate in position then remove the clutch spring compressor.
42. Install the clutch plates and steel plates, starting with a steel plate then clutch plate, finishing up with the end plate which is thicker than the normal steel plates.
43. Fit the snap-ring into cylinder E to retain the clutch plate assembly.

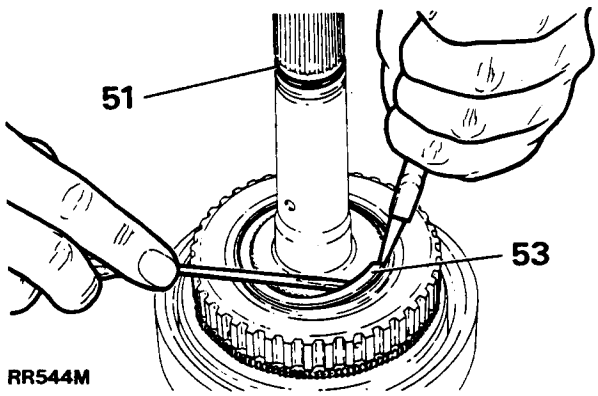
    NOTE: Do not confuse the steel plates of E clutch with that of the F clutch. The differences are thus:
    E clutch—steel plates are thinner and the end plate has inner teeth.

44. Fit the freewheel ring (inner) to the hollow gear.
45. Secure using the snap-ring.
46. Fit freewheel cage into the freewheel ring (outer), and press home.
47. Turn the freewheel cage in the freewheel ring (outer) until rim of the cage has been seated.
48. Fit carrier E to freewheel cage assembly.
49. Fit freewheel cage assembly to ring gear assembly using a clockwise motion.
50. A minimum clearance of 0,1 mm (0.0039 in) should be obtained between the freewheel cage assembly and ring gear.



RR545M

51. Inspect the output shaft for damage to the snap-ring, if any, replace snap-ring; also remove 'O' ring and discard, replace with new 'O' ring.
52. Align inner teeth of carrier E with freewheel ring (inner) teeth and then place freewheel 3rd assembly onto the output shaft.
53. Secure snap-ring into position, retaining the freewheel 3rd.



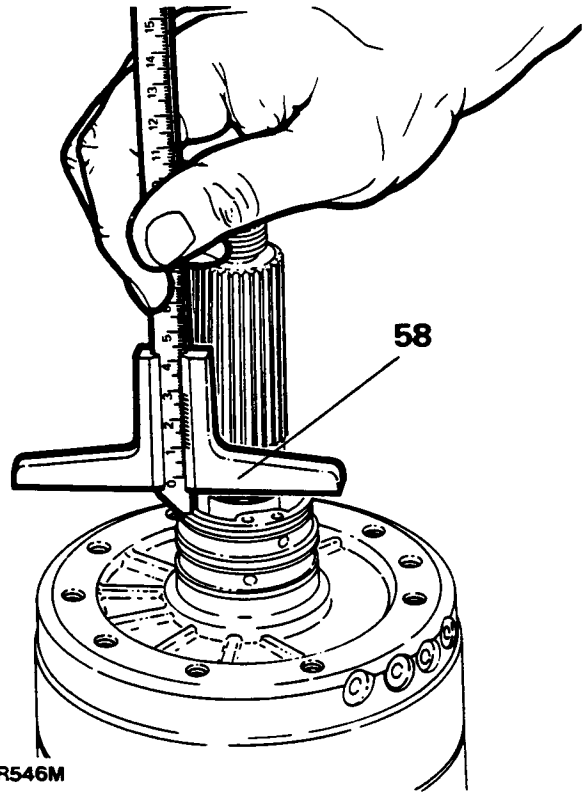
RR544M

54. Fit the steel thrust washer and then the copper thrust washer onto the freewheel 3rd assembly.
55. Fit cylinder E onto freewheel 3rd assembly using a turning motion, ensuring that the teeth of the end plate line up with the freewheel ring (outer).

    NOTE: When correctly assembled, copper thrust washer must be touching cylinder E assembly.
    The cylinder E assembly will turn in a clockwise direction when holding the output shaft. If the cylinder E assembly is turned in a counter clockwise direction the freewheel will lock up.

56. Fit the axial cage and axial disc onto the rear of cylinder E.
57. Using a turning motion, fit cylinder F assembly onto cylinder E assembly.
58. When correctly mounted the raised edge of the output shaft will be 10,00 mm (0.393 in) above the top surface of cylinder F assembly.

NOTE: Disengagement of end plate and freewheel ring (inner) will occur if end play exceeds 3,00 mm (0.118 in).



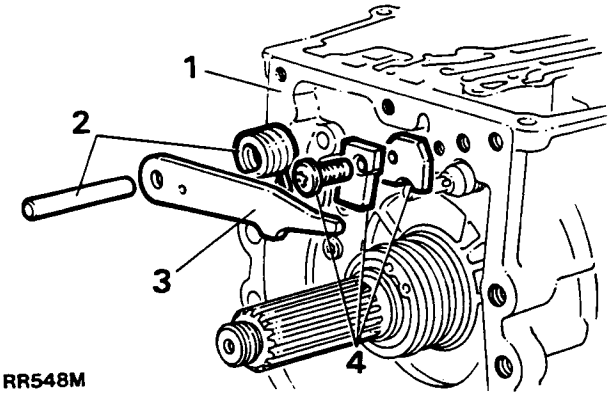
59. Fit the complete 4th gear assembly into the gearbox, ensuring that the oil feed holes in cylinder F line up with the corresponding holes in the gearbox casing.
60. Secure the 4th gear assembly to the gearbox using ten countersunk screws. Tighten screws to the specified torque using torx bit TX30.

NOTE: If screws are not tightened correctly, clutch pressure will be lost in clutch F.

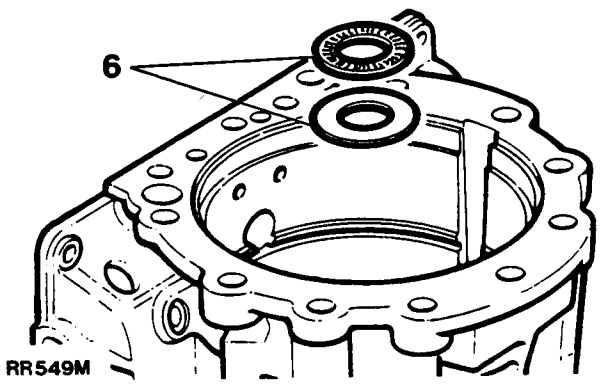
61. Turn the gearbox so that the front of the case is uppermost.
62. Fit the disc washer, axial cage and thrust washer onto the 4th gear assembly.
63. Fit the seal ring onto the planetary case and snap together if ring has been removed.
64. Fit the planetary set into the hollow gear using a turning motion.
65. Fit the sun gear onto the planetary set.

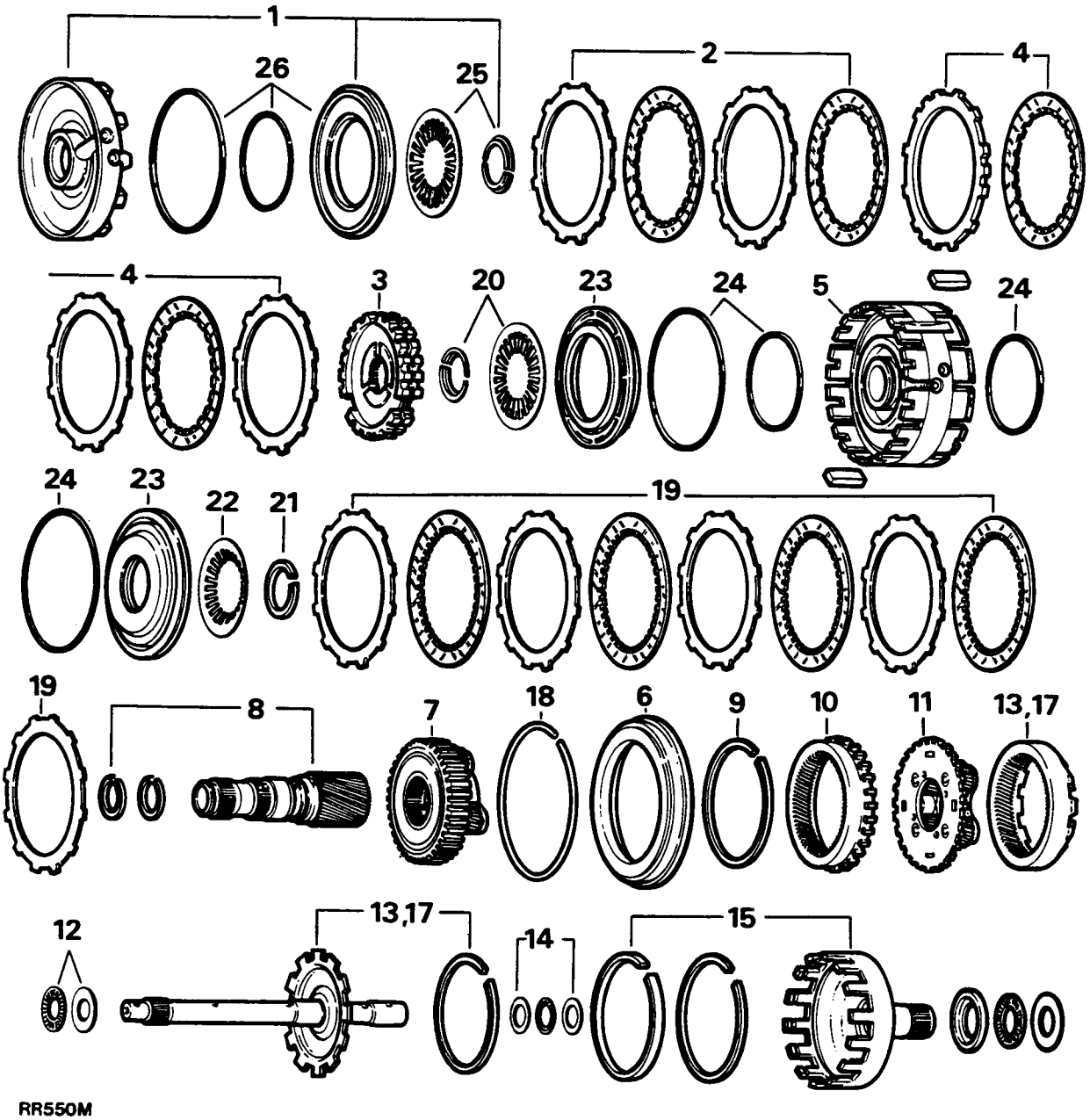
Refit park mechanism

1. Turn gearbox into a horizontal position.
2. Fit leg spring over pin and place into rear of gearbox.
3. Fit pawl onto pin, to tension spring fit leg of spring into hole of pawl.
4. Fit plate and guide plate and tighten to specified torque using torx bit TX27.



5. Turn gearbox so that the front of the case is uppermost.
6. Fit the disc and axial cage.





RR550M

Brakes C, C' and D with planetary sets—overhaul

1. Remove the centre plate assembly.
2. Remove the two brake C' clutches and two steel plates from cylinder C–D.
3. Remove freewheel 2nd complete.
4. Remove the two brake C' clutches and three steel plates from cylinder C–D.
5. Remove the cylinder C–D with brake D assembly.
6. Remove the support ring from the planetary sets assembly.
7. Remove the front planetary set with freewheel assembly.
8. Remove the sunshaft from the assembly.

NOTE: Do not remove the seal ring unless damaged from the sunshaft.

9. Remove the snap-ring from the hollow gear.
10. Remove the hollow gear from the assembly.
11. Remove the rear planetary set.
12. Remove the thrust washer and axial bearing.
13. Remove the intermediate shaft with the hollow gear complete.
14. Remove the axial bearing and two thrust washers, one from each side of the bearing.
15. Remove the distance ring.

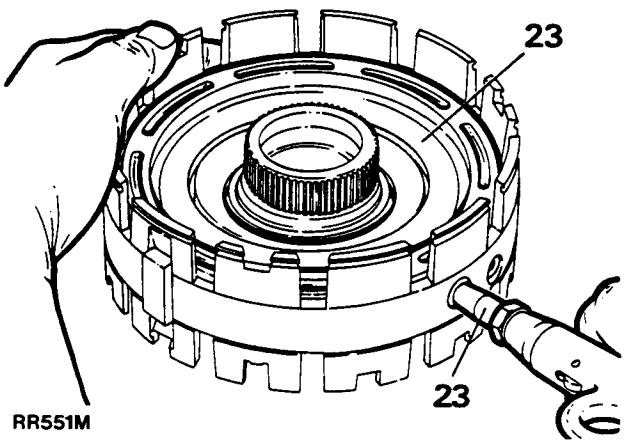
NOTE: The snap-ring in the webshaft need only be removed if damaged.

16. Holding the hollow gear with the rear face uppermost, remove the snap-ring.
17. Disconnect the hollow gear from the intermediate shaft.

18. Remove the external snap-ring from the brake D assembly.
19. Remove the four clutch plates and five steel plates from the assembly.
20. Using clutch spring compressor LST1016-1 press down on the spring plate to remove the split rings.
21. Turn cylinder C–D upside down and using the clutch spring compressor, remove the snap-ring with pliers.
22. Remove the spring plate.
23. For ease of removal of both piston C and piston D, use air pressure fed through the oil feed holes.

WARNING: Care should be taken using air pressure when removing the pistons.

24. Discard 'O' rings from both piston assemblies.
25. Using the clutch spring compressor remove the spring plate, as previously explained, from the centre plate assembly.
26. To remove the piston use air pressure as previously described and discard 'O' rings.



RR551M

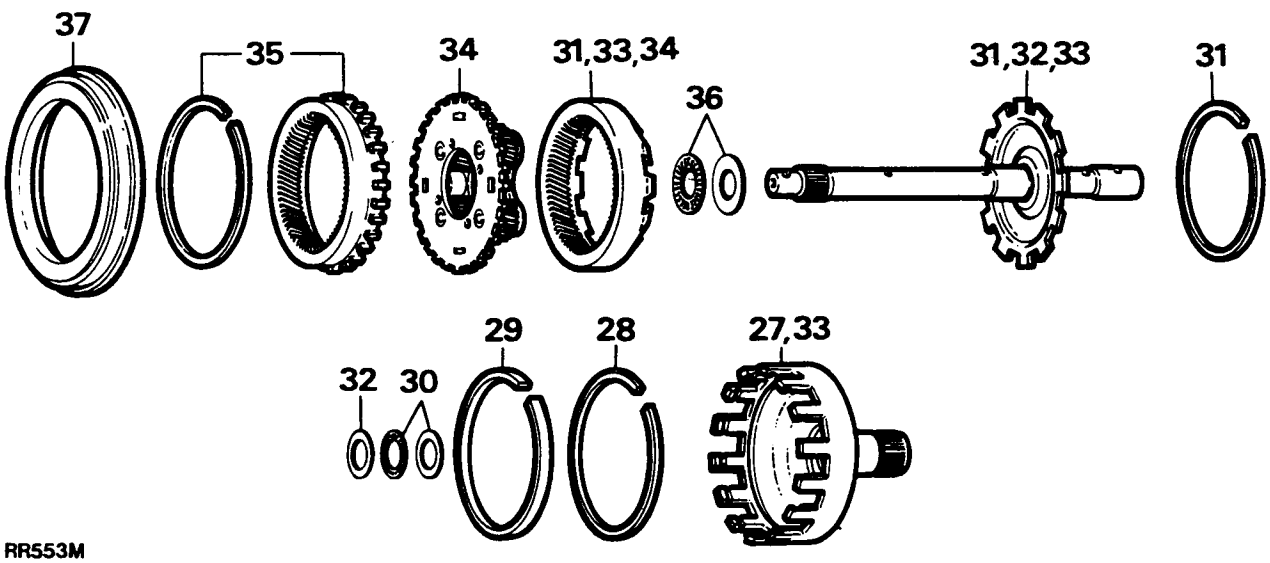
Assemble

27. Secure the webshaft into a soft-jawed vice.
28. Fit the snap-ring if it has been removed into the lower groove.
29. Fit the distance ring into the webshaft.
30. Place a disc washer and axial cage into the assembly.
31. Assemble together the hollow gear with the intermediate shaft and secure with the snap-ring.
32. Place the other disc washer onto the rear of the intermediate shaft using grease.
33. Fit the intermediate shaft assembly into the webshaft ensuring the disc washer mates up to the axial cage.
34. Using a turning motion fit the rear planetary set into the hollow gear.
35. Fit the front hollow gear into the webshaft assembly and secure with a snap-ring.
36. Insert disc washer and axial cage.
37. Place support ring onto the webshaft assembly.
38. Tap the two fitting pegs down into the slots on the side of the cylinder C–D if they have been removed.
39. Place the two 'O' rings onto piston D.

NOTE: For ease of assembly, apply petroleum jelly to the 'O' rings.

40. Fit the D piston into cylinder C–D ensuring that the correct side is selected, that is, the side with the least number of slots in cylinder C–D.
41. Fit the spring plate and using the clutch spring compressor LST1016-1, fit the snap-ring into the groove.
42. Place the two 'O' rings onto piston C.

NOTE: For ease of assembly, apply petroleum jelly to the 'O' rings.



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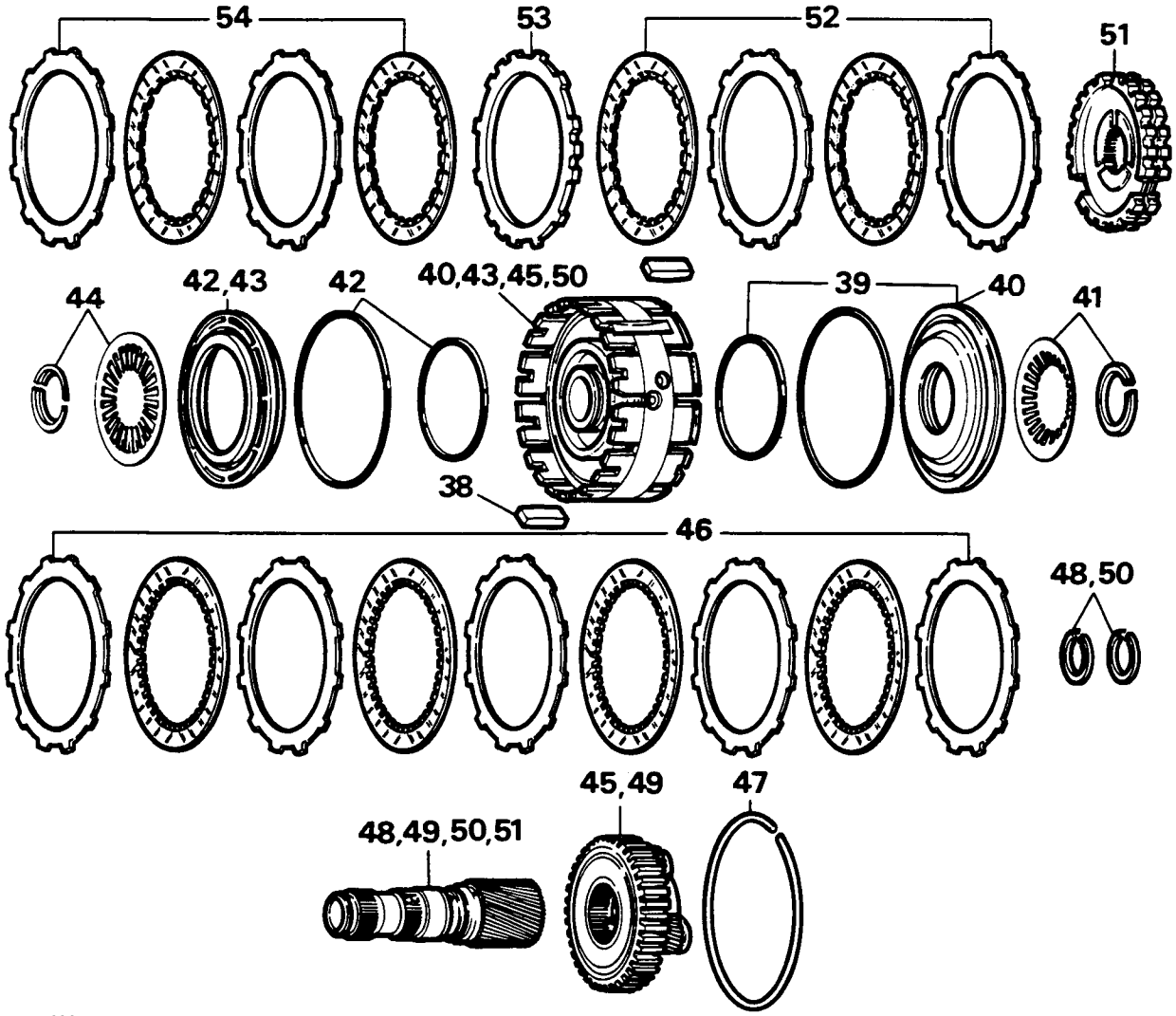


RR552M

43. Fit the C piston into cylinder C–D.
44. Using the clutch spring compressor LST1016-1, fit the spring plate and the two halves of the split rings.
45. With the clutch D aperture uppermost, fit the planetary set with freewheel 1st gear onto the hub of cylinder C–D.
46. Fit the clutch plates and steel plates starting with a steel plate then a clutch plate, finishing up with the thin end plate.
47. Fit the snap-ring on the outside of the C–D cylinder which secures the D clutch assembly.
48. Fit two seal rings onto the sunshaft and snap together if they have been removed.
49. Fit the sunshaft into the planetary set, splines first.
50. Turning the whole assembly around so the C clutch side is uppermost, fit the assembly into the webshaft assembly.
51. Fit freewheel second onto the sunshaft, before fitting align the upper and lower halves.

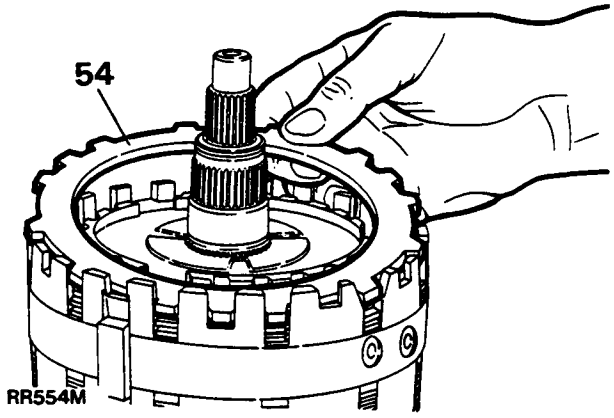
    NOTE: To ensure correct fitment of the freewheel second, the top of the assembly is marked with the word 'open'.

52. Fit the C clutch plates and steel plates starting with a steel plate then a clutch plate into the longer slots of C–D cylinder.
53. Fit end plate which has three groups of three teeth, of which the middle tooth must fit into the short slots in the C–D cylinder.
54. Fit the C' clutch assembly starting with a clutch plate ending with a steel plate.

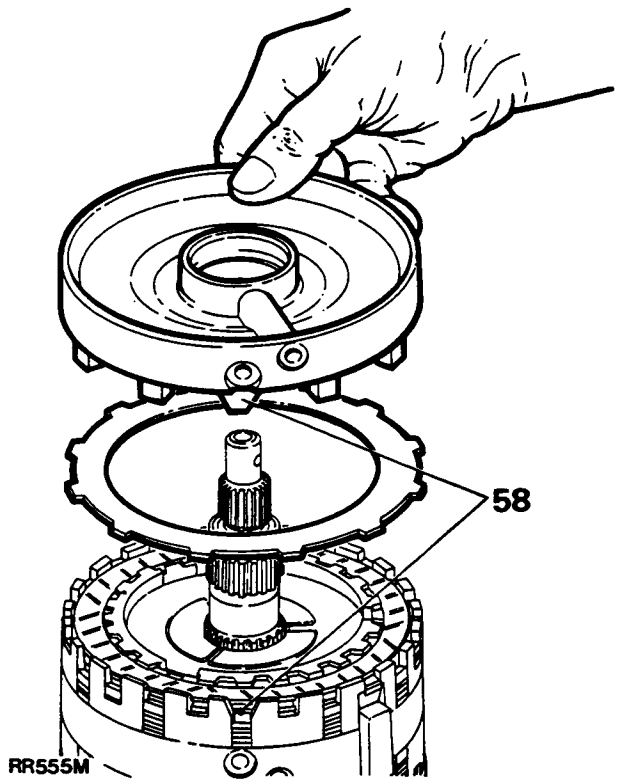
    NOTE: When fitting these plates ensure teeth on the outside do not go into the 'V' shaped area of the C–D cylinder.

    If thin steel plates have to be added into the C or C' clutch assembly ensure that these plates are placed on the side nearer to the respective pistons.
55. Fit the two 'O' rings onto the piston C'.

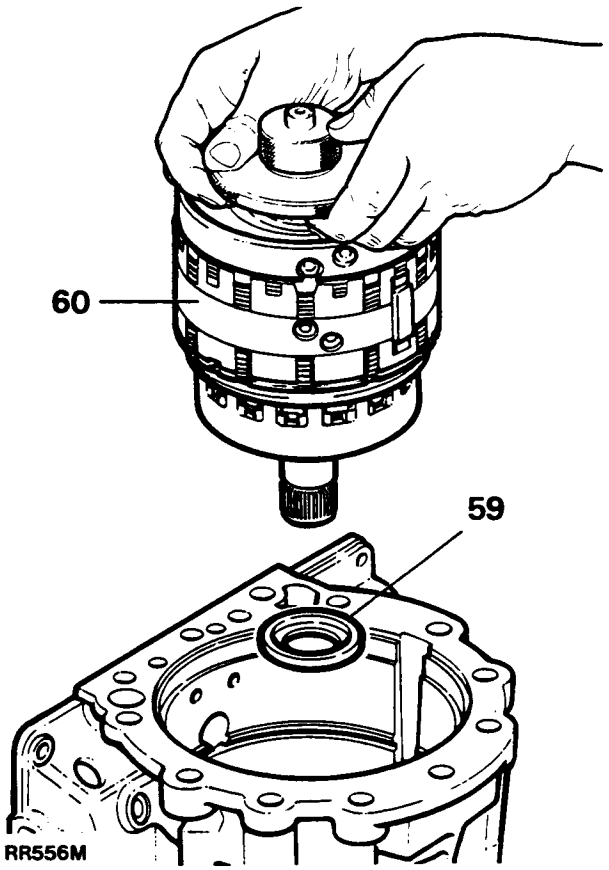
    NOTE: For ease of assembly use a petroleum jelly.



56. Fit C' piston assembly into centre plate.
57. Using clutch spring compressor LST1016-1, fit spring plate and the two halves of the split rings.
58. Place the centre plate onto the C–D cylinder making sure that the 'V' shaped tag on the centre plate fits the 'V' shaped hollow in the C–D cylinder.



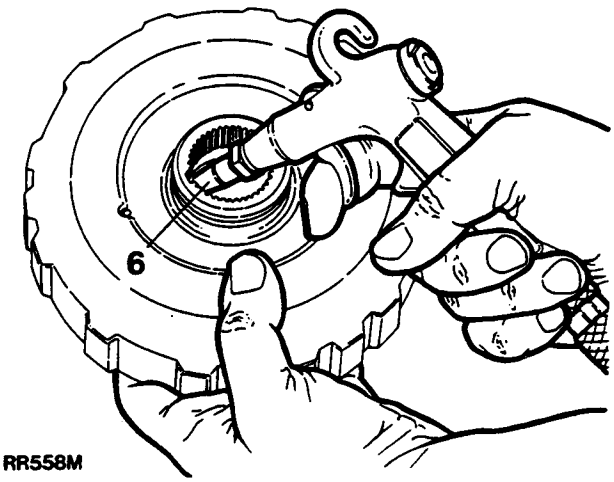
59. Remove the C, C' and D clutch assembly from vice and place a greased thrust washer rear face of the webshaft.
60. Fit the whole assembly into the transmission case using the gear train remover/replacer LST117, ensuring that the oil feed holes are aligned with those in the bottom of the casing.
61. Secure the whole assembly with a snap-ring which fits into the groove inside the casing.

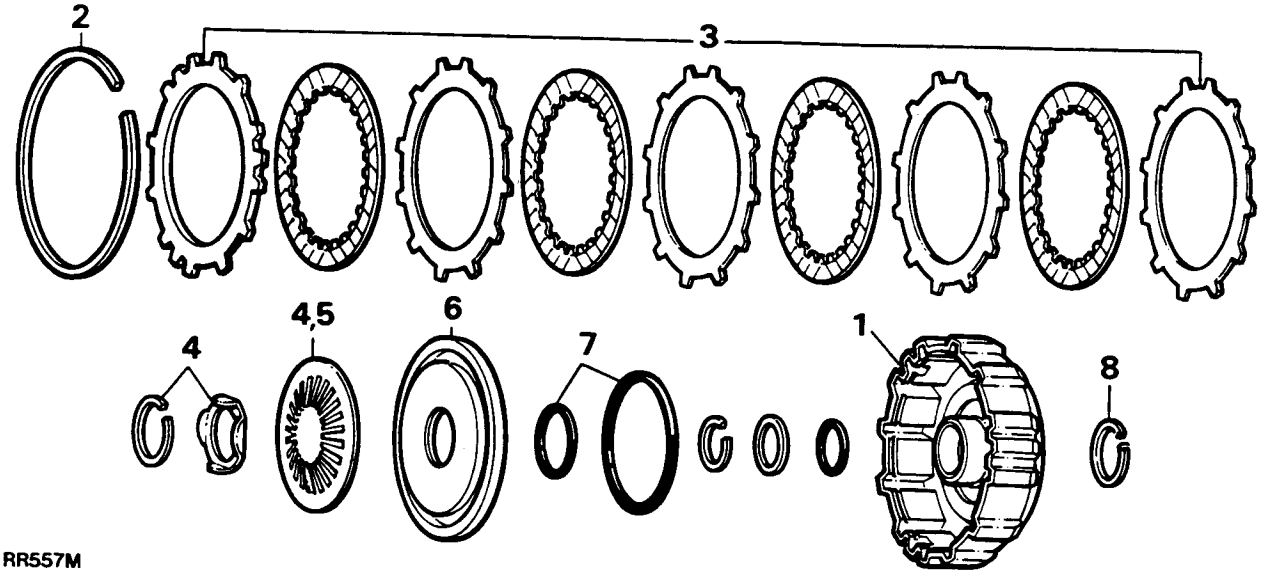


Clutch B overhaul

1. Place B clutch assembly with open face upwards.
2. Remove the snap-ring from inside the assembly.
3. Remove the four clutch plates and five steel plates.
4. Using clutch spring compressor LST1016-1, depress spring plate and remove snap-ring and retaining washer.
5. Remove the spring plate.
6. For ease of removal of the piston B, use air pressure fed through the oil feed hole, then turn assembly upside down and tap lightly on the working surface.

WARNING: Care should be taken using air pressure when removing the piston.





RR557M

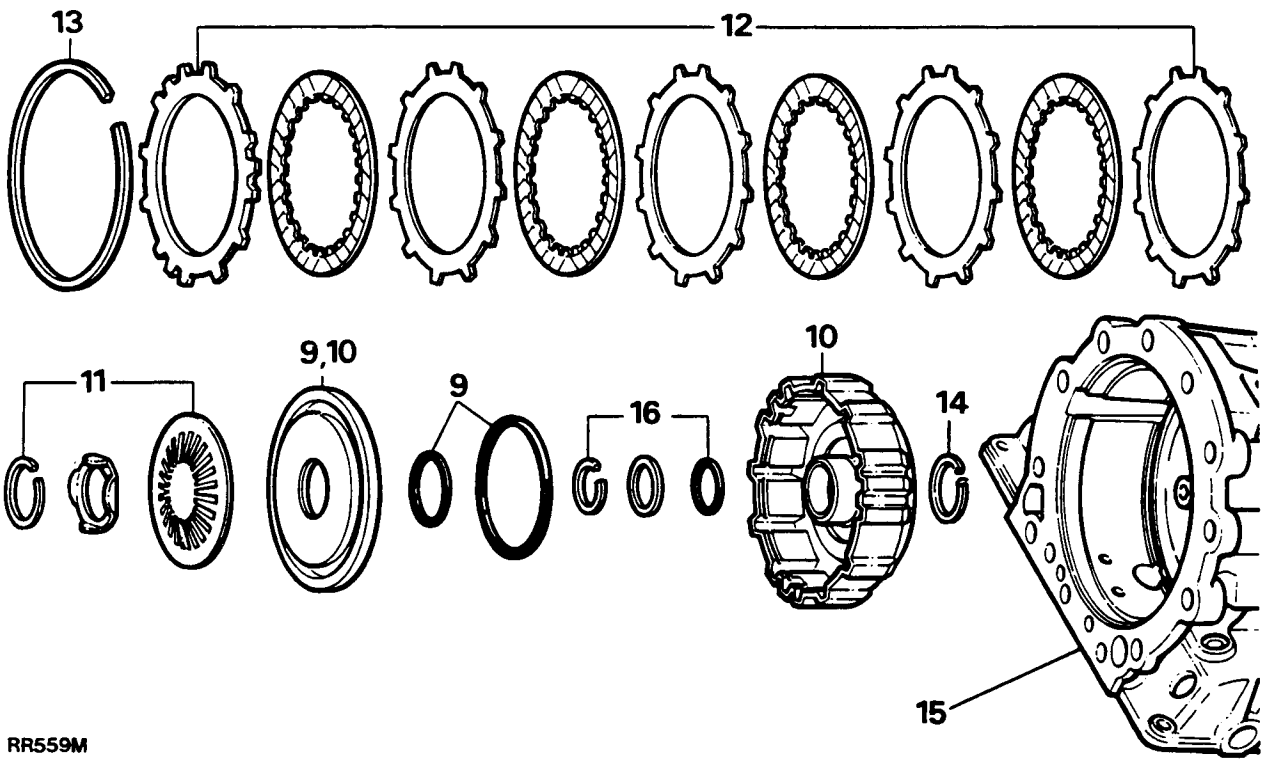
7. Remove and discard the two 'O' rings on piston B.
8. Remove seal ring on bottom of B cylinder if damage has occurred.

Assemble

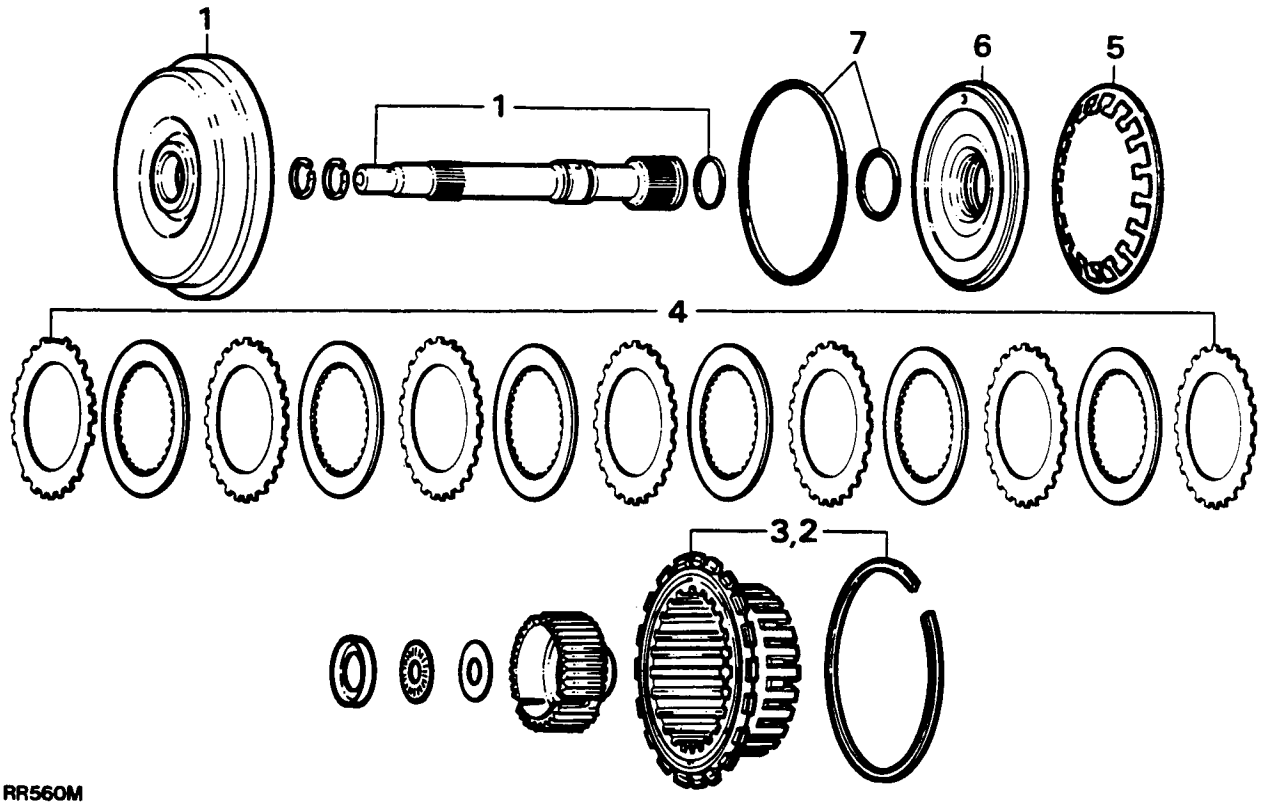
9. Fit the two 'O' rings onto piston B.

   NOTE: For ease of assembly use a petroleum jelly.

10. Install piston B into cylinder B.
11. Place spring plate into cylinder B and using clutch spring compressor LST1016-1, fit retaining washer (lips facing upward) and snap-ring.
12. Fit the clutch and steel plates starting with a steel plate finishing with the steel plate with three sets of three teeth grouped together.
13. Fit snap-ring into the clutch B assembly.
14. Turn upside down and fit seal ring and snap together if removed.
15. Install B clutch assembly into the transmission case, clutch plates facing upwards.
16. Using B clutch 'O' ring and snap-ring replacer LST116, fit 'O' ring, support ring and finally the snap-ring.



RR559M



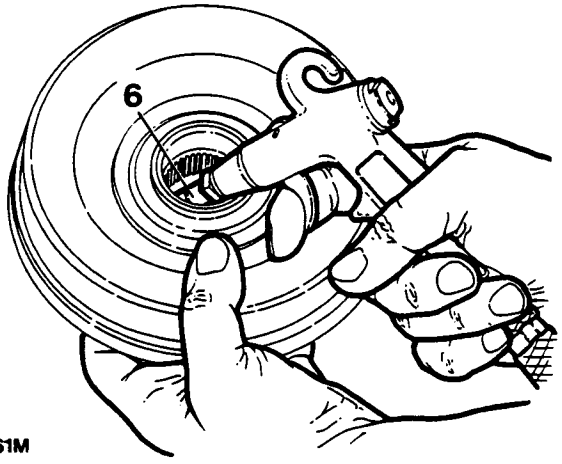
RR560M

A clutch assembly overhaul

1. Remove the input shaft by holding the A clutch assembly firmly and pushing the shaft against the working surface. Remove the 'O' ring and discard.
2. Using a suitable press, depress the A–B carrier and remove the snap-ring.
3. Remove carrier A–B.
4. Remove the six clutch plates and seven steel plates.
5. Remove spring plate.
6. For ease of removal of piston A, use air pressure fed through the oil feed hole.

   WARNING: Care should be taken using air pressure when removing the piston.

7. Remove and discard both 'O' rings on piston A.



RR561M

Assemble

8. Fit the two 'O' rings onto piston A.
9. Place the piston into cylinder A.
10. Fit the spring plate into the cylinder A with the convex side facing the piston.
11. Placing carrier A–B on the bench fit the clutch and steel plates starting with a steel plate and then a clutch plate, finishing with a steel plate.
12. Fit carrier A–B with the clutch assembly onto cylinder A.
13. Using a suitable press, depress the A–B carrier and secure with the snap-ring.
14. Fit the two seal rings, if removed, and an 'O' ring onto the input shaft.
15. Fit the input shaft into the cylinder A assembly and press downwards until shaft meets the stop.
16. Fit the thrust washer onto the input shaft seat.

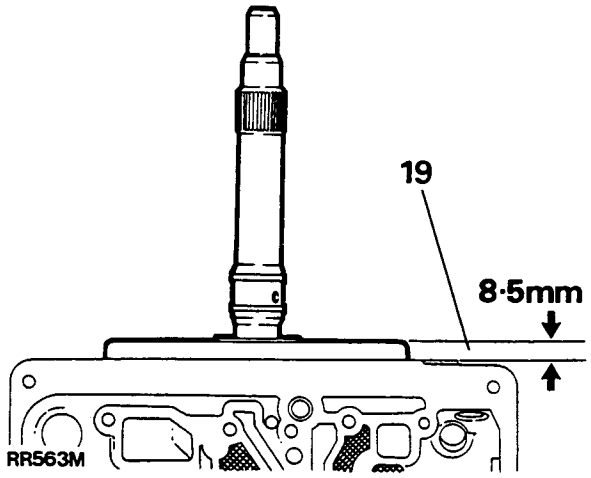
    NOTE: Use petroleum jelly to retain washer in place.

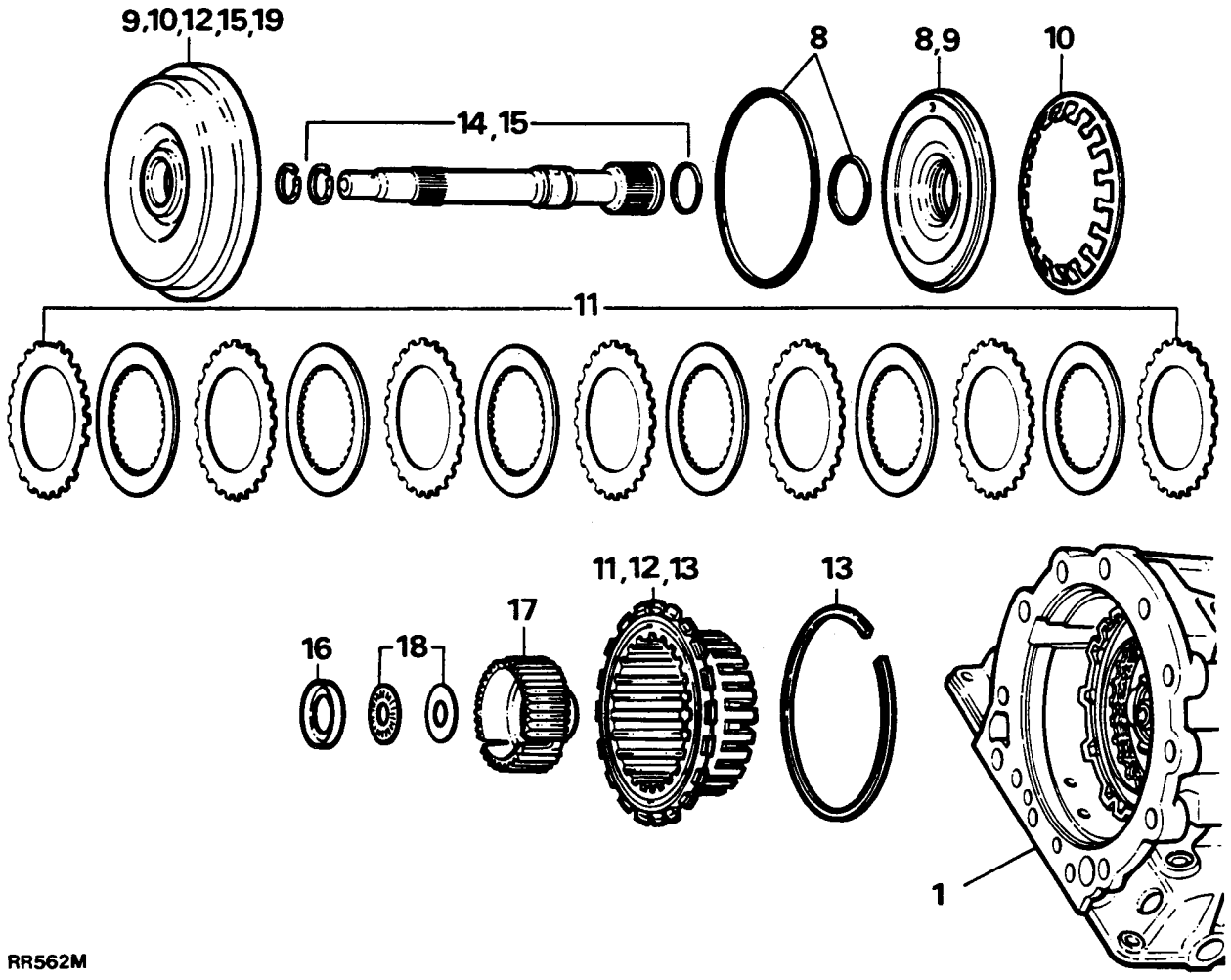
17. Install the inner carrier A onto the intermediate shaft within the gearbox.
18. Place the disc washer and axial cage into the inner carrier A.

19. Fit cylinder A assembly into the gearbox using a right to left twisting motion. This will enable the teeth of the clutch plates to mesh into the A–B carrier and inner carrier.

    NOTE: When properly engaged the top of cylinder A should not protrude more than 8,5 mm (0.33 in) above the gearbox front face.

20. Place the thrust washer and axial cage onto the A cylinder.

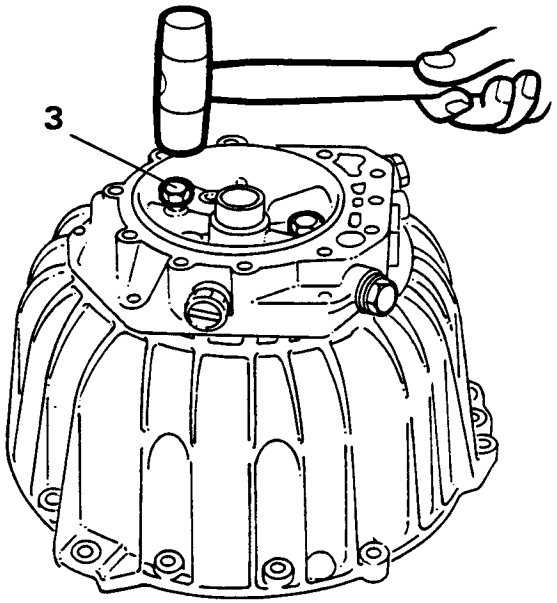




Pump, Intermediate Plate and Bell Housing

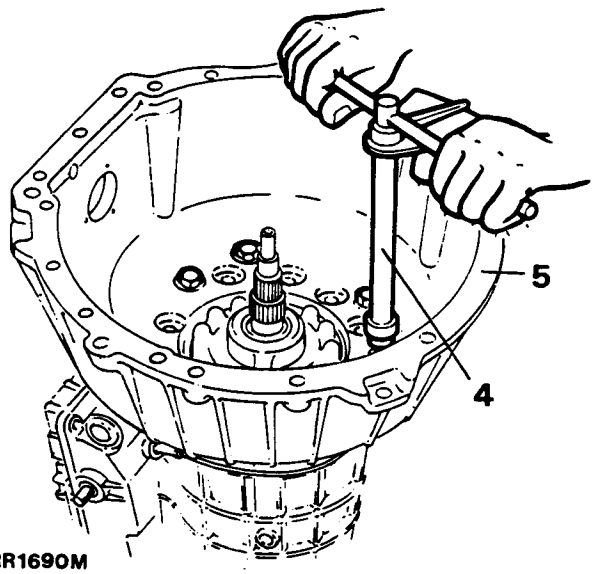
Remove and overhaul

1. Place the bell housing on the bench, open face down.
2. Remove the eight hexagonal bolts on the rear of the pump.
3. Screw in two bolts, diagonally opposite each other, tap lightly using a soft-headed mallet, this will free the pump assembly from the intermediate plate.



RR900M

4. Remove the six remaining bolts situated on the inside of the bell housing.
5. Separate the bell housing from the intermediate plate.



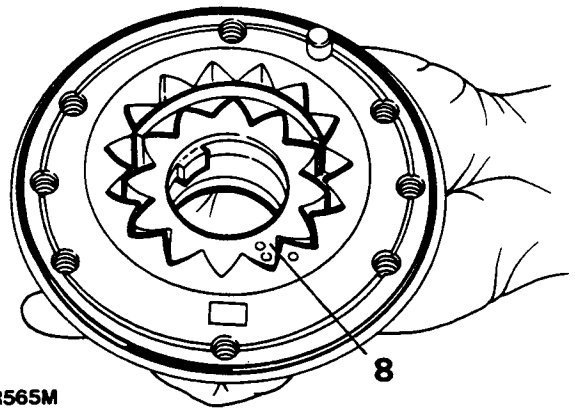
RR1690M

Pump assembly

6. Using a suitable tool remove the shaft sealing ring and 'O' ring from the pump housing and discard.
7. Strip, inspect and clean the pump assembly using a lint-free rag.

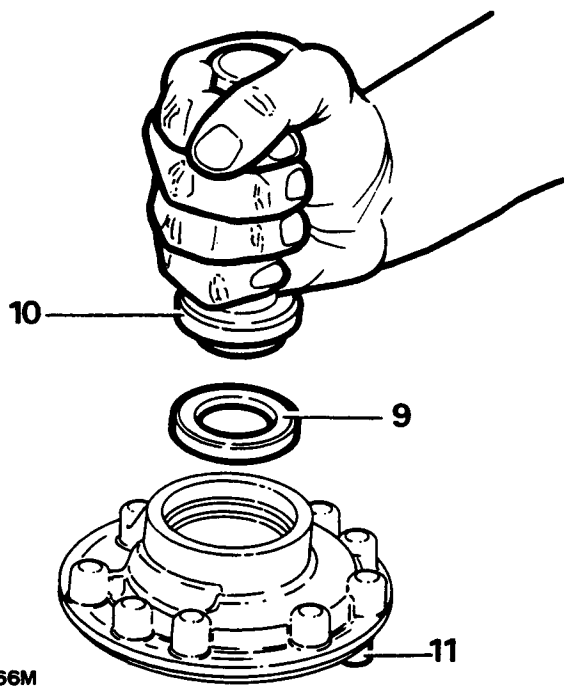
   NOTE: If damage has occurred to the assembly, replace the whole pump.

8. Replace the pump hollow gear and pump gear into pump housing with the marked side of gears facing upwards.



RR565M

9. Fit the 'O' ring onto the circumference of the pump housing.
10. Using oil seal replacer LST108, fit the shaft seal ring into the pump housing.
11. Fit the alignment pin into the pump housing.



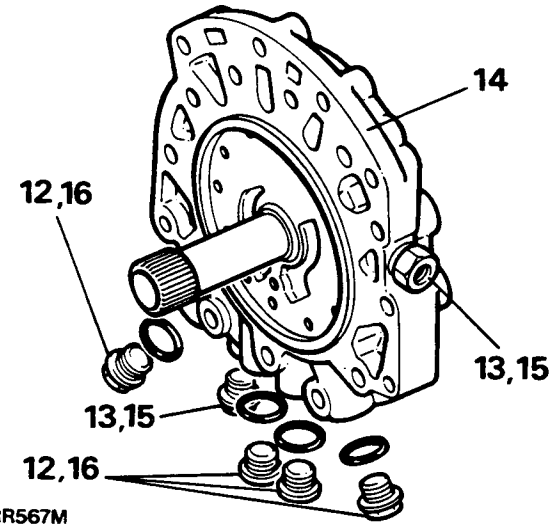
RR566M

Intermediate assembly

12. Remove the four screw plugs and seal rings from the plate and discard the seal ring.
13. Remove the oil cooler pipe adaptors.
14. Inspect and clean the intermediate plate with a lint-free rag.

NOTE: If damage is found replace the intermediate plate.

15. Fit the oil cooler pipe adaptors.
16. Fit the four screw plugs into their correct locations with new seal rings.



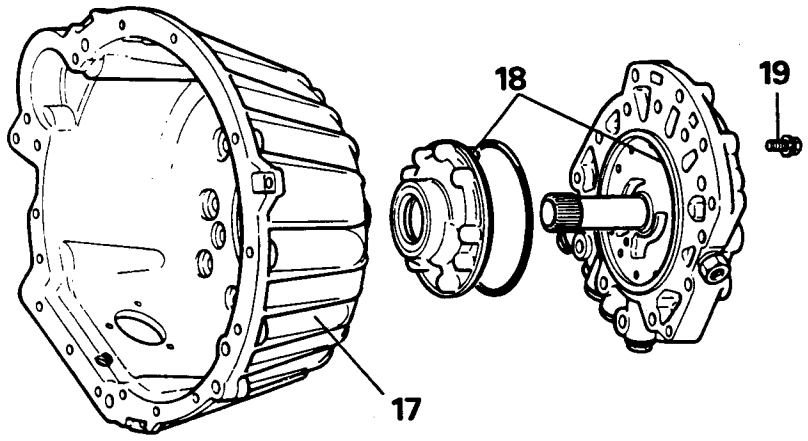
RR567M

Refit bell housing, intermediate plate and pump assembly

17. Inspect and clean the bell housing.

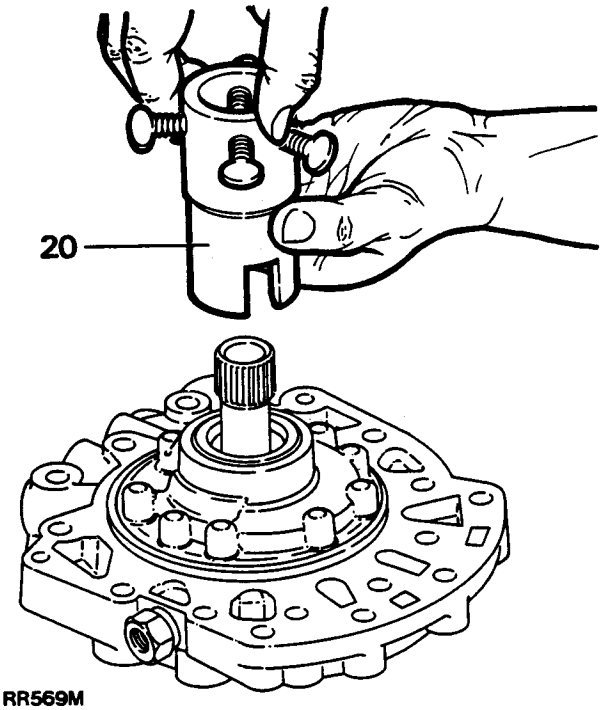
NOTE: If damage is found replace the bell housing.

18. Align the dowel in the pump with its hole in the intermediate plate and press the housing into position.
19. Secure the pump housing to the intermediate plate with the eight hexagonal bolts and tighten to the specified torque.



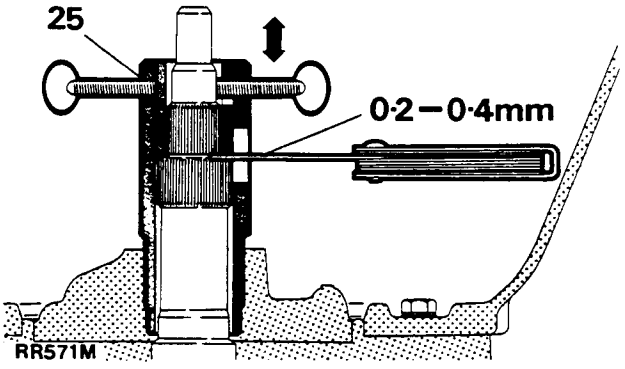
RR568M

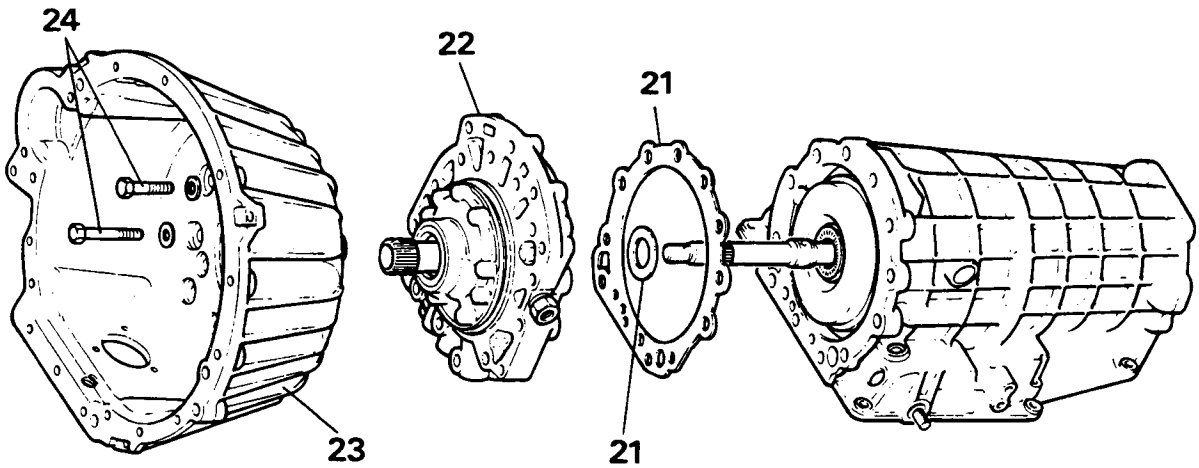
20. Using the oil pump rotation sleeve LST111 check that the pump gears rotate freely.
21. Place the gasket and disc washer onto the intermediate plate assembly using a petroleum jelly or vaseline.
22. Fit the intermediate plate onto the gearbox.
23. Fit the bell housing onto the intermediate plate assembly.



RR569M

24. Secure with the six short bolts which locate on the outside diameter ring pattern within the bell housing and the twelve long bolts which are located in the inner diameter ring pattern. All the bolts to be tightened to the specified torque.
25. Using the end-float gauge LST111 check the axial clearance 0,2 to 0,4 mm (0.008 to 0.016 in). If the axial clearance is not achieved, remove the bell housing/intermediate plate assembly complete and replace existing disc washer using a thicker or thinner one depending on the reading first taken. Reassemble bell housing/intermediate plate and check the axial clearance once again. Repeat this operation until axial clearance has been achieved.





RR570M

Check axial clearance

1. Fit LST111 end-float gauge onto the output shaft, making sure the outer shaft engages into the pump.
2. Pressing the output shaft towards the rear of the gearbox and tighten the three screws on the gauge.
3. Measure the clearance and note.
4. Now secure the remaining screw which retains the outer shaft to the inner collar.
5. Pull the whole assembly away from the bell housing, measure the clearance and note.
6. Subtract the first measurement from the second to obtain the axial clearance.

Extension housing and governor—overhaul

1. Remove the two bolts using torx bit TX27 retaining the parking wheel.
2. Remove the clip and counterweight from inside the governor hub.
3. Remove the two bolts from the top of the governor hub which releases the housing and discard.
4. Release the retaining clip and discard.
5. Remove the pin, spring, piston and weight from the governor housing.
6. Clean and inspect all parts for damage.

NOTE: Replace any part which may be damaged.

7. Remove the seal ring from the extension housing.
8. Clean and inspect the extension housing for damage.

NOTE: If the dowels are damaged replace the dowels only. If extension casing is damaged replace the case and dowels.

9. Inspect and clean extension shaft and bolt for damage, replace if necessary.

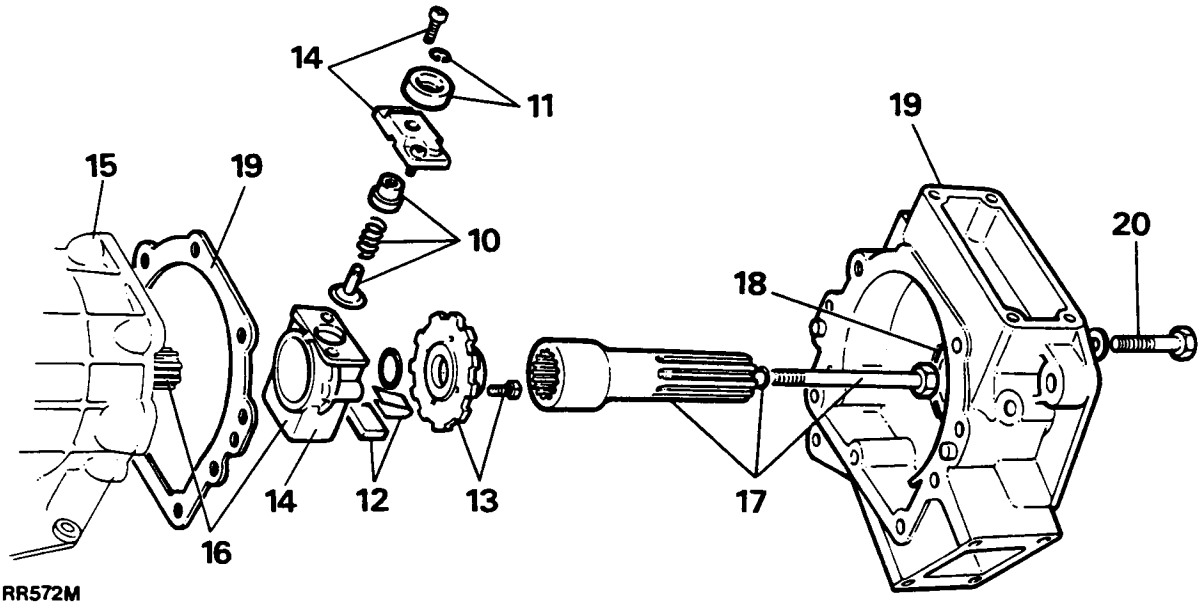
Assemble

10. Fit the pin, spring and piston to the governor housing.
11. Fit the weight on the top of the governor housing and secure with a new retaining clip.
12. Fit the counterweight into the governor hub and secure with the clip.
13. Fit the parking wheel and secure with two bolts using torx bit TX27 to the specified torque.
14. Fit the governor housing assembly to the hub and secure with two bolts using torx bit TX27 to the specified torque.
15. Turn gearbox over in holding fixture so that the rear of the box is uppermost.

16. Fit the governor/parking wheel assembly onto the output shaft and press the assembly until fully seated.

    NOTE: To avoid damage to the 'O' ring use a petroleum jelly. Ensure the seal rings are snapped together and are seated correctly.

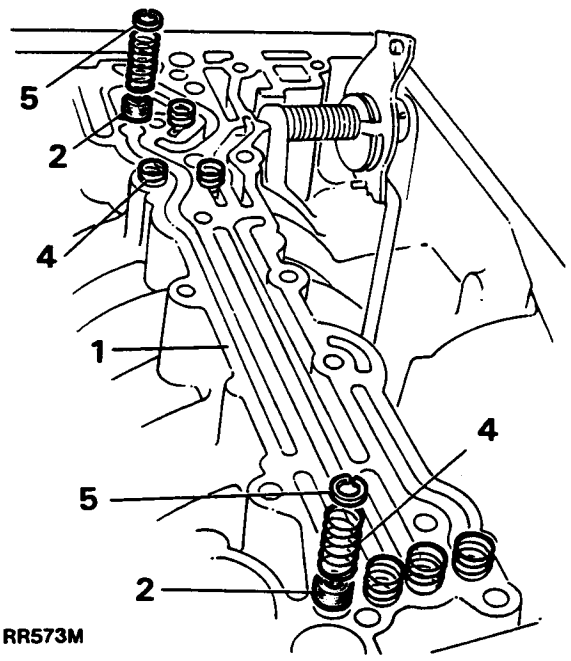
17. Fit the extension shaft and retaining bolt using a new 'O' ring.
18. Fit a new seal to the extension housing using the rear oil seal replacer LST108.
19. Fit a new gasket onto the rear of the gearbox and fit the extension housing taking care not to damage the seal on assembly.
20. Secure the extension housing using the nine bolts to the specified torque.



RR572M

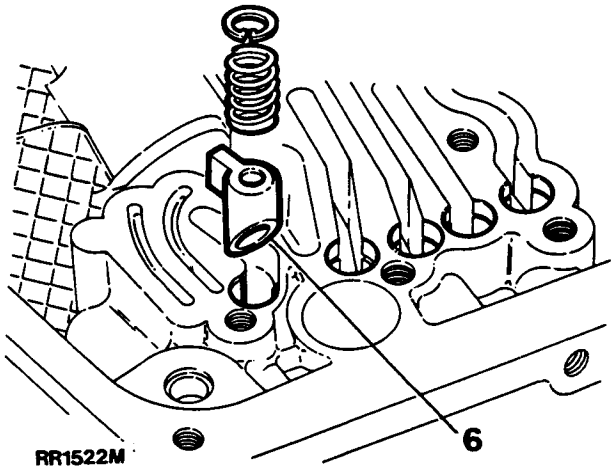
Refit valve body, oil pan and torque converter

1. Position the gearbox so that the bottom is uppermost.
2. Insert the eight sealing bushes into the oil feed holes using the control unit inlet oil seal remover/replacer LST113.
3. As a test to check the function of the clutch and brake assemblies, insert an air gun into the oil feed holes and exert a pressure of 5 to 6 bar (72.5 to 87 lb/in²).
4. Fit the four short springs into the oil feed holes at the front of the gearbox and four long springs into the oil feed holes at the rear of the gearbox.
5. Fit the eight circlips to retain the springs and sealing bushes.

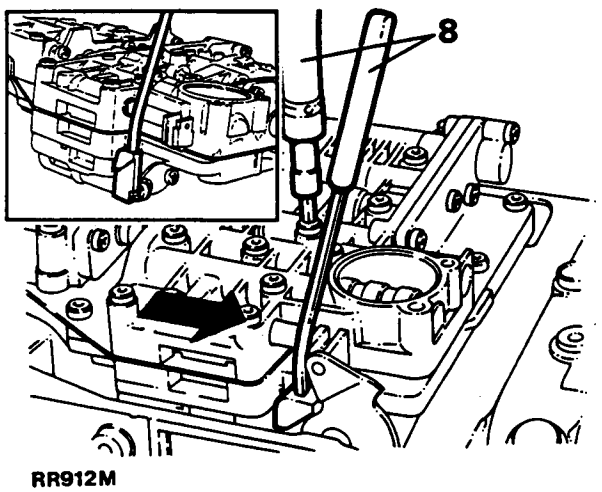


RR573M

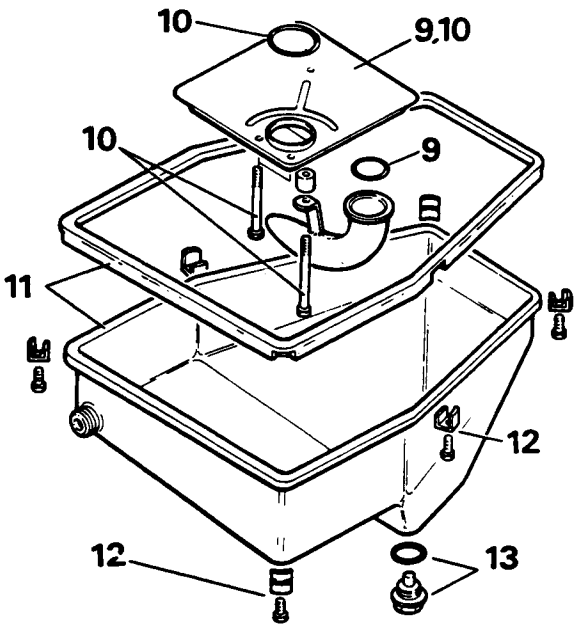
6. Fit the restrictor, spring and circlip using LST 113 into the hole adjacent to the four rear oil feed holes.



7. Place the control unit ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.
8. Place the selector linkage setting gauge LST109 in position and gently press the control unit against the tool and tighten all thirteen bolts using torx bit TX27 to the specified torque.



9. Remove the setting gauge and fit the suction and 'O' ring to new oil screen.
10. Fit the new oil screen with new 'O' ring and secure with the three bolts using torx bit TX27 to the specified torque.
11. Fit the oil pan using a new gasket.
12. Secure the oil pan with the six retaining plates (two straight and four corner plates), tighten to the specified torque.
13. Fit oil pan plug with a new seal.



14. Turn the gearbox around until the gearbox is horizontal.
15. Using the torque converter remove/refit handles 18G1501, install the torque converter into the gearbox.

NOTE: Check that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.