

Section 4

Transmission, Rear Axle

Service Procedures

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Specifications

Clutch

Clutch, type	Single dry plate, diaphragm spring	
Size	8 1/2"	
Clutch friction area, total	440 cm ²	68.2 sq in
Clutch pedal travel LHD	150 mm	6.0"
RHD	160 mm	6.4"
Throw-out yoke travel	3 mm	0.12"

Transmission

M 40

Type designation	M 40	
Reduction ratios:		
1st speed	3.41:1	
2nd speed	1.99:1	
3rd speed	1.36:1	
4th speed	1:1	
Reverse	3.25:1	
Lubricant, type	Gear oil	
viscosity	SAE 80	
Alternative lubricant, type	Engine oil	
viscosity, all year round	SAE 30	
Oil capacity	0.75 dm ³ = 0.7 Imp. Qts = 0.8 US Qts	

Tightening torque

	Nm	Lb.ft.
Nut for driving flange	95–105	65–75

M 41 (transmission M 40 with overdrive)

Reduction ratio, overdrive	0.797:1	
Clearance, piston-cylinder in oil pump	.005–.040 mm	0.0002–0.0016"
Oil pressure, direct drive	approx. 1.5 kp/cm ²	21 psi
overdrive	27–30 kp/cm ²	385–425
Lubricant, type	Engine oil	
viscosity, all year round	SAE 30	
alternative	Multigrade oil SAE 20 W–40	
Oil capacity	1.6 dm ³ = 1.4 Imp. Qts = 1.7 US Qts	

Tightening torque

Nut for driving flange	110–140 Nm	80–100 lb.ft.
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Automatic transmission

Make and type	Borg-Warner, type 35	
Volvo No. 242 and 244	254785	
245	254784	
Borg-Warner No. 242 and 244	468	
245	470	
Label color: 242 and 244	Shell pink	
245	Aircraft blue	

Reduction ratios:

1st gear	2.31:1	} x Converter ratios
2nd gear	1.45:1	
3rd gear	1:1	
Reverse	2.09:1	
Number of teeth, front sun gear	32	
rear sun gear	28	
planet gear, short	16	
planet gear, long	17	
ring gear	67	
Size of converter	24 cm	9 1/2"
Torque ratio in converter	2:1—1:1	
Normal stall speed, B 20 F engine		2300 rpm
Weights total, with fluid	53.1 kg	117 lbs
Fluid, type	Automatic Transmission Fluid, Type F (FLM)	
Fluid capacity	6.4 dm ³ = 5.6 Imp.Qts = 6.8 US Qts	
Normal operating temperature of fluid, approx.	110—115°C	212—240°F

Approximate shift speeds at kick-down

Car	Engine	Rear axle ratio	1—2 shift		2—3 shift		3—2 shift		3—1 shift	
			km p h	m p h	km p h	m p h	km p h	m p h	km p h	m p h
242, 244 245	B 20 F	4.10:1	60	37	108	67	98	—	max 49	30

Springs for control system

SPRING

	Approximate length		Effective Number of turns	Wire diam.
	mm	inch		
1—2 shift valve	27.8	1.094	13 1/2	6.61
Primary regulator valve, B 20 F	74.7	2.940	14	1.42
Servo orifice control valve	27.6	1.086	24	0.64
*) Servo orifice control valve	30.8	1.213	25	0.61
Modulator valve	27.2	1.069	19	0.71
*) Modulator valve	27.2	1.069	19	0.71
Secondary regulator valve	65.9	2.593	18	1.42
2—3 shift valve (inner spring)	40.4	1.59	22 1/2	0.91
Throttle valve (inner spring)	20.5	0.907	28	0.46
*) Throttle valve (inner spring)	20.5	0.907	25	0.46
Throttle valve (outer spring)	29.8—	1.107—	19 1/2	0.81
*) Throttle valve (outer spring)	30.1	1.185		
Governor valve	29.8—30.1	1.107—1.185	18	0.81

*) Alternative springs

Tightening torques

APPLICATION

	Nm	lb. ft.
Torque converter — drive plate	35—41	25—30
Transmission case — converter housing	11—18	8—13
Extension housing — transmission case	41—76	30—55
Oil pan — transmission case	11—18	8—13
	11—18	8—13
Rear servo — transmission case	18—37	13—27
Pump adaptor — front pump body	24—30	17—22

Slotted screws	3-4	2-3
Pump adaptor — transmission case	11-26	8-18.5
Oil deflector flange — transmission case	6-10	4-7
Center support — transmission case	14-25	10-18
Outer lever — manual valve shaft	10-12	7-9
Pressure point	6-7	4-5
Oil pan drain plug	12-17	9-12
Oil tube collector — lower body	2.5-3.5	1.7-2.5
Governor line plate — lower body	2.5-3.5	1.7-2.5
Lower body end plate — lower body	2.5-3.5	1.7-2.5
Upper body end plate front or rear — upper body	2.5-3.5	1.7-2.5
Upper body — lower body	2.5-3.5	1.7-2.5
Valve bodies assembly — transmission case	6-12	4.5-9
Front pump strainer — lower body	2.5-3.5	1.7-2.5
Downshift valve cam bracket — valve body	2.5-5.0	1.7-3.5

Governor

Governor body — counterweight	6-7	4-5
Cover plate — governor body	2.5-5.5	1.7-4.0

Brake band adjustment

Adjusting screw locking nut, rear servo — case	41-55	30-40
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Special threaded parts

Starter inhibitor	8-12	6-8
Downshift valve cable adaptor — transmission case	11-12	8-9
Coupling flange — driven shaft	48-69	35-50
Nipple for oil cooler connection	7-10	5-7
Nut for nipple	14-17	10-12

Rear axle

Rear axle, type	Semi-floating	
Track	1350 mm	53.15"

Final drive

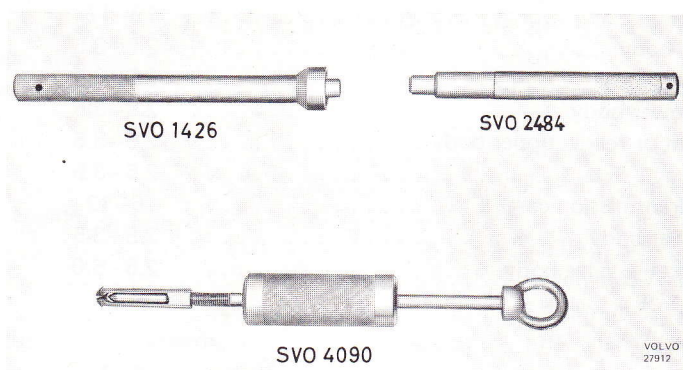
Type	Hypoid	
Reduction ratio	3.91:1, 4.10:1 or 4.30:1	
Warp, crown wheel	max. .08 mm	0.0032"
Backlash	0.15-0.20 mm	0.003-0.008"
Pre-loading on pinion bearings, new bearings	1.1-2.3 Nm	9.55-20 lb.in.
run-in bearings	0.6-1.1 Nm	5.21-9.55 lb.in.
Pre-loading on differential bearings	0.13-0.20 mm	.005-.008"
Lubricant, type, without limited slip	Oil acc. to MIL-L-2105 B	
with limited slip	Oil acc. to MIL-L-2105 B provided with additive for limited slip	
viscosity	SAE 90	
Oil capacity	1.3 dm ³ = 1.1 Imp.Qts = 1.4 US Qts	
Oil capacity	1.3 dm ³ = 1.2 Imp.Qts. = 1.4 US Qts	

Tightening torques

	Nm	Lb.ft.
Flange	280-300	200-220
Caps	50-70	35-50
Crown wheel	65-90	45-65
Wheel nuts	100-140	70-100

Group 41

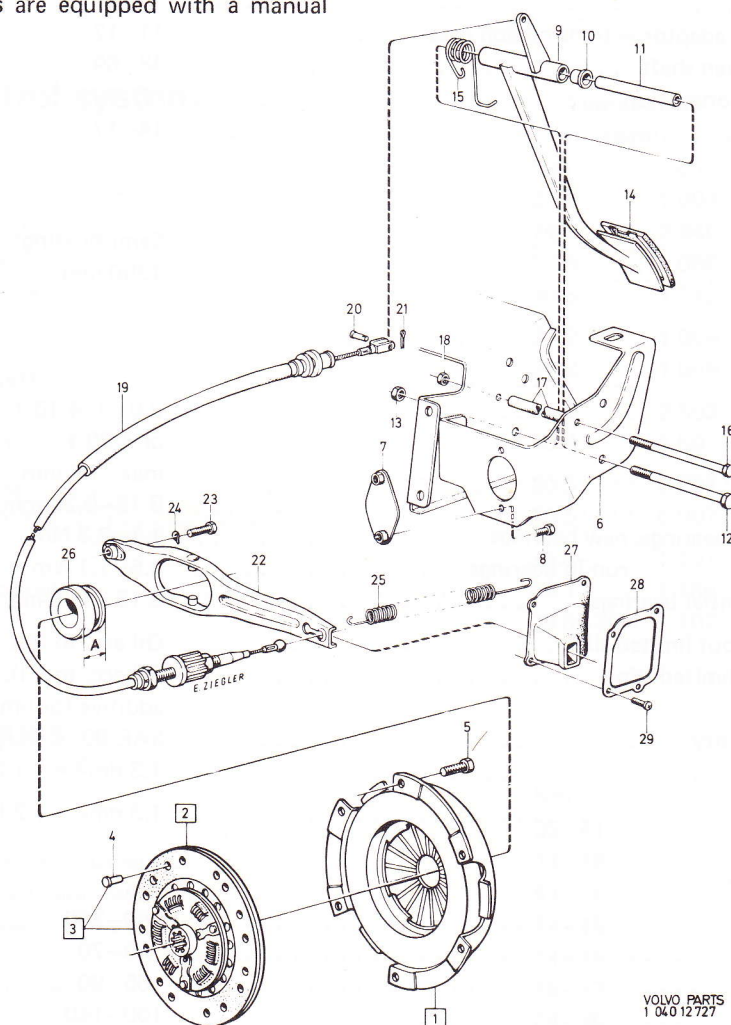
Clutch



Special tools for clutch repairs

- 999 (SVO) 1426 Drift for pilot bearing in flywheel
- 999 (SVO) 2484 Mandrel for centering clutch plate.
- 999 (SVO) 4090 Puller for ball bearing in flywheel.

The 1975 240 models are equipped with a manual clutch control.

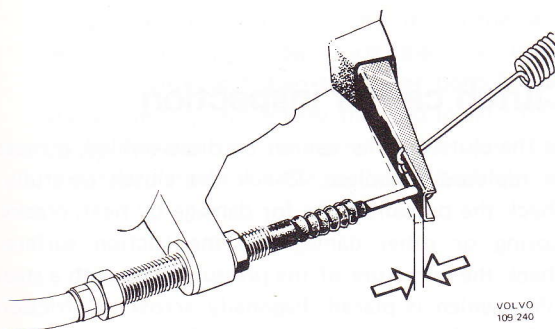


VOLVO PARTS
1 040 12 727

Replacing clutch operating cable

Op. No. 41254 (41205 w. flywheel housing removed)

1. Put front end on stands. Remove under-dash panel.
2. First remove the return spring and then disconnect the clutch cable at the clutch fork. Pull out cable.
3. Remove the Clevis pin at the cable upper end. Pull the cable out of the rubber grommet in the firewall.
4. Push the new cable into the rubber grommet in the firewall. Re-install the Clevis pin.
5. Fit the adjustment device in the bell housing. Connect the cable to the clutch fork. Install the return spring.



6. Adjust the clutch fork free play to approx. 1/8" (3-4 mm).

Replacing clutch pedal/bushing

The instructions below cover replacement of pedal and/or bushings.

1. Remove the Clevis pin securing the cable to the clutch pedal. Remove the nut, pull out the bolt and remove the pedal.
2. Remove the tubular shaft. Drive out the bushings with a suitable drift.
3. Pre-lubricate the new bushings with grease and install them. Install the tubular shaft.
4. Position the pedal and attach the bolt. Install and torque the nut. Reconnect the cable and the Clevis pin.

Removing clutch

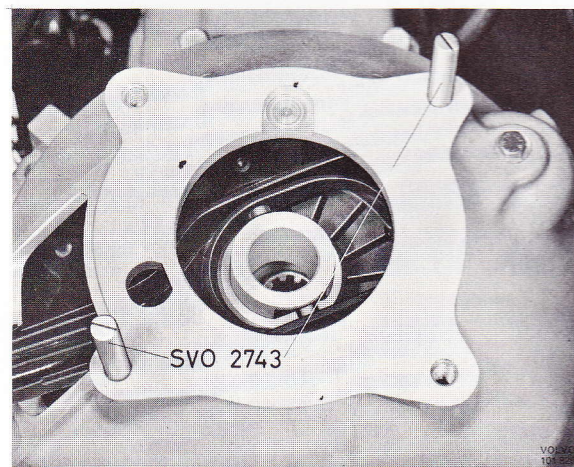
Replace clutch disc (clutch)

Op.No. 41112 includes transmission removal

Op.No. 41103 excludes transmission removal

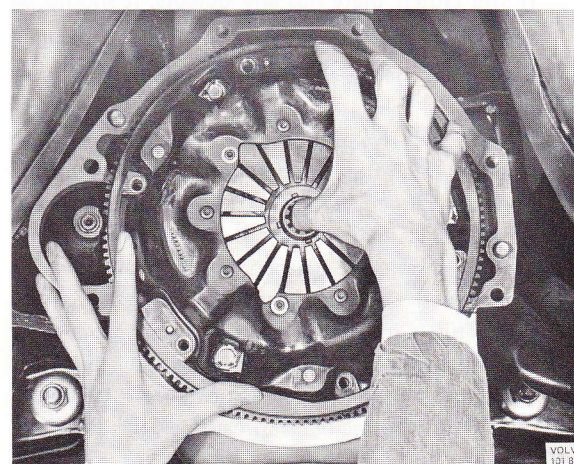
1. Remove the transmission according to the instruction in Group 43.
2. Remove the upper bolt for the starter motor.

3. Remove the release bearing. Disconnect the cable from the release fork. Slacken the cable sheath from the bracket.



Release bearing

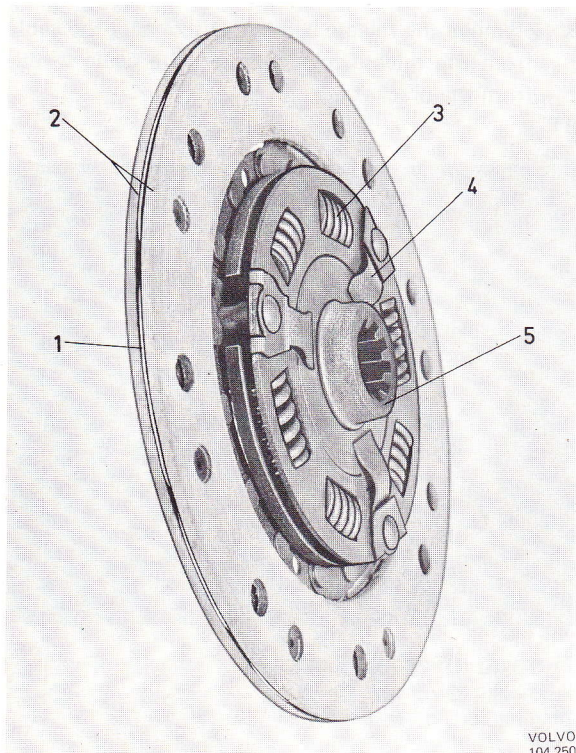
4. Slacken the bolts and remove the flywheel housing.
5. Slacken the bolt for the release fork ball joint. Remove the ball and the release fork.
6. Slacken the bolts holding the clutch to the flywheel by loosening them crosswise a couple of turns at a time to prevent warping. Remove clutch and clutch plate.



Removing clutch

Clutch facing replacement

1. Drill out the old rivets with a drill having the same diameter as the rivets, 9/64" = 3.5 mm, and remove the old facings.



Clutch disc

1. Disc 2. Facings 3. Spring 4. Damping spring 5. Hub

2. Check the clutch plate. The indentations on the tongues should be even. The clutch plate must not be warped. The clutch springs and rivets in the hub should fit securely and not show any signs of looseness. Check to make sure that there are no cracks.

If the clutch plate has any defects, it should be replaced with a new one.

3. Rivet the new facings (preferably in a rivet press).

NOTE: the rivets should be inserted from the side on which the facing lies and riveted from the opposite direction against the disc. Use every other hole in the facing. After riveting, the facings should be spaced from each other as determined by the indentations on the clutch disc. This is most important in order to achieve a smooth engagement when starting and driving.

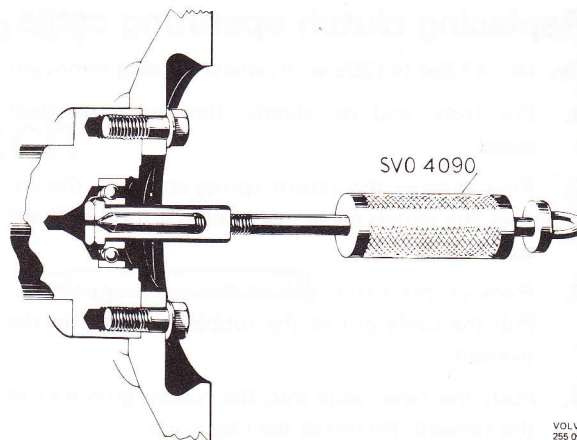
The clutch facings must be absolutely free from oil. Oil on the facings can cause clutch grabbing.

Servicing clutch shaft pilot bearing

1. Use puller 4090 to remove the bearing.

If the bearing, after cleaning and light oiling, runs smoothly and evenly and has no noticeable play, it should be packed with ball bearing grease and reinstalled.

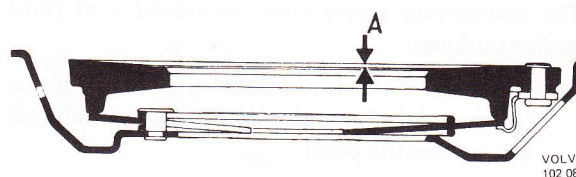
NOTE: heat-resistant grease should be used.



Pilot bearing removal

Clutch carrier inspection

As the clutch carrier cannot be disassembled, it must be replaced complete. Check the clutch carefully. Check the pressure plate for damage by heat, cracks, scoring or other damage on the friction surface. Check the curvature of the pressure plate with a steel ruler, which is placed diagonally across the friction surface of the pressure plate. Then measure the distance between the straight edge of the ruler and the inner diameter of the pressure plate. This measurement must not exceed $0.00012'' = 0.03 \text{ mm}$.



Checking curvature of pressure plate

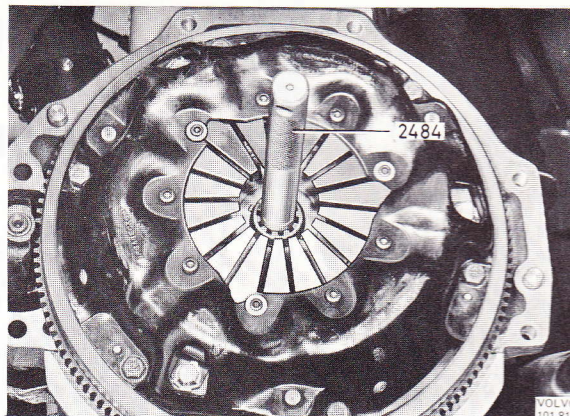
There must be no "crowning", i.e. clearance between the straight edge of the ruler and the outer diameter of the pressure plate. Check at several points. Check the pressure spring carefully, if it is cracked or damaged in any other way, the clutch should be replaced.

Check the release bearing by turning it round a few times under light pressure so that the balls rotate against the races. The bearing should turn easily without binding at any point. The release bearing should also slide easily on the guide sleeve from the transmission.

Clutch installation

Before installation, check that clutch facings, flywheel and pressure plate are completely free from oil. Wash them with gasoline and wipe off with a clean piece of cloth.

1. Set up the clutch plate (the longest side of the hub facing backwards) together with the clutch and insert the centering mandrel 2484 so that the guide journal in this centers the pilot bearing in the flywheel.
2. Install the six bolts which hold the clutch and tighten them crosswise a couple of turns at a time. Remove the centering mandrel.
3. Install the release yoke in the flywheel housing.
4. Install the upper bolt for the starter motor in the housing and install the housing. Install the bolts in the following order: First the four upper (7/16") bolts, and then the lower bolts for the starter motor, and finally the two lower (3/8") bolts. The nut for the starter motor upper bolt is installed after the cable has been attached.



5. Insert the cable shaft in the bracket and the rear nut. Secure the cable in the release fork. Install the release bearing.
6. Install and tighten the nut for the upper starter motor bolt.
7. Install the transmission according to instructions in Group 43.
8. Adjust the clutch pedal play.

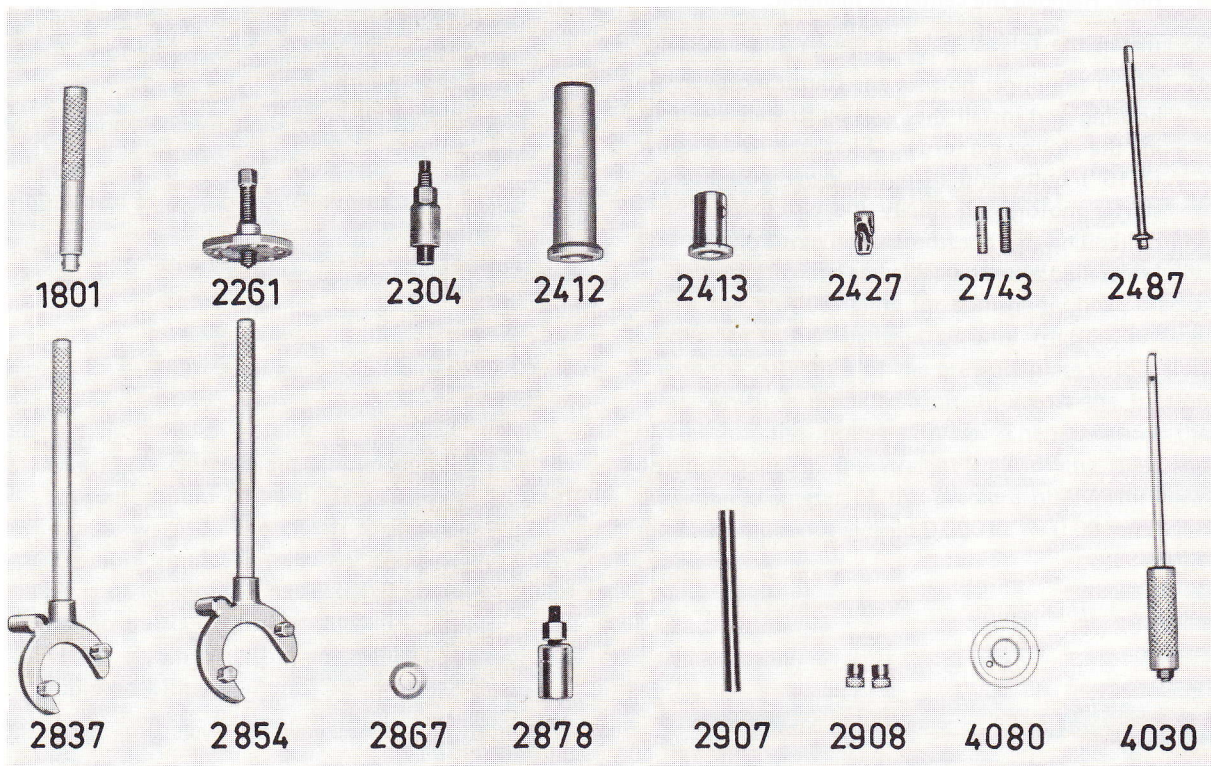
Group 43 A

Transmission

M 40 — standard
M 41 — with overdrive

Tools

The following special tools are required for transmission repairs.



Special tools

VOLVO
105 064

999
(SVO)

- 1801 Standard handle 18x200 mm
- 2261 Flange puller
- 2304 Press tool for flange installation
- 2412 Drift for installation of bearing on input shaft and for installation of input shaft in housing
- 2413 Drift for installation of oil seal in rear cover
- 2427 Universal joint for 2487
- 2487 3/8" drive extension for upper transmission bolts
- 2743 Guide pins for transmission
- 2837 Flange adaptor, 245
- 2854 Flange adaptor, 242 and 244

- 2867 Drift for installation of oil seal in input shaft cover
- 2878 Reverse shaft puller
- 2907 Mandrel for idler gear installation
- 2908 Centering plug for thrust washer, used (two) together with 2907 when installing idler gear
- 4030 Puller for rear cover oil seal
- 4080 Drift for installation of rear cover bearing

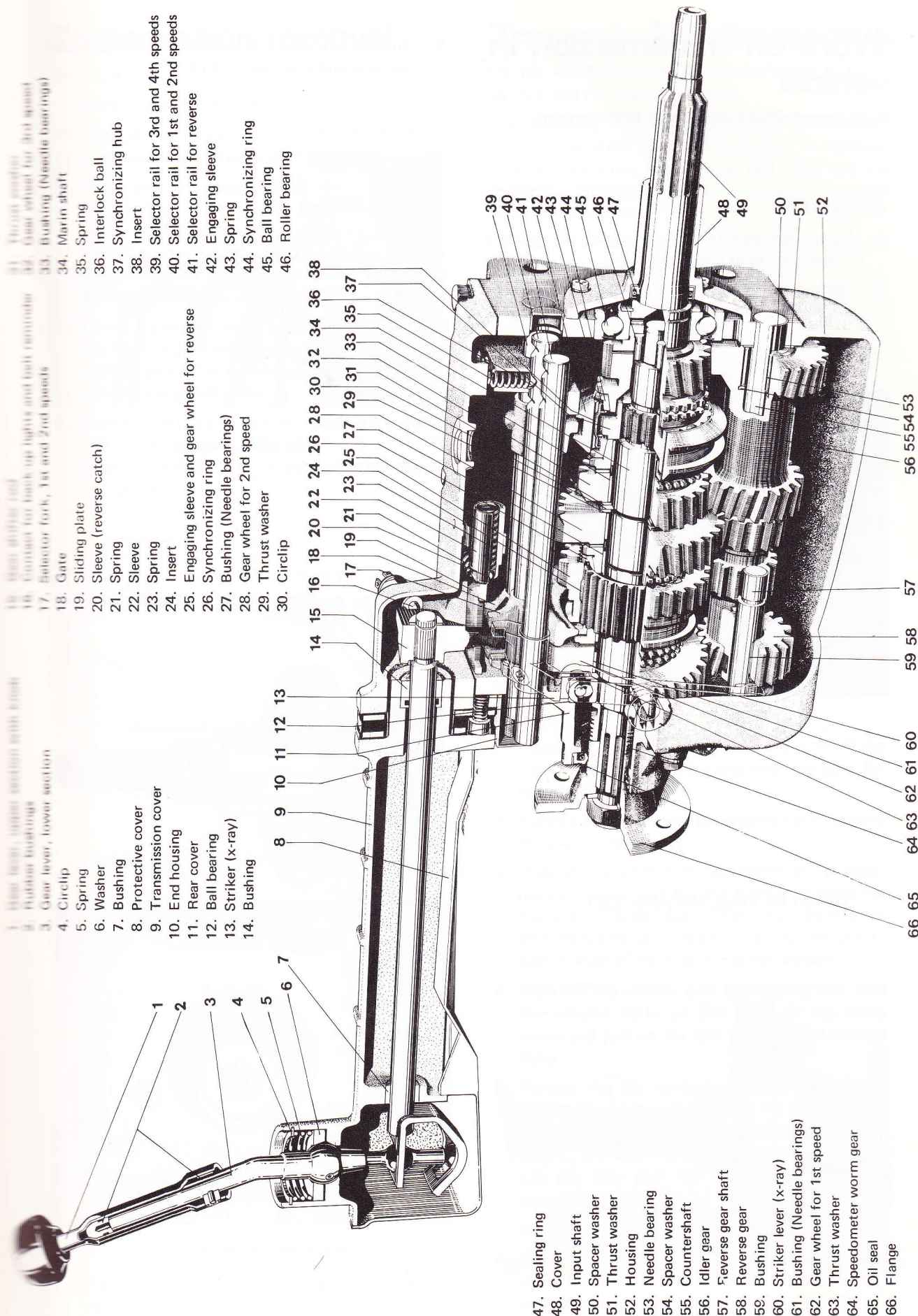
The following tools are also used:

- 2520 Stand for fixture 2922
- 2922 Fixture for transmission disassembly and assembly (used together with 2520).

1. Gear lever, upper section with bush
2. Rubber bushings
3. Gear lever, lower section
4. Circlip
5. Spring
6. Washer
7. Bushing
8. Protective cover
9. Transmission cover
10. End housing
11. Rear cover
12. Ball bearing
13. Striker (x-ray)
14. Bushing

15. Gear driver feed
16. Contact for back up lights and belt reminder
17. Selector fork, 1st and 2nd speeds
18. Gate
19. Sliding plate
20. Sleeve (reverse catch)
21. Spring
22. Sleeve
23. Spring
24. Insert
25. Engaging sleeve and gear wheel for reverse
26. Synchronizing ring
27. Bushing (Needle bearings)
28. Gear wheel for 2nd speed
29. Thrust washer
30. Circlip

31. Thrust washer
32. Gear wheel for 3rd speed
33. Bushing (Needle bearings)
34. Main shaft
35. Spring
36. Interlock ball
37. Synchronizing hub
38. Insert
39. Selector rail for 3rd and 4th speeds
40. Selector rail for 1st and 2nd speeds
41. Selector rail for reverse
42. Engaging sleeve
43. Spring
44. Synchronizing ring
45. Ball bearing
46. Roller bearing



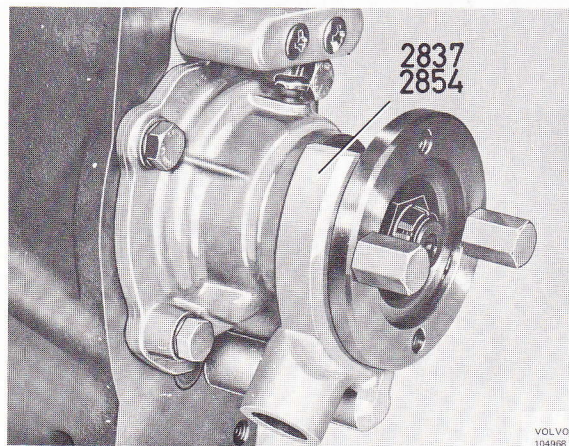
47. Sealing ring
48. Cover
49. Input shaft
50. Spacer washer
51. Thrust washer
52. Housing
53. Needle bearing
54. Spacer washer
55. Countershaft
56. Idler gear
57. Reverse gear shaft
58. Reverse gear
59. Bushing
60. Striker lever (x-ray)
61. Bushing (Needle bearings)
62. Gear wheel for 1st speed
63. Thrust washer
64. Speedometer worm gear
65. Oil seal
66. Flange

Work on transmission in vehicle

Rear transmission cover seal replacement

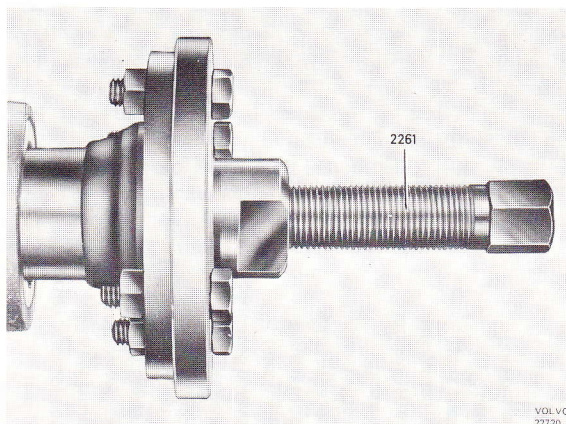
Op. No. 43130

1. Carry out operations 1–4 under the heading "Removal" to extent necessary.
2. Slacken the flange nut. Use 2854 as an adaptor for 242 and 244 and 2837 for 245.



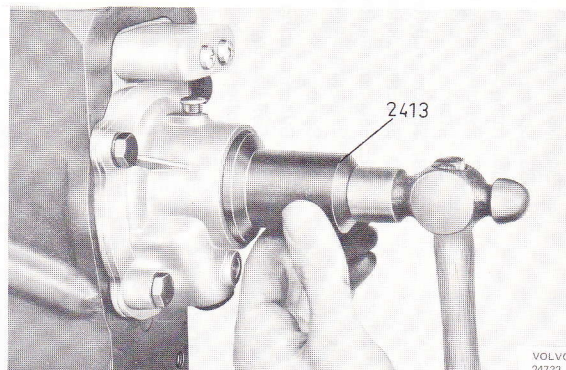
Flange counterhold

Pull off the flange. Use puller 2261.



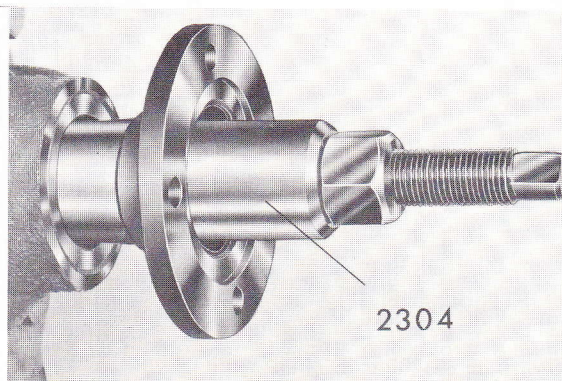
Flange removal

3. Pull out the old oil seal with puller 5069. Install the new seal with sleeve 2413.



Oil seal installation

4. Press on the flange with tool 2304. Re-store.

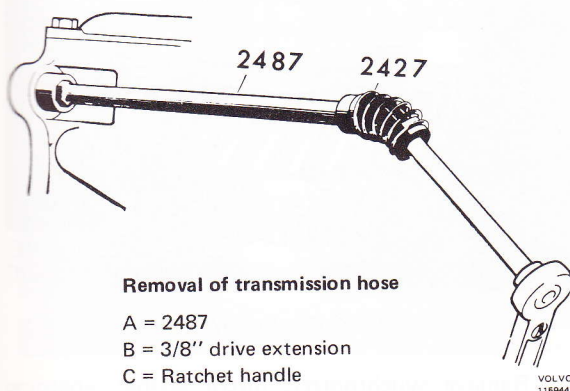


Flange installation

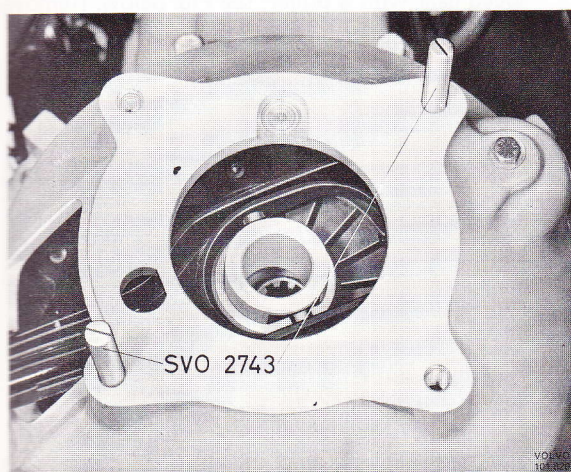
Transmission removal

Op. No. 43170.

1. Remove the gearshift lever.
2. Begin with the rear end, jack up the vehicle and put it on stands. Drain transmission oil.
3. Use a jack to support under the transmission. Loosen and remove the supporting member under the transmission. Disconnect the front universal joint from the transmission flange. Disconnect the speedometer cable. Disconnect rear motor mount and exhaust pipe bracket.
4. Install a piece of wood between the engine and the firewall and lower the jack until the engine is aligned against the wooden piece. Disconnect the wires at the transmission.
5. Slacken right upper and left lower transmission bolt with spanner 2487, flexible joint 2427, extension with 3/8" drive and ratchet handle, see Fig. below:



Install two guide pins 2743, see below:



Guide pins for transmission

Slacken the other two bolts. Pull out the transmission backwards and lower it.

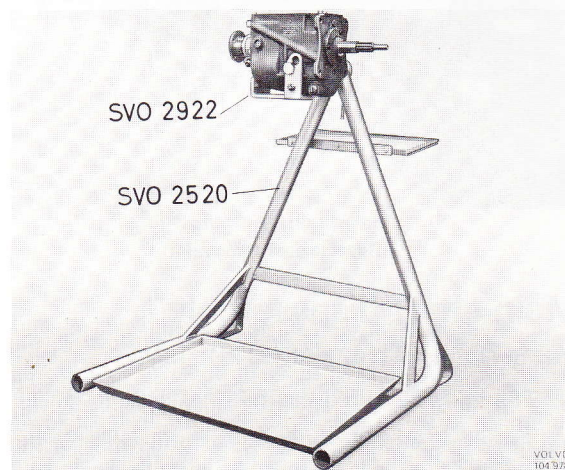
Transmission disassembly

Op. No. 43102: rebuild, incl. remove/install

Op. No. 43171: rebuild, removed

The following description applies to transmissions without overdrive. If the transmission is equipped with an overdrive, remove rear end bolts and the overdrive. Proceed with the operations described below as far as necessary.

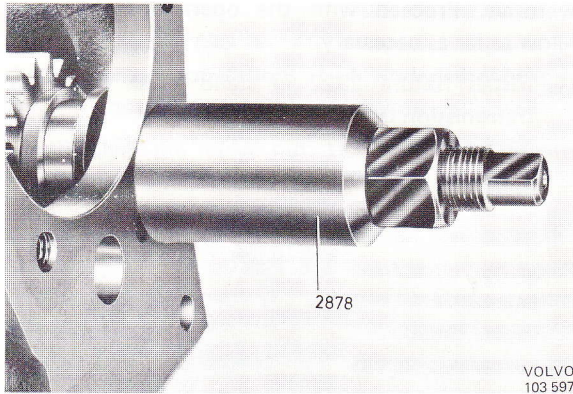
1. Install fixture 2922 in stand 2520. Place the transmission in the fixture, see Fig.



Transmission fixture

2. Remove the transmission cover bolts. Lift off the cover. Remove the spring and interlock bolts for the selector rails.
3. Remove the cover over the selector rails. Remove the selector fork bolts.
4. Slide the selector fork backwards to 1st speed position. Drive out the pin slightly (it must not foul the 1st speed gear). Then move the selector fork forwards sufficiently to allow the pin to pass in front of the gear. Drive out the pin.
5. Slide out the selector rails. When doing this, hold the selector forks so that they do not come askew and jam on the rails. Remove the selector forks.
6. Remove the rear cover bolts. Turn the cover so that it does not lock the shaft for the idler and reverse gears. Drive out the idler gear shaft.
NOTE: The shaft must be driven out backwards. Let the idler gear fall to the bottom of the transmission.
7. Pull out the mainshaft.
8. Remove the bolts and the cover over the input shaft. Lever out the oil seal from the cover with a screwdriver or similar tool.

9. Drive out the input shaft. If necessary, remove the circlip and press the ball bearing off the shaft.
10. Take out the idler gear. Pull out reverse gear shaft with puller 2878, see Fig. Take out reverse gear and other parts.



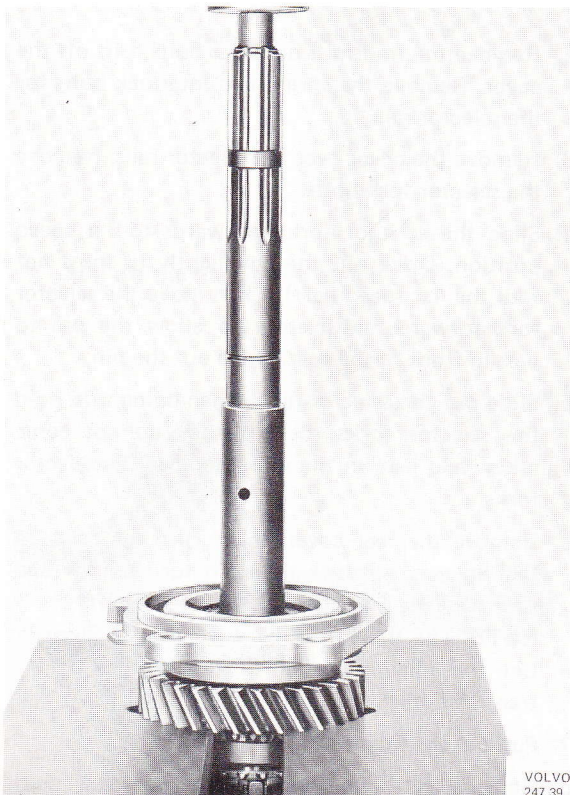
Reverse gear removal

Main shaft disassembly

(Part of Op. No. 43102 and 43171)

1a. Transmission with overdrive (M 41):

Remove the circlip and press off the rotor for the overdrive oil pump. Remove the circlip for the mainshaft rear bearing. Slide the engaging sleeve for 1st speed and 2nd speed forwards. Place the

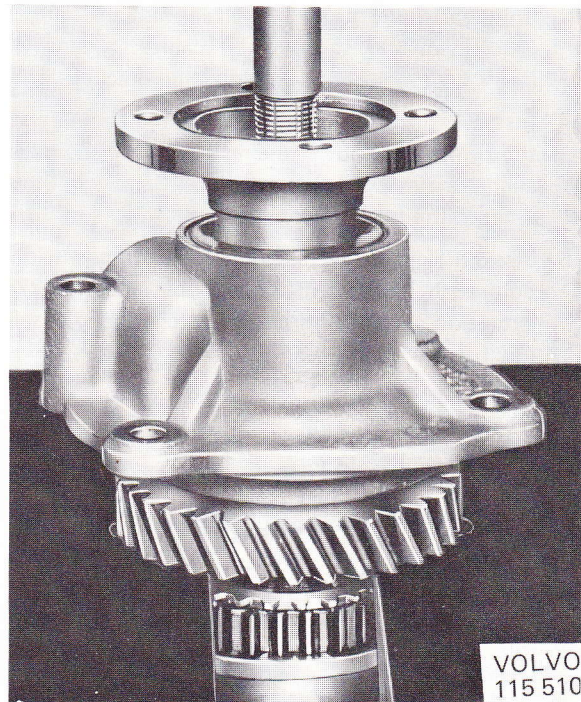


Main shaft disassembly, M 41

shaft in a press and a support under the 1st speed gear. Press out the shaft as shown below:

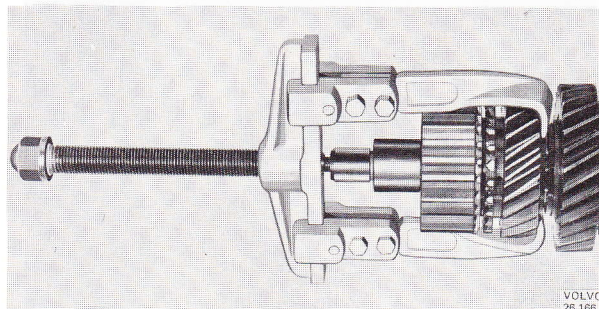
1b. Transmission without overdrive:

Remove the flange nut. Use 2837 resp. 2854 as a flange counterhold. Slide the engaging sleeve for 1st speed and 2nd speed forwards. Place the shaft in a press and a support under the 1st speed gear. Press out the shaft with a drift.



Main shaft disassembly, M 40

2. Remove synchronizer, thrust washer, engaging sleeves, inserts and springs from the shaft.
3. Remove the snap ring on the front end of the shaft. Pull off the synchronizing hub and 3rd speed gear with a puller, see Fig. below. Remove the thrust washer.



Front synchronizer removal

4. Remove snap ring and then thrust washer, 2nd speed gear, synchronizing ring and spring.
5. Remove the oil seal from the rear cover and take out the speedometer gear. If necessary, remove snap rings and press out ball bearing.

Inspection

(Part of Op. No. 43102 and 43171)

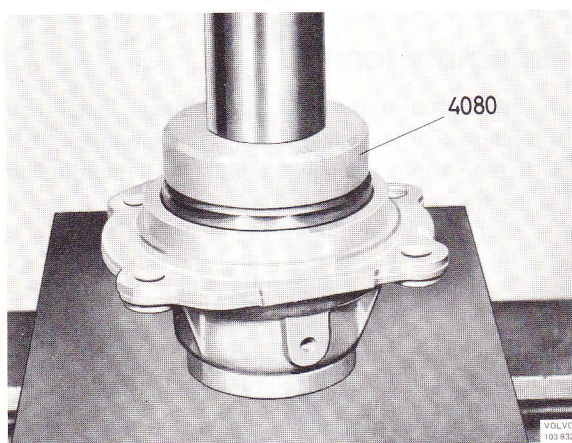
Check the gears, particularly for cracks or chips on the tooth surfaces. Damaged or worn gears must be replaced.

Check the ball bearings, particularly for scoring or cracks on the races or balls.

Transmission Assembly Main shaft assembly

(Part of Op. No. 43102 and 43171)

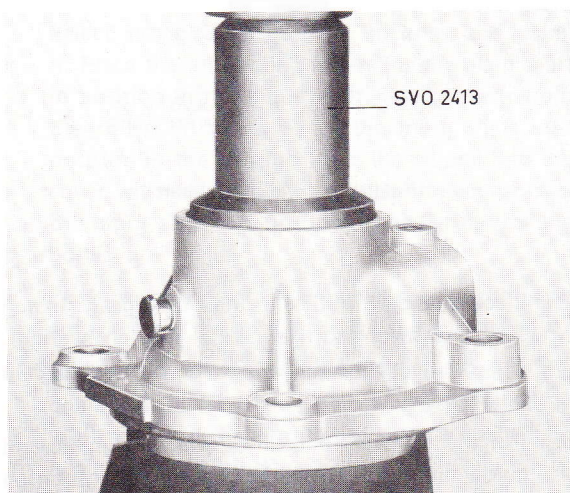
1. Press the ball bearing into the rear cover, see Fig. below, and install the snap ring. There are different thicknesses of snap rings. Select one which fits snugly into the groove.



Installation of ball bearing in rear cover

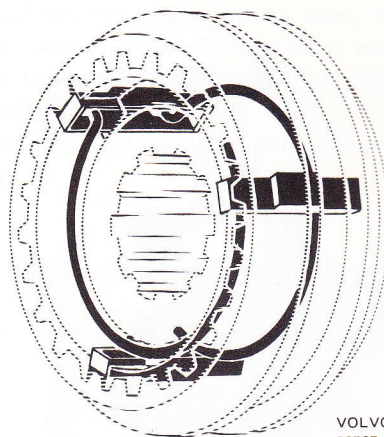
2. **Transmission without overdrive: (M 40)**

Place the speedometer gear on the bearing in the rear cover. Press in the oil seal with drift 2413:



Installation of oil seal in rear cover

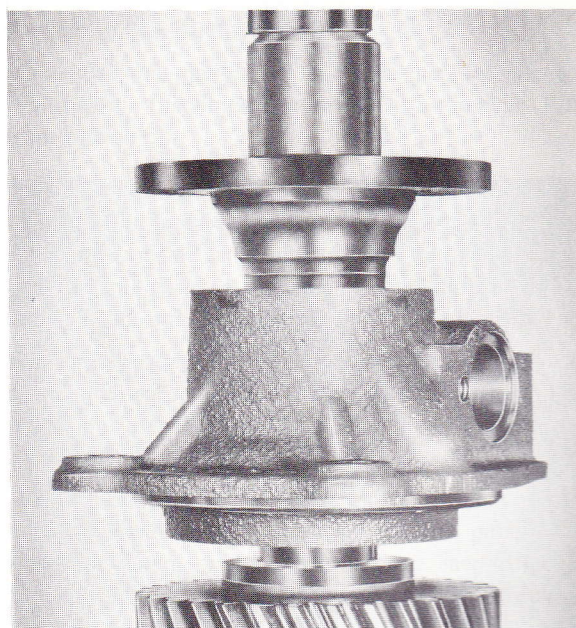
3. Install parts for the 1st and 2nd synchronizer on the main shaft. Install the springs correctly:



Synchronizer assembly

- 4a. **Transmission without overdrive (M 40):**

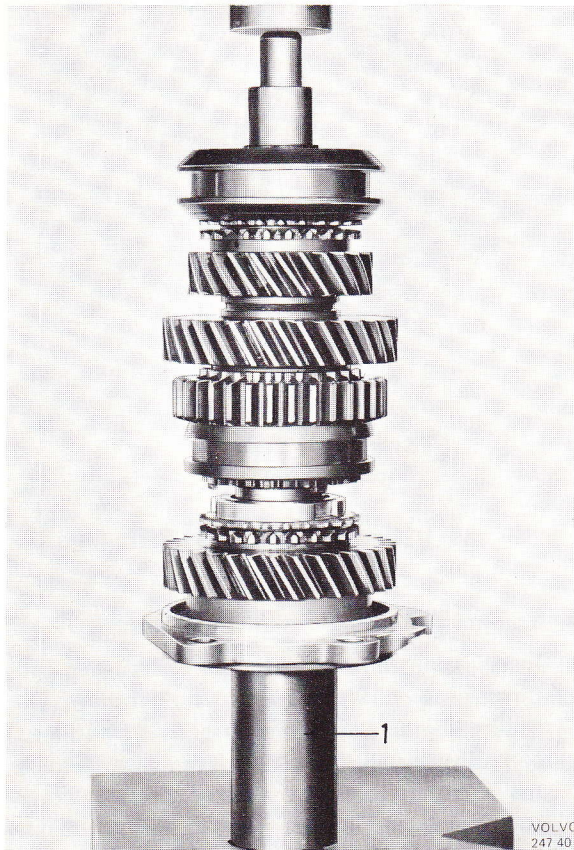
Install synchronizing ring, 1st speed gear and thrust washer. Place rear cover on the shaft. Ensure that the speedometer gear is positioned correctly. Install the flange. Use a sleeve which fits into the recess in the flange, press on cover and flange, see Fig. below. Install washer and nut for the flange. Use 2854 resp. 2837 as an adaptor on the flange and tighten the nut.



Installation of rear cover, M 40

4b. **Transmission with overdrive (M 41):**

Place the rear cover and ball bearing on a cushioning ring or sleeve as shown:

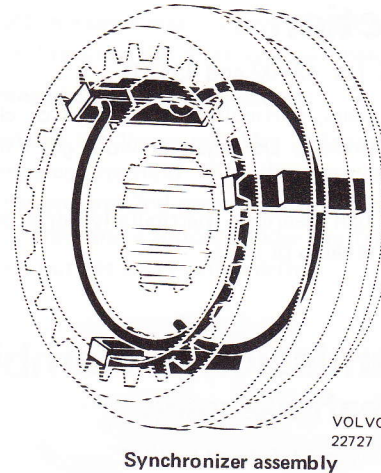


Installation of rear cover, M 41

Install thrust washer, 1st speed gear and synchronizing ring. Press in the shaft. Select a snap ring of suitable thickness and install it. Install key, rotor for the oil pump and snap ring.

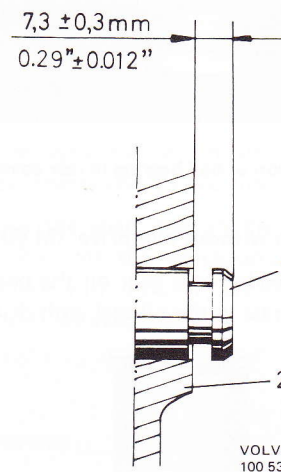
5. Install synchronizing ring, 2nd speed gear and thrust washer on the shaft. Select a circlip which fits snugly in the groove on the shaft and install it.
6. Install thrust washer, 3rd speed gear and synchronizing ring on the shaft. Assemble the 3rd and 4th gear synchronizing parts. Install the snap rings correctly, see Fig.

Install the synchronizer on the main shaft. Select a lock ring of correct thickness and install it.



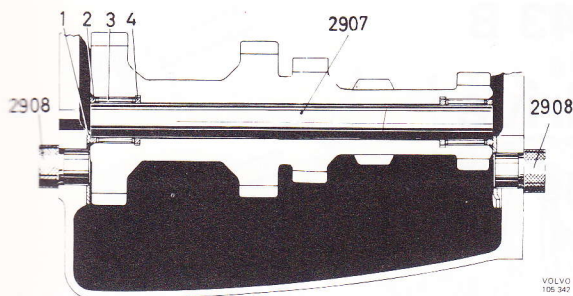
Assembly (cont.)

1. Install the striker lever and striker. Install the reverse gear and reverse shaft. The reverse shaft is fitted so that it extends $9/32'' = 7.5 \text{ mm}$ outside the transmission housing:



Installation reverse gear shaft

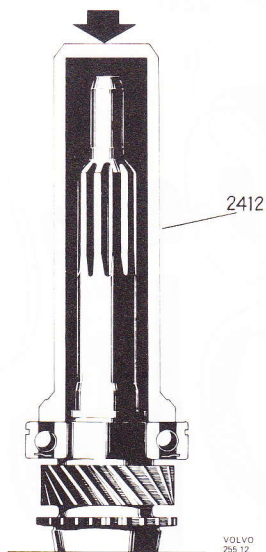
2. Place mandrel 2907 in the idler gear. Install spacer washers and needles (24 in each bearing). Use grease to hold the needles and washers in position.
3. Fix the washers to the housing with grease and guide them into position, with the centering plugs 2908, see Fig. Lay the idler gear in the bottom of the housing.



Installation idler gear

- | | |
|-------------------|-------------------|
| 1. Thrust washer | 3. Needle bearing |
| 2. Spacing washer | 4. Spacing washer |

4. Press the bearing onto the input shaft, using drift 2412, see Fig. below:



Installation ball bearing on input shaft

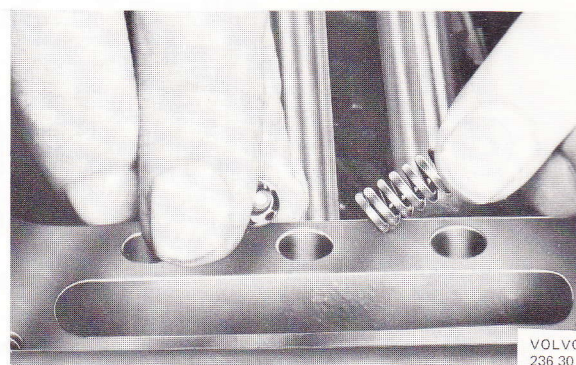
Select a snap ring of suitable thickness and install it. Place the 14 bearing rollers for the main shaft in position in the input shaft. Use grease to hold the rollers in place. Press the input shaft into position in the housing. Press the oil seal into the cover with drift 2867. Then install the cover over the input shaft. Do not forget the O-rings for the bolts.

5. Place the main shaft in the housing. Turn the rear cover so that the countershaft can be installed.
6. Turn the transmission upside down. Install the countershaft from the rear. Hold against 2907 with the hand. Ensure that the thrust washers do not loosen and fall down.
- 7a. **Transmission without overdrive:**
Install the rear cover bolts.

7b. **Transmission with overdrive:**

Install the overdrive. Use new locking for the intermediate flange.

8. Install selector rails and forks. Move the selector fork over the rear position when installing the pin. Use a new pin. Install the cover over the selector rails.
Place interlock balls and springs in position, see Fig.



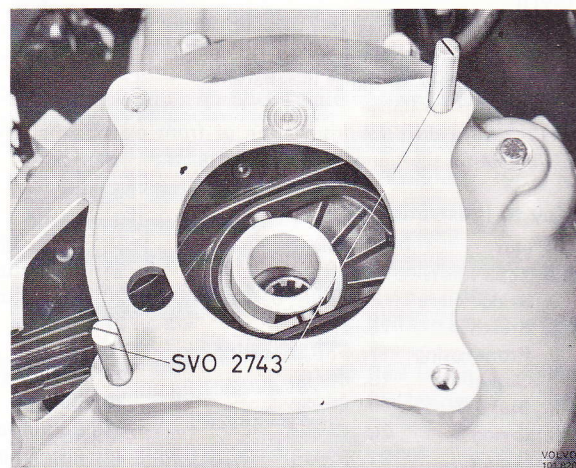
Installation of lock balls and springs

Install the gearbox cover. Check that all the gears engage and disengage freely.

Transmission installation

Part of Op. No. 43102 and 43172.

Make sure that guide pins 2743 are installed acc. to Fig. below. Installation is reverse to removal. Fill transmission oil.



Guide pins for transmission

Group 43 B

Overdrive

Tools



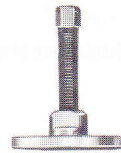
1797



1801



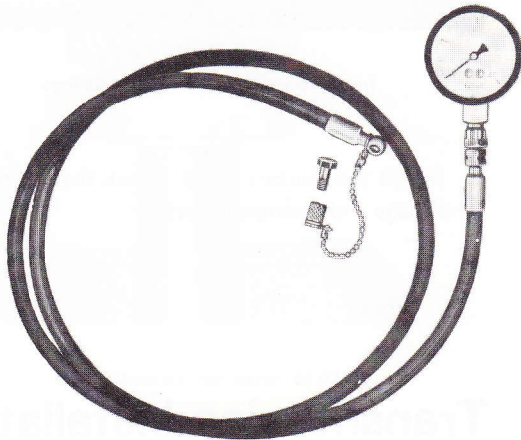
1845



2261



2412



2834



2835



2836

999

(SVO)

1797 Drift for removal rear bearing, output shaft

1801 Standard handle

1845 Press tool for flange installation

2261 Puller for flange

2412 Sleeve drift for installation of front rear bearing on output shaft and oil seal at flange

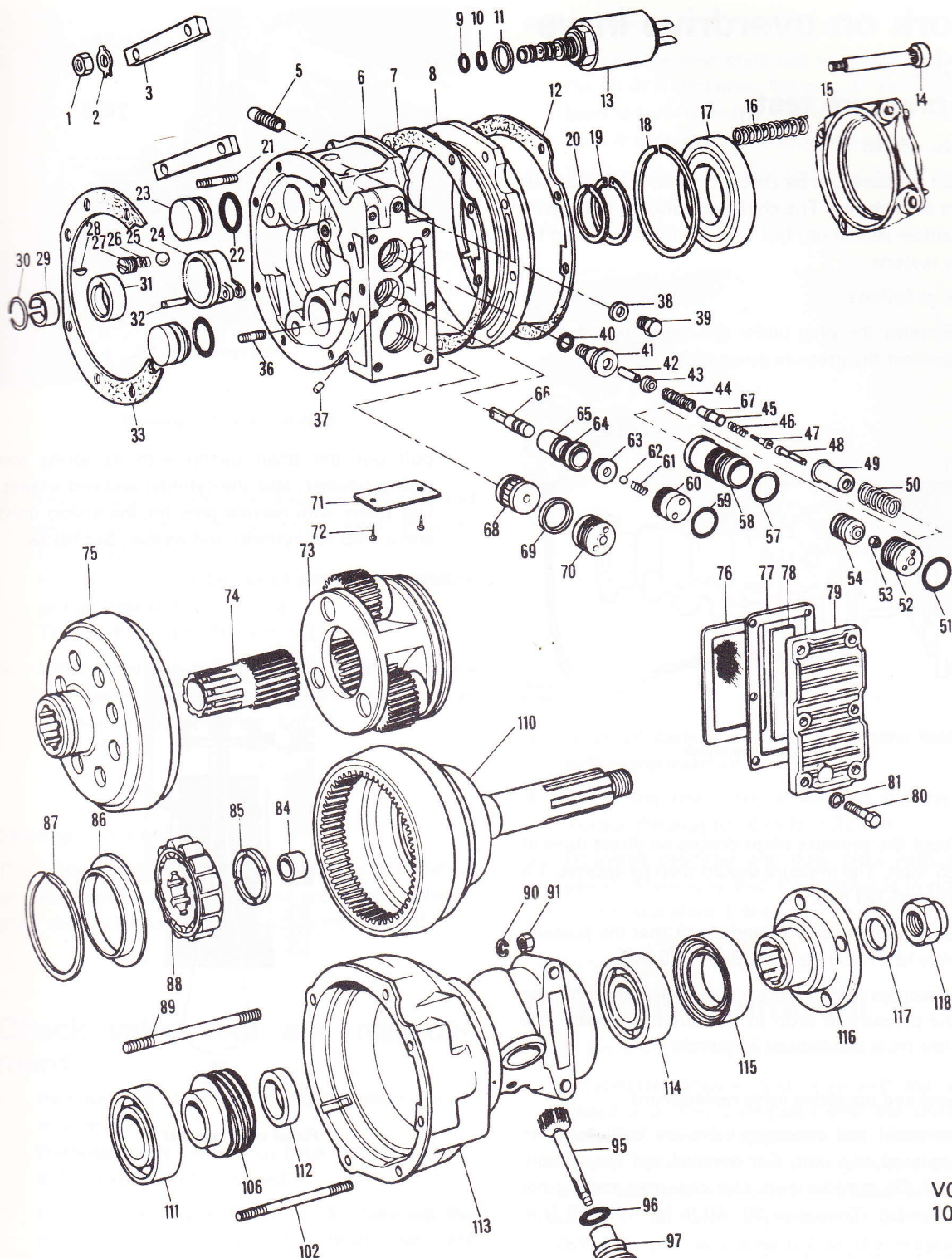
2834 Oil pressure gauge

2835 Centering mandrel for splines in planet carrier and one-way clutch

2836 Socket for removal and installation of plugs for fine filter, oil pump and relief valve
Oil seal puller

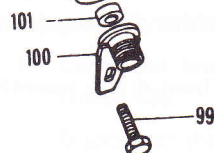
Key to Illustration

1. Nut	13. Solenoid	24. Connecting rod	37. Orifice nozzle	48. Screw	61. Spring
2. Lock washer	14. Bolt	25. Non-return ball	38. Seal	49. Holder	62. Ball
3. Bridge piece	15. Thrust bearing retainer	26. Non-return valve spring	39. Plug	50. Spring	63. Non-return body
5. Breather	16. Spring	27. Plug	40. O-ring	51. O-ring	64. O-ring
6. Front casing	17. Thrust bearing	28. Key	41. End piece	52. Plug	65. Pump body
7. Gasket	18. Circlip	29. Resilient ring	42. Piston	53. Nut	66. Pump plunger
8. Brake ring	19. Circlip	30. Circlip	43. Washer	54. Piston	67. Washer
9. O-ring	20. Circlip	31. Eccentric	44. Spring	57. O-ring	68. Fine filter
10. O-ring	21. Stud	32. Piston pin	45. Retainer	58. Cylinder	69. Seal
11. Seal	22. Piston seal	33. Gasket	46. Spring	59. O-ring	70. Plug
12. Gasket	23. Piston	36. Stud	47. Screw	60. Plug	71. Data plate



VOLVO
106128

- 72. Screw
- 73. Planet gear and carrier
- 74. Sur wheel
- 75. Clutch sliding member
- 76. Pre-filter
- 77. Gasket
- 78. Magnet
- 79. Base plate
- 80. Bolt
- 81. Resilient washer
- 84. Bushing
- 85. Thrust washer
- 86. Oil thrower
- 87. Circlip
- 88. Uni-directional clutch
- 89. Stud
- 90. Resilient washer
- 91. Nut
- 95. Speedometer pinion
- 96. O-ring
- 97. Bushing
- 99. Bolt
- 100. Retainer
- 101. Oil seal



- 102. Stud
- 106. Speedometer driving gear
- 110. Output shaft
- 111. Ball bearing
- 112. Spacer
- 113. Rear casing
- 114. Ball bearing
- 115. Oil seal
- 116. Flange
- 117. Washer
- 118. Nut

Work on overdrive in vehicle

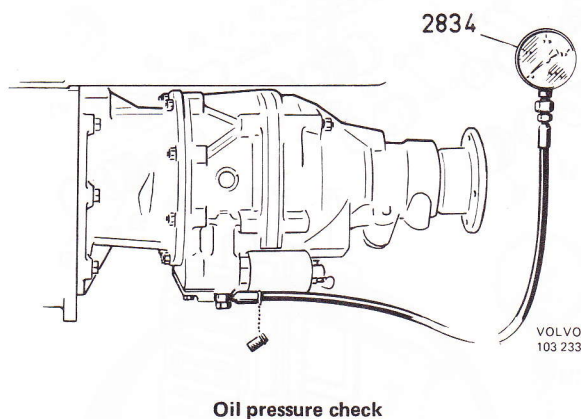
Oil pressure test

Op. No. 43318

The oil pressure can be checked when driving on test rollers or highway. The check can also be made with the vehicle jacked up, but this should be avoided for safety reasons.

Check as follows:

1. Remove the plug under the operating valve and connect the pressure gauge 2834, see



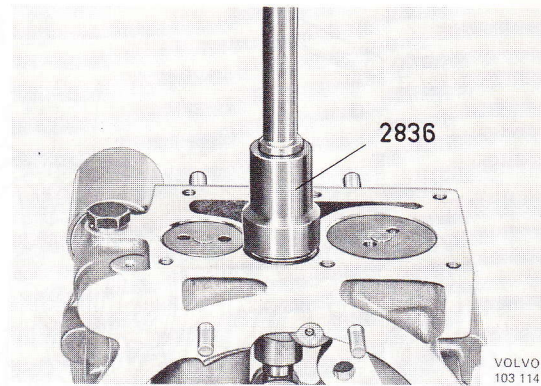
2. Read the pressure when driving on direct drive at 25 mph. The pressure should then be approx. 1.5 kp/cm² (21 psi).
3. Engage the overdrive and check that the pressure rises to 27–30 kp/cm² (380–425 psi).
4. Disengage the overdrive and check the time for the pressure to drop to 1.5 kp/cm² (21 psi). The time must not exceed 3 seconds.

Solenoid and operating valve replacement

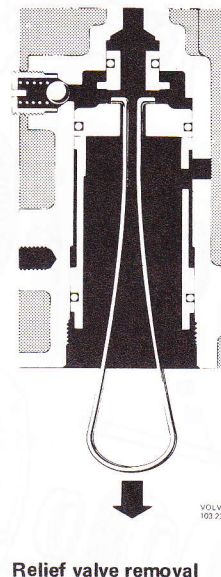
The solenoid and operating valve are built together and replaced as a unit. For removal and installation, use a 1" (25 mm) wrench. Use new seals and O-rings when needed. Torque to 30–40 lb.ft. = 42–55 Nm.

Relief valve check and replacement

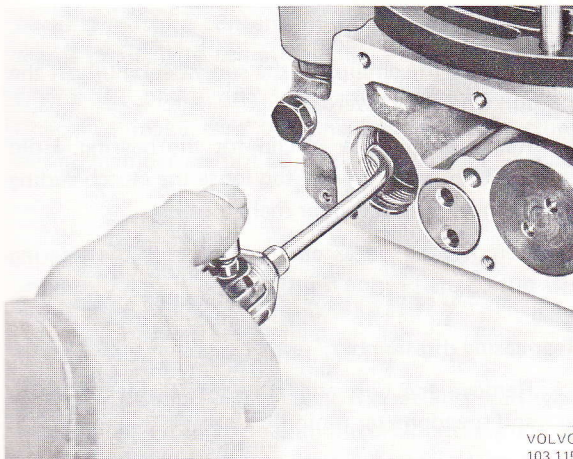
1. Remove base plate and pre-filter. Collect the oil in a container.
Warning: If the vehicle has been driven recently, the oil may be hot and scald.
2. Remove the plug under the relief valve with tool 2836, see Fig:
Pull out the large piston of the relief valve, then spring and spring retainer. The low-pressure spring will also be included in the removal. Then



pull out the small piston with its spring and spring retainer, also the cylinder and end washer. Use pliers with narrow jaws for the piston units and a loop for cylinder and washer. See below:



3. Clean all parts in solvent and blow them dry with compressed air. Check them carefully for wear and damage. The pistons run easily in their cylinders. Replace defective parts.
NOTE: The following units are available as spare parts: End washer, cylinder, small piston, adjustment washer, low-pressure spring, large piston, plug and O-rings.
4. Before installation of relief valve parts, blow the orifice nozzle clean with compressed air:



Blowing orifice nozzle clean

5. Install new O-rings on end washer, cylinder and plug. Lubricate with oil. Then install them in following order:
End washer, cylinder, small piston, low-pressure spring, large piston and plug.
Torque the plug to 16 lb.ft. = 22 Nm.
6. Install pre-filter and base plate complete with a new gasket. Make sure that the magnet is in position on the base plate. Fill oil.

Cleaning orifice nozzle

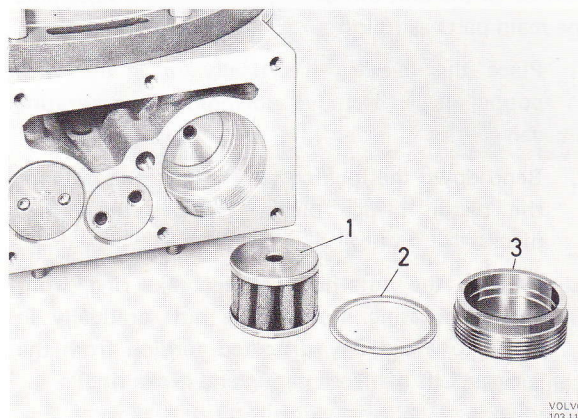
The orifice nozzle is accessible after the cylinder of the relief valve has been removed according to above. Blow the orifice nozzle clean with compressed air.

Check valve test and replacement

1. Remove base plate and pre-filter. Collect the oil in a container.
Warning: If the vehicle has been recently driven, the oil may be hot and scald.
2. Remove the plug with tool 2836. Take out the non-return valve spring, non return ball and non-return body.
3. Clean all the parts in solvent and blow them dry with compressed air. Check the parts for damage and wear. Replace defective parts.
4. Install a new O-ring on the plug and then re-install non-return body, ball spring and plug. Torque the plug to 16 lb.ft. = 22 Nm.
5. Re-install pre-filter and base plate with a new gasket. Do not forget the magnet on the bottom plate. Fill oil.

Filter cleaning

1. Remove the base plate and the pre-filter. Collect the oil in a container. **Warning:** If the vehicle has been driven recently, the oil may be hot and scald if contact is made with your skin.
2. Remove plug and seal and fine filter, see Fig. below:



Fine filter

3. Clean all parts in solvent. Then blow them dry with compressed air.
4. Install the fine filter, a new seal and the plug. Torque the plug to 16 lb.ft. = 22 Nm.
5. Re-install pre-filter and base plate with a new gasket. Make sure that the magnet is in position on the base plate. Fill oil.

Overdrive removal

Op. No. 43313 (= replace overdrive).

To facilitate removal, first drive with the overdrive engaged and then disengaged **with the clutch pedal depressed**. This is important in order to avoid torsional tensions in the shaft between the planet carrier and one-way clutch. Stresses will also disappear if oil with a pressure of 20–25 kp/cm² (285–355 psi) is connected to the output at the operating valve. The overdrive is engaged and disengaged with this pressure.

1. Carry out operations 1–5 under "Removal" in Group 43a.
2. Disconnect the solenoid wires.
3. Remove the bolts holding the overdrive unit to the intermediate flange. Pull the overdrive straight out backwards, until it is free from the transmission main shaft.

Overdrive disassembly

Rebuild overdrive, separated from transmission

Op. No.

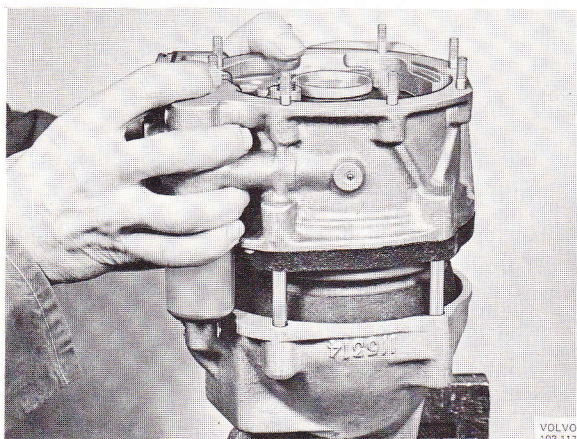
43301

Rebuild overdrive, incl. remove and install transmission assembly

43312

Maximum cleanliness must be observed when working with the overdrive unit. Before disassembly, clean the outside of the unit thoroughly. Then first disassemble the main parts as follows:

1. Place the overdrive vertically in a vise with copper jaws. Remove solenoid and operating valve.
2. Bend down the locking tab, remove the nuts for the piston bridge pieces. Remove the bridge pieces.
3. Remove the nuts holding the brake ring, front and rear casing. Loosen the nuts gradually in order to avoid any distorted tension from the springs. Lift off front casing and brake ring:



Overdrive disassembly

4. Tap loose the brake ring from the front casing with a copper drift and hammer.
5. Remove the springs for the clutch sliding member. Lift out the clutch sliding member complete with thrust bearing and sun wheel.
6. Lift out the planet carrier complete.

Front casing removal

1. Place the casing on a bench with the front side downwards. Connect compressed air to the hole for the operating valve and blow out the pistons.
2. Disconnect the base plate and remove the pre-filter. Then remove the plugs and take out the parts for the fine filter, relief valve and pump check valve. See also under the heading "Work on overdrive in vehicle".
3. Press down and pull out the pump cylinder. Then take out the connecting rod and pump plunger.

Clutch unit disassembly

1. Remove the circlip for the sun wheel. Pull off the sun wheel backwards.
2. Remove the inner circlip for the bearing. Hold the bearing body and tap loose the clutch sliding member with a rubber mallet.
3. Remove the outer circlip and press the bearing out of the bearing housing.

Rear casing disassembly

1. Remove the bolt and pull out retainer, bushing and speedometer pinion.
2. Remove the nut and pull off the flange with puller 2261. Place the housing in a press and press out the output shaft.
3. Remove the spacer and the speedometer drive gear. Pull out the bearing on the output shaft using a so-called knife extractor. The rear bearing and oil seal are pressed out of the housing with drift 1797 and handle 1801.
4. Remove the circlip and the oil thrower, which hold the one-way clutch on the output shaft. Lift out the one-way clutch components. Remove the thrust washer.

Overdrive inspection

(Part of Op. No. 43301 and 43312)

Before inspecting, clean all parts with solvent and blow them dry with compressed air. Pay particular attention to the cleaning of the filters and all the oilways. Check that the orifice nozzle in the channel between the relief and operating valves is clean. If it is not possible to blow the nozzle clean, it can be cleaned with a pointed wooden stick or similar. Hard objects must not be used, since this can alter the graduation.

Check also that the groove inside the ring gear on the output shaft is properly cleaned. Dirt easily collects here due to the centrifugal force. After cleaning, check all the parts carefully for wear cracks or other damage.

Pay particular attention to the following:

Check the solenoid with the help of a 12 volt battery and an Amp-meter. Current draw should be approx. 2 amps. Check the movement of the valve during engagement and disengagement.

Check to make sure that the filters are not damaged. Also check the pistons of the hydraulic system for abrasion and wear. Check the valves for wear. Make sure that all the springs are not damaged. Check all the gears and ball bearings for cracks and wear. Make sure that the bushing on the sun wheel is not worn. If it is, replace sun wheel complete with bushing. The

bushing must be concentric with the gear wheel, and this is difficult to achieve outside a special workshop. Check the brake ring for abrasion, cracks or wear. Check to make sure that the linings on the clutch sliding member are not burnt or worn.

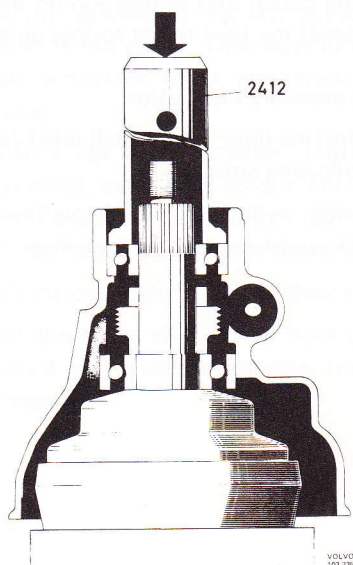
Overdrive assembly

(Part of Op. No. 43301 and 43312)

Use new gaskets, O-ring, lock washer and seals when assembling. Observe maximum cleanliness since the hydraulic system is very sensitive to impurities.

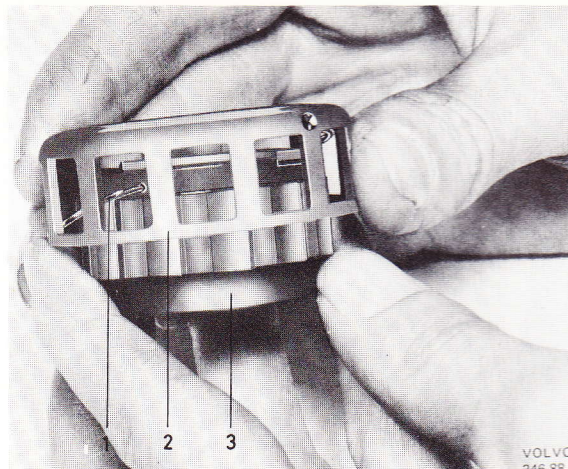
Rear casing assembly

1. Press the front bearing to the output shaft with drift 2412.
2. Press rear bearing on to rear casing section with drift 2412.
3. Place a wooden block under the output shaft as support. Install speedometer driving gear and spacer. Press on rear casing with drift 2412, see Fig. 3.



Output shaft installation

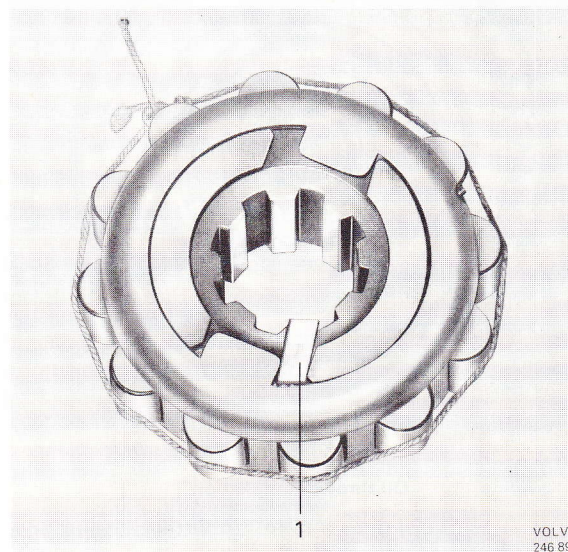
4. Press in the oil seal with drift 2412. Fit coupling flange, washer and nut. Torque the nut to 80–100 lb.ft. = 110–140 Nm.
5. Assemble one-way clutch, spring and roller cage:



One-way clutch assembly, I

1. Spring 2. Cage 3. One-way clutch hub

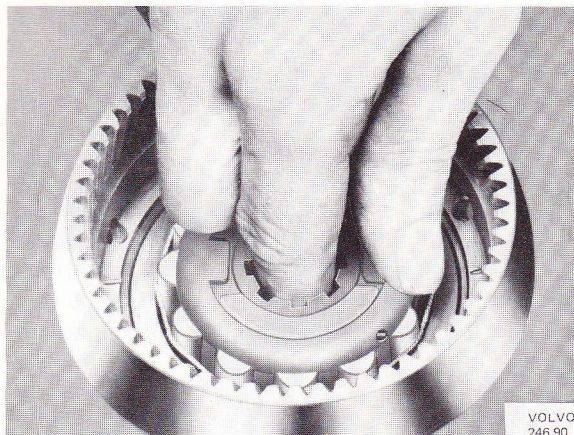
Turn the roller cage clockwise as far as it goes. Lock it in this position with a key as shown:



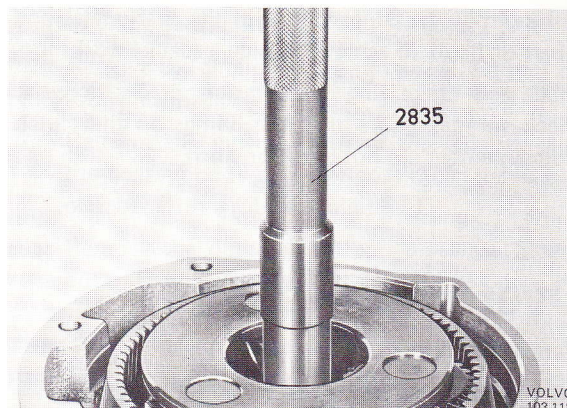
One-way clutch assembly, II

1. Key

- Install the rollers. Tie a piece of rubber band or string round the rollers.
6. Install thrust washer and then one-way clutch in position on the output shaft:

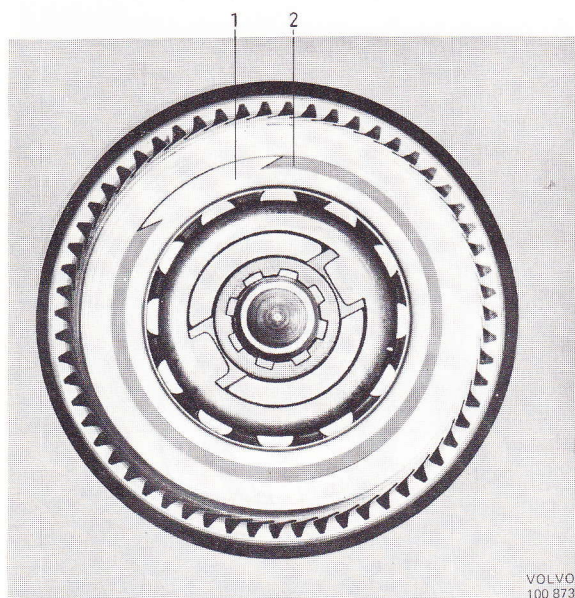


One-way clutch installation



Planetary gear installation

Install oil slinger and circlip:



Oil thrower installation

1. Oil thrower plate 2. Circlip

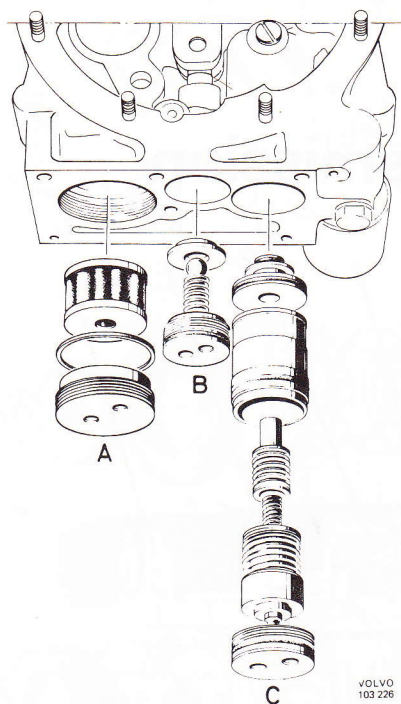
Clutch unit assembly

1. Press the ball bearing into the retainer and install the circlip.
2. Install the bolts on the bearing retainer. Then press bearing with retainer on to the clutch sliding member. Install the circlip.
3. Install the sun wheel to the clutch sliding member. Install the circlip.
4. Install the clutch unit in position on the output shaft. Install the four thrust springs on the bolts.

Front casing assembly installation

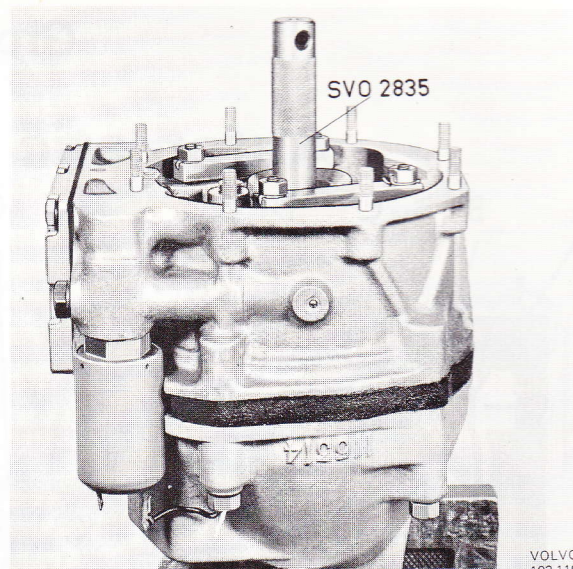
1. Install the fine filter. Also install relief valve parts in the following order:
End washer, cylinder, small piston, low-pressure spring, large piston and plug see below:

7. Install speedometer pinion and bushing. Install retainer and bolt.
8. Place the planet carrier complete with planet gear in position on the output shaft. Guide the splines into the planet carrier and one-way clutch with drift 2835:



Installation of fine filter, oil pump check valve and relief valve

2. Place the connecting rod and pump plunger in position in the casing. Then push in the cylinder. Install non-return body, non-return ball, spring and plug.
3. Tighten plugs for fine filter, relief valve and pump check valve with torque wrench and tool 2836. Torque to 16 lb.ft. = 22 Nm. Install pre-filter, magnet, gasket and base plate.
4. Install the operating pistons in their cylinders.
5. Install the brake ring on the front casing. Place the front casing on the rear one. Install washers and nuts:



Front casing assembly

Note that both the copper washers should be fitted on the upper bolts. Tighten the bolts a little at a time until they are tightened evenly all round.

6. Install both thrust washers. Tighten and lock the nuts. Install the operating valve and solenoid.

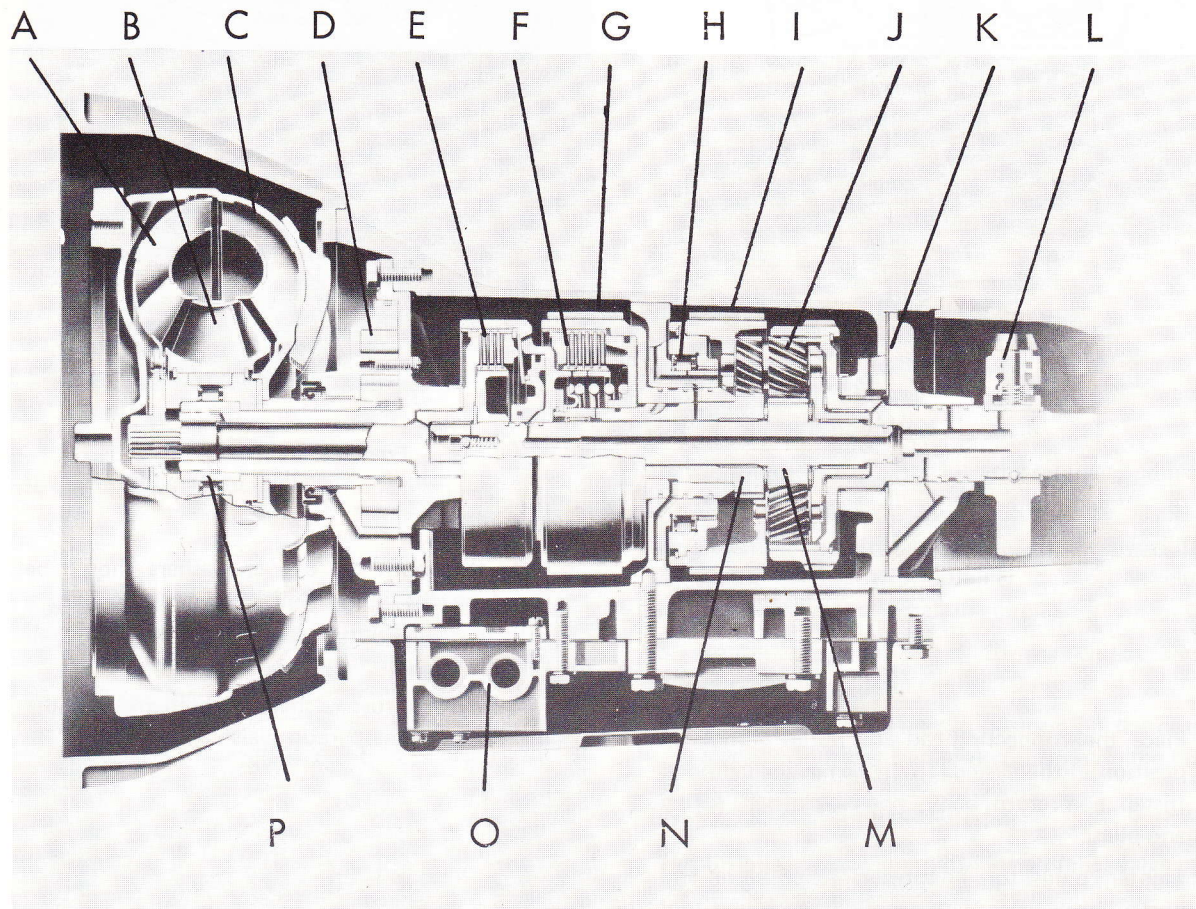
Overdrive installation

(Op. No. 43313 = replace overdrive = remove and install overdrive)

Install the overdrive in reverse order to **removal**. Fill oil. Check the transmission oil level after driving 5–10 miles.

Group 44

Automatic Transmission



Transmission sectional view

VOLVO
106 176

A. Turbine
B. Stator
C. Impeller and cover
D. Pump
E. Front clutch
F. Rear clutch

G. Front brake band
H. One-way clutch in transmission
I. Rear brake band
J. Planetary gear set
K. Oil deflector flange
L. Governor

M. Reverse sun gear
N. Forward sun gear
O. Control system
P. One-way clutch in coverter

Key to Illustration

- | | | | | |
|--------------------------|---------------------------|--------------------------|------------------------------|---------------------------|
| 1. Oil seal | 16. Piston and reed | 30. Piston ring (rubber) | 44. Brake band | 58. Transmission case |
| 2. Pump | 17. Rubber ring | 31. Piston | 45. Needle thrust bearing | 59. Rear servo |
| 3. O-ring | 18. Front clutch cylinder | 32. Rear clutch cylinder | 46. Thrust plate | 60. Stop shaft |
| 4. Pump body | 19. Front servo | 33. Oil ring | 47. Snap ring | 61. Nipple |
| 5. Gasket | 20. Servo strut | 34. Rubber ring | 48. Free wheel | 62. Plate |
| 6. Thrust washer | 21. Contact pin | 35. Needle bearing | 49. Brace | 63. Oil deflector flange |
| 7. Snap ring | 22. Brake band | 36. Key | 50. Planetary gear | 64. Lock bolt |
| 8. Input shaft | 23. Thrust washer | 37. Reverse sun gear | 51. Thrust plate and bearing | 65. Spindle |
| 9. Thrust washer | 24. Thrust washer | 38. Needle thrust plate | 52. Gear | 66. Spring |
| 10. Hub | 25. Snap ring | 39. Oil rings | 53. Snap ring | 67. Valve |
| 11. Disc kit | 26. Spring seat | 40. Forward sun gear | 54. Driven shaft | 68. Centrifugal governor |
| 12. Snap ring | 27. Spring | 41. Oil ring | 55. Washer | 69. Counterweight housing |
| 13. Spring | 28. Snap ring | 42. Center bearing | 56. Oil ring | 70. Speedometer gear |
| 14. Ring | 29. Disc kit | 43. Servo strut | 57. Seal ring | 71. Flange |
| 15. Piston ring (rubber) | | | | |

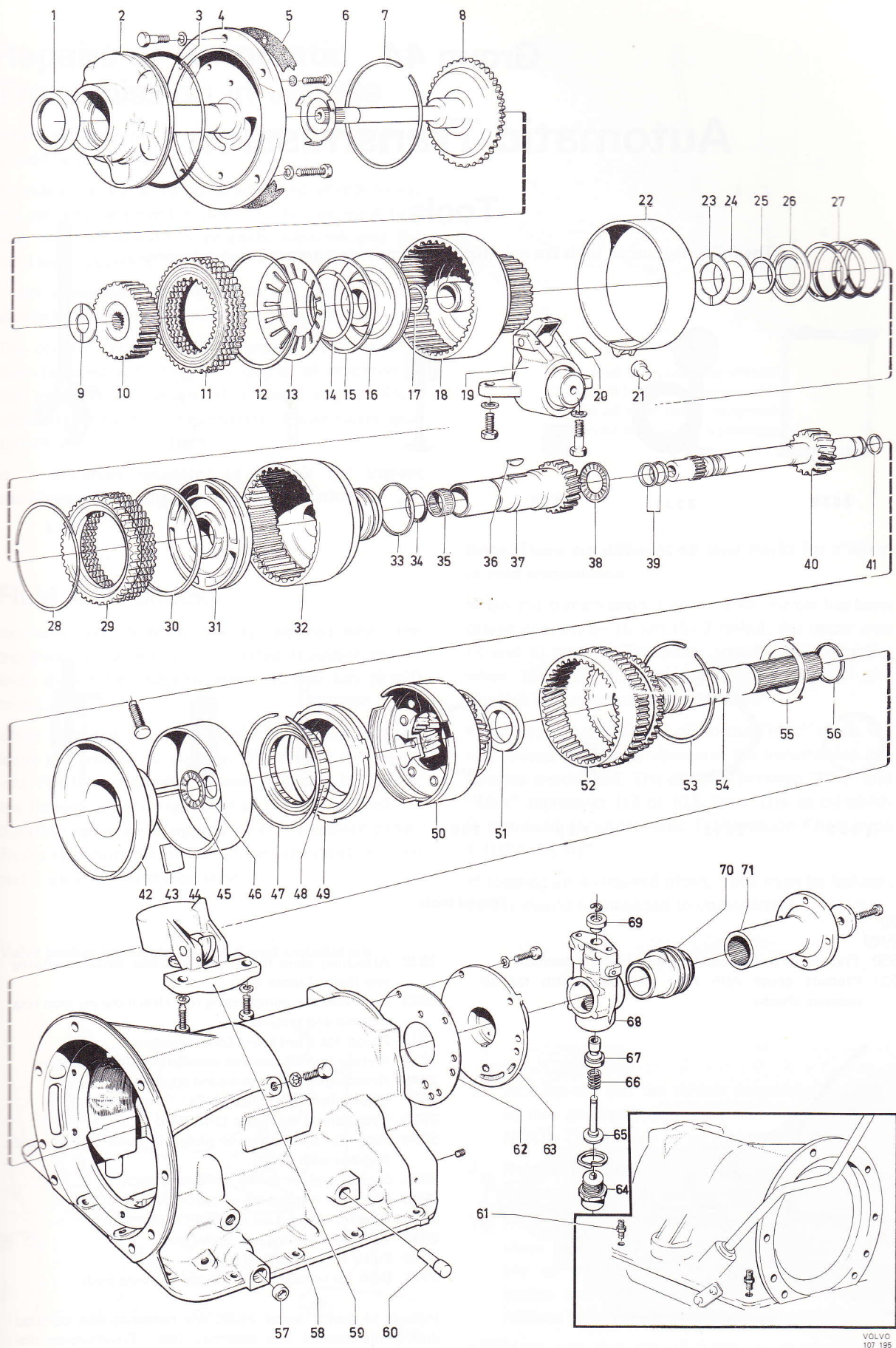


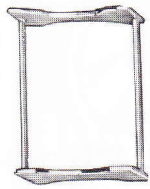
Illustration Automatic transmission BW 35

Group 44

Automatic Transmission

Tools

The following special tools are essential when repairing automatic transmissions.



2530



2531



2532



2533



2537



2748



2837
2854



2900



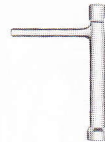
2975



2993



5000



5042



5069



5117

Special tools

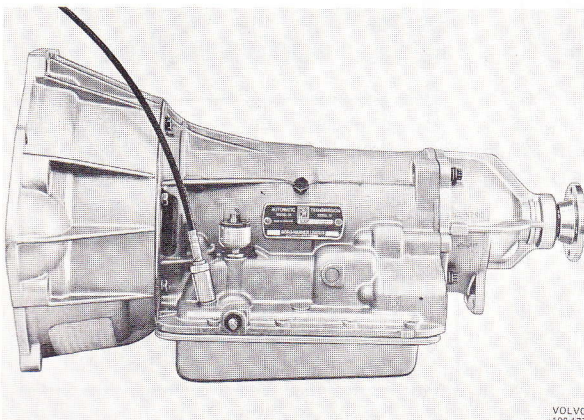
999
(SVO)

2530 Fixture for transmission disassembly and assembly
2531 Pressure gauge with hose and connection for oil pressure checks

2532 Attaching plate for magnetic holder when measuring end float of input shaft
2533 Press tool for compressing rear clutch during snap ring removal and installation
2537 Spacer for front brake band adjustment
2746 Fixture for removal and installation of transmission
2748 Wrench for front brake band adjustment
2837 Counterhold for flange (245)
2854 Counterhold for flange (242, 244)
2900 Ring for installation of piston in front clutch (used together with 2993)
2975 Special tool for starter inhibitor switch
2993 Guide for installation of piston in front clutch
5000 Ring for installation of piston in rear clutch
5042 Tool for adjusting rear brake band
5069 Puller for oil seal in flange
5117 Drift for installation of oil seal in pump body

Instead of bench stand 2539, the following can be used during disassembly and assembly (see "Transmission disassembly")

2520 Stand
2934 Fixture



The Borg-Warner Automatic Transmission type 35

VOLVO
106 177

Repairs of Automatic Transmission in vehicle

When working on the vehicle, the selector lever should be in position "P".

Provided the transmission is operating satisfactorily, the car may be towed in position "N", on condition that the transmission is properly adjusted and the fluid level is correct.

If the transmission is inoperative, the propeller shaft should be disconnected before towing is started.

The control system of the automatic transmission is manufactured with the same degree of precision as the injection equipment of a diesel engine. Fluid circulates through the converter, transmission gear system and control system.

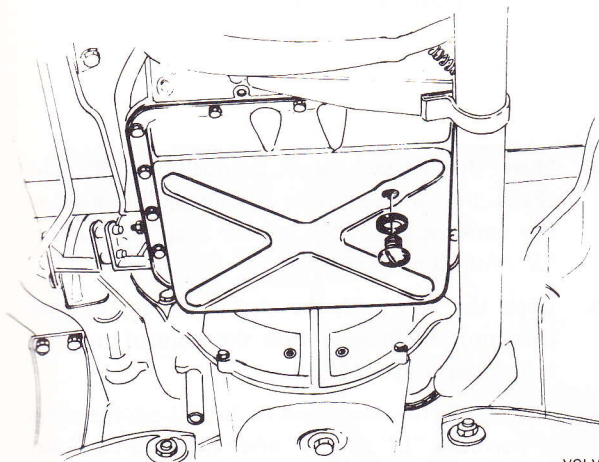
It is therefore necessary to observe the utmost cleanliness when working on the transmission.

Fluid level check

Normally, oil changing is only required when the transmission has been reconditioned. However, the oil level should be checked every 10 000 km (6 000 miles).

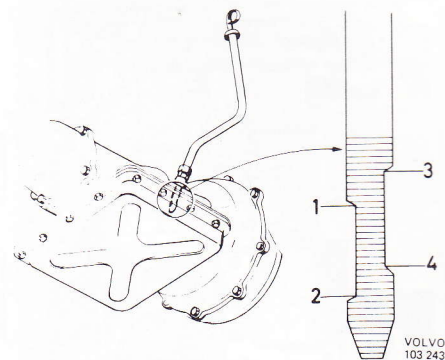
When checking the oil level, the car should be level. Move the selector to position "P" and let the engine idle. The filler pipe with dipstick is located in front of the firewall on the right side of the engine. Pull the dipstick, and wipe it with nylon cloth or clean paper. Fluffy rags must not be used. Insert the dipstick, then pull it up and note the oil level.

Valve bodies assembly, removal and installation



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Oil drain plug



Dipstick

1. Max oil level, cold transmission
2. Min oil level, cold transmission
3. Max oil level, warm transmission
4. Min oil level, warm transmission

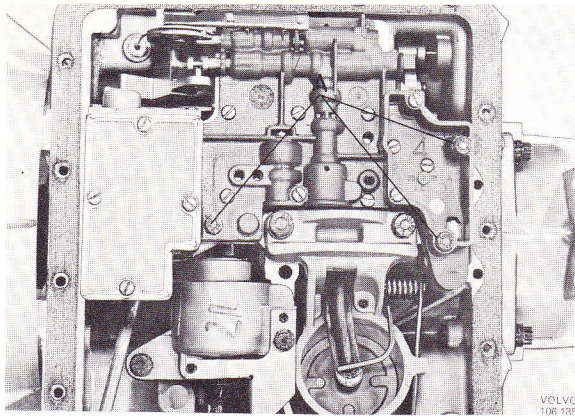
Note: There are different oil level marks for a warm or cold transmission.

When the transmission is warm, after the car has been driven approx. 8—10 km (5—7 miles), the upper area (3 and 4) applies. The lower area (1 and 2) applies when the transmission is cold. The text on the dipstick also mentions this difference.

If necessary, top up with oil to the "Max" mark. Do not exceed this mark, otherwise the transmission can become overheated. The distance between "Min" and "Max" represents 1/2 qt (0.5 liter). Use an oil which is approved as "Automatic Transmission Fluid, type F (USA: FLM)".

If topping up is required often, there must be leakage, which should be attended to immediately.

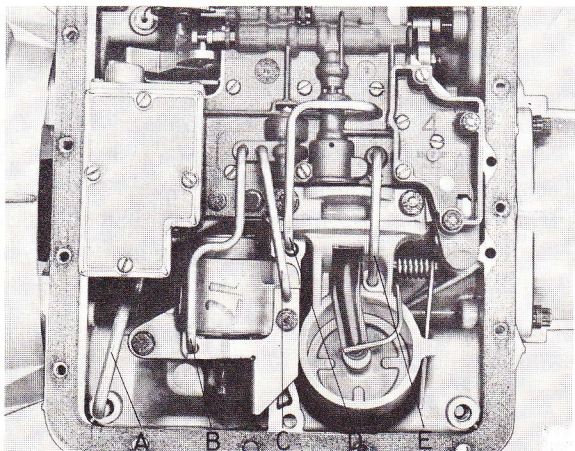
1. Jack up and put the vehicle on stands. Drain the oil into an absolutely clean pan.
NOTE: The oil may be very hot and scald.
2. Release the bolts for the oil sump and remove the sump. Carefully remove the oil tubes.
3. Release the throttle cable from the cam. Remove three bolts which secure the valve bodies assembly to the transmission casing. Remove valve bodies assembly straight downwards so that it releases from the oil tubes at the front end.
4. Make sure that the oil tubes are in position on the pump body. Position valve bodies assembly and secure it with three bolts, see Fig:



Valve bodies assembly

A. Attaching bolts

5. Install the throttle cable on the cam. Install the oil tubes as shown below:



Oil tubes

- A. Converter outlet
- B. Front piston release
- C. Front piston application
- D. Rear clutch
- E. Rear piston

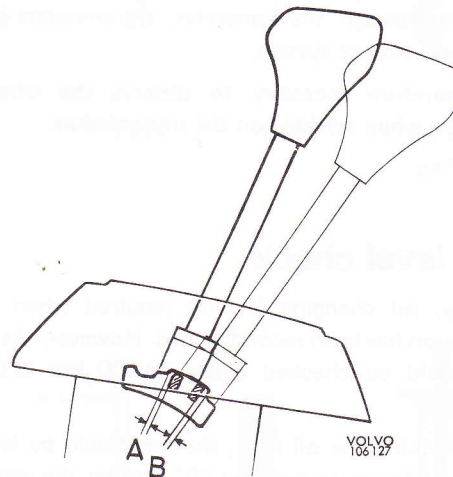
Check that the magnetic element lies in the oil pan. Install the pan. Use a new gasket. Coat the threads on the drain plug with sealing fluid 277691 and then install the plug.

6. Lower the vehicle, fill oil.

Selector controls adjustment

1. Disconnect the shift rod from the transmission lever. Place the lever in position "2". Also set the selector lever to position "2".

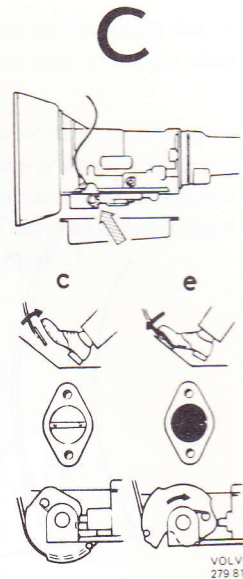
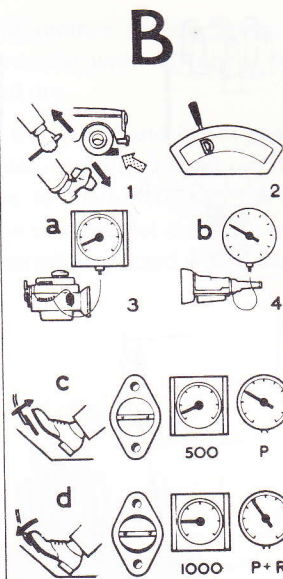
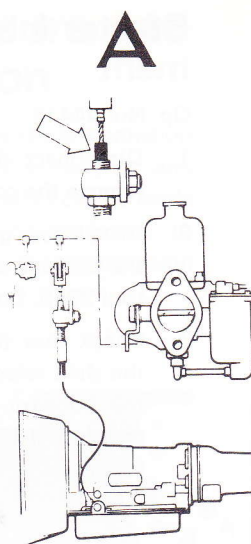
Adjust the length of the shift rod to provide a small clearance (min 0.04" = 1 mm, see B) between selector lever inhibitor and inhibitor plate when the rod is connected to the lever on the transmission.



Selector controls adjustment

3. Move the selector lever to position "D" and check that the clearance to the sliding place is the same or somewhat greater than in position "2". Adjust if necessary.
4. Lock the bolt with the circlip and tighten the lock nut. Make sure that the control rod lug follows with the yoke.
5. Check that the clearances (A and B) are the same in positions "D" and "2" after the yoke has been moved to positions "P" and "1". Also check that the output shaft is locked with the selector lever in position "P".

- A. Adjusting cable stop
- B. Adjusting with tachometer and manometer
1. Block the wheels and apply the brakes
 2. Select position "D"
 3. Connect a tachometer (a)
 4. Connect a pressure gauge (b)
 - c. Measure pressure (P) at 700 rpm
 - d. Measure pressure (P+R) at 1200 rpm
 - R. Should be 1.1–1.4 kp/cm² = 15–20 psi
- C. Adjust the cam in transmission
- a. Accelerator pedal in idling position
 - e. Accelerator pedal fully depressed



Throttle cable adjustment

Throttle cable adjustment

Correct adjustment of this cable is most important for satisfactory operation of the transmission. There are three different methods.

Adjust first in accordance with A. Method B is to be applied if the transmission is not functioning satisfactorily and method C when replacing the cable.

- A. 1. Check that engine idling speed is correctly adjusted and that the inner cable and outer cable are correctly attached.
2. Screw up the threaded sleeve until it almost contacts the stop.
3. With the accelerator pedal fully depressed, check that:
- a. the carburetor lever is at the fully open stop.
 - b. the line pressure at converter stall speed at least 11 kp/cm² (160 psi).

- B. If the cable stop has been damaged or moved, the cable must be adjusted as follows:

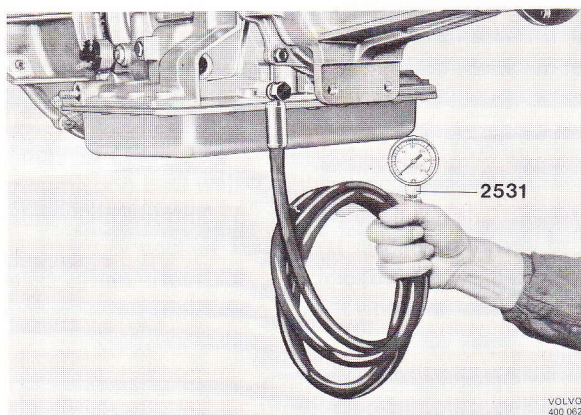
1. Connect a tachometer to the engine and a pressure gauge to the transmission:
2. Block the wheels and apply the brakes. Start the engine and move the lever to "D". At 1200 rpm the pressure should be 1.1–1.4 kp/cm² (15–20 psi) higher than at 700 rpm. If the pressure rise is less than 1.1 kp/cm² (15 psi) the effective length of the outer cable should be adjusted longer. Conversely, if the rise is more than 1.4 kp/cm² (20 psi) the effective length of the outer cable should be adjusted shorter.

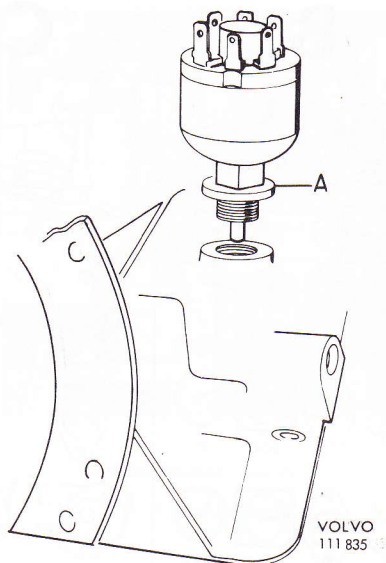
- C. If a new cable is installed, the transmission oil pan must be removed. In this event it is often simpler to adjust the cable by observing the movement of the cam in relation to pedal movement as follows:

1. With the accelerator pedal fully released and the throttle lever at the idling stop, the heel of the cam should contact the full diameter of the downshift valve, with all the slack of the inner cable taken up.
2. With the accelerator pedal fully depressed and the throttle lever at the full open stop, the constant radius area of the cam should be the point of contact with the downshift valve.

NOTE:

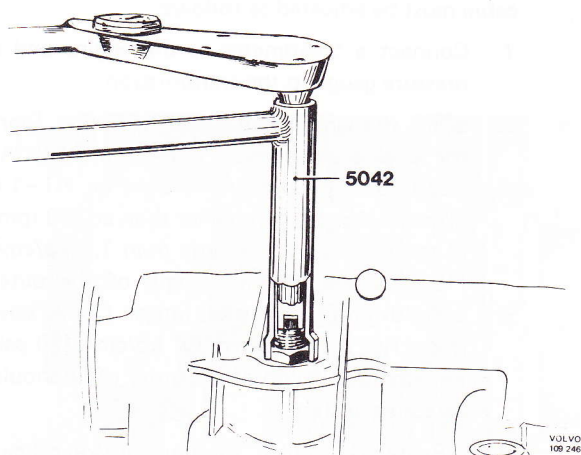
1. The cable is pre-lubricated with silicon or molybdenum disulphide lubricant and must not be oiled.
2. Ensure that at all times the cable sheath is correctly located in the adjuster.





Starter inhibitor installation

A. Gasket



Rear brake band adjustment

Starter inhibitor switch replacement

Op. No. 44418

1. Disconnect the switch wires. Use tool 2975 to remove the contact.
2. Install new gasket (A) on the contact. Screw in the contact and torque to 10 lb.ft. = 14 Nm. Use tool 2975. Connect the wires.
3. Check that the engine can only be started with the shift selector in positions "P" and "N", that the back-up lights go on with the selector in position "R" and that the seat belt reminder functions in "D", "2" and "1".

Rear brake band adjustment

OP. No. 44212

When adjusting this band in the car, a hole has been introduced in the body tunnel, which is accessible after the mats have been moved on side, the air duct has been released and the rubber removed. Adjusting is made as follows:

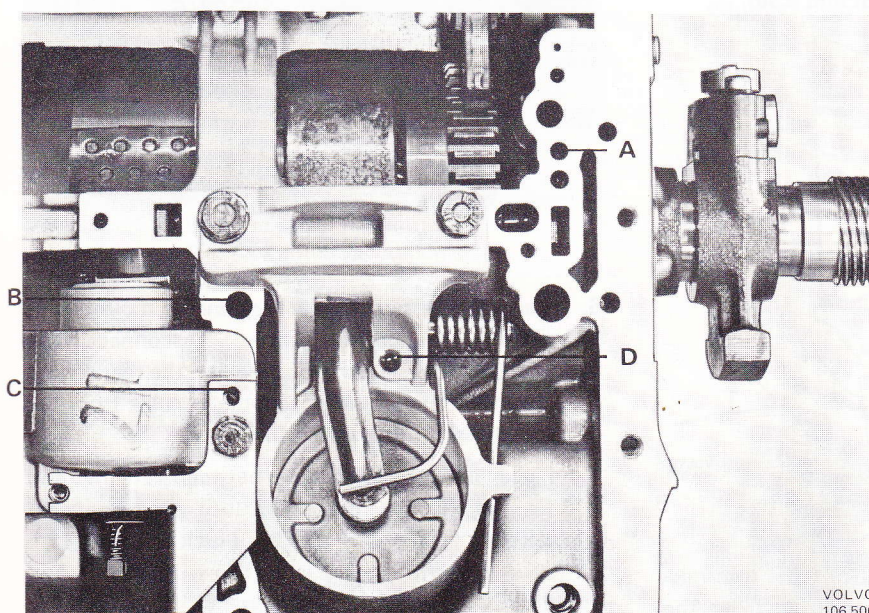
1. Connect a torque gauge to the inner socket in tool 5042. Attach the tool assembly to the transmission as shown in Fig.
2. Torque the screw to 10 lb.ft. = 14 Nm. Back off the adjusting screw one turn.
3. Tighten the lock nut and restore.

Using air pressure to check transmission

Air pressure checks can be made on the transmission assembly to determine whether the clutches and brake bands are operating. These checks can be made with the transmission in the car or on the bench. In either event, drain the fluid from the transmission

and remove the oil pan as well as the valve bodies assembly with oil tubes. The air used must be clean and dry.

If the clutch and bands operate satisfactorily with air pressure, faulty operation of the transmission must be due to malfunction of the hydraulic control system. The valve bodies assembly must then be disassembled, cleaned, inspected and re-assembled.



- A. Front clutch (5)
- B. Rear clutch (15)
- C. Front piston application
- D. Rear piston

Function test with compressed air

Front clutch and governor feed "A"

Apply air pressure to the passage 5 of the transmission case rear wall, see Fig. Listen for a thump, indicating that the clutch is functioning. On the bench, also verify by rotating the input shaft with air pressure applied.

If the extension housing has been removed, rotate the output shaft so that the governor weight will be at the bottom of the assembly. Verify that the weight moves inwards with air pressure applied.

Rear clutch "B"

Apply air pressure to the passage (15) of the transmission case web. On the bench, verify that the clutch is functioning by turning the input shaft. Keep air pressure applied for several seconds to check for leaks. Then listen for a thump indicating that the clutch is releasing when the air pressure is removed.

Front piston "C"

Apply air pressure to the hole immediately adjacent to the rear retaining bolt. Observe the movement of the piston pin.

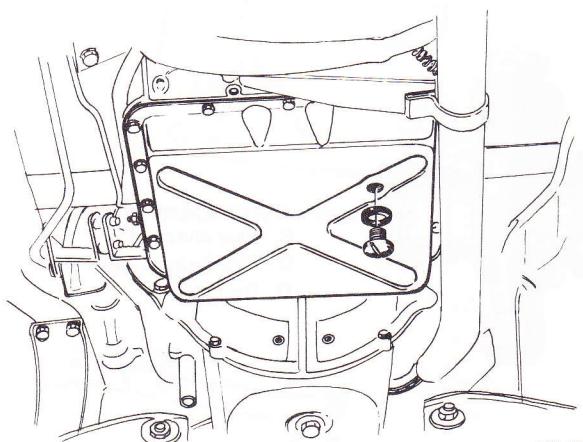
Rear piston "D"

Apply air pressure to the hole on the body. Observe the movement of the piston lever.

Automatic Transmission Removal

Op. No. 44274

1. Remove oil dipstick and filler pipe clamp. Remove bracket and throttle cable from dashboard and throttle control respectively. Disconnect the exhaust pipe at the manifold flange. Jack up the car and put stands under front and rear axles.
2. Drain the oil into a clean container
NOTE: The oil may be very hot and scald.



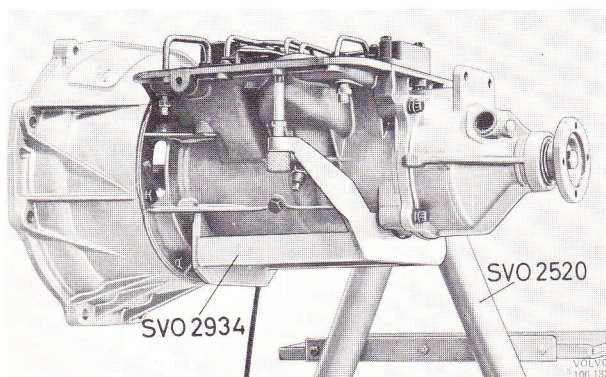
Oil drain plug

3. Disconnect the propeller shaft from the transmission flange. Disconnect the controls from the selector shaft lever as well as the reinforcing bracket under the oil pan.
4. Remove the attaching bolts for the converter. Turn the crankshaft forwards with a wrench on the crankshaft pulley bolt. Also use the wrench as a counterhold.

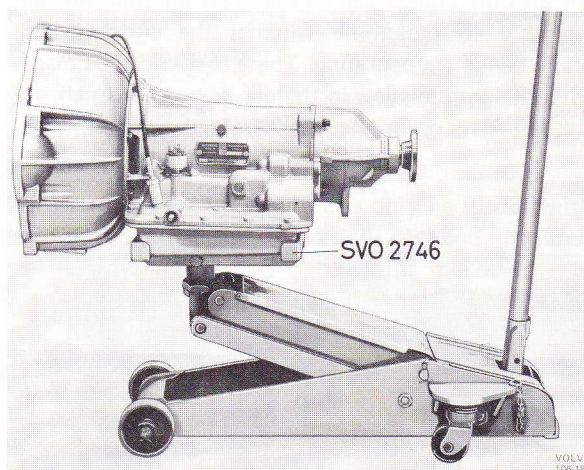
Automatic Transmission Disassembly

Op. No. 44202: rebuild, incl. remove/install

Op. No. 44273: rebuild, removed



5. Install fixture 2746 on a jack. Support the transmission with the jack:



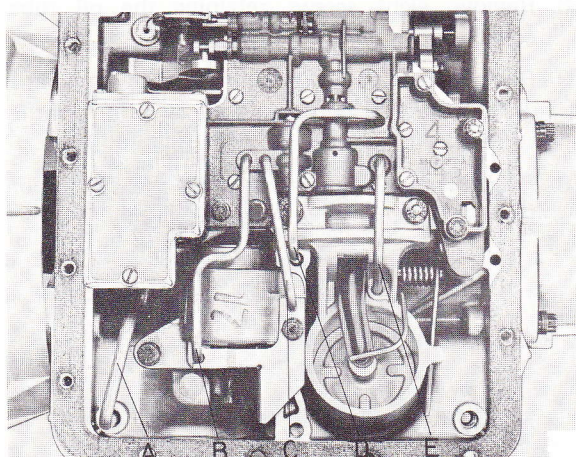
6. Remove the nut for the rear engine mounts and remove the cross-member. Disconnect the brackets for the exhaust pipe and the rear engine mounts. Remove the speedometer cable from the transmission. Release oil filler pipe.
7. Place a wooden block between engine and firewall. Lower the jack until the engine is aligned against the wooden block. Observe due care with the battery lead. If any tensions arise, disconnect the battery lead.
8. Disconnect the electric wires at the starter inhibitor switch. Remove the screws for the starter. Remove the attaching bolts for the converter casing. Pull the transmission backwards and release the guide pin on the converter at the same time. Lower and remove the transmission.

As a general rule it is advisable only to disassemble those components requiring attention as indicated by road-testing or trouble shooting procedure.

Prior to removal of any components, the outside of the transmission must be thoroughly washed with alcohol or a suitable solvent. A high standard of cleanliness is required when handling or storing components.

When disassembling, the transmission should be inverted and placed on the bench cradle or in fixture 2934.

Use special tools as shown in the service tool list. Treat the various components with great care, particularly light-alloy parts.

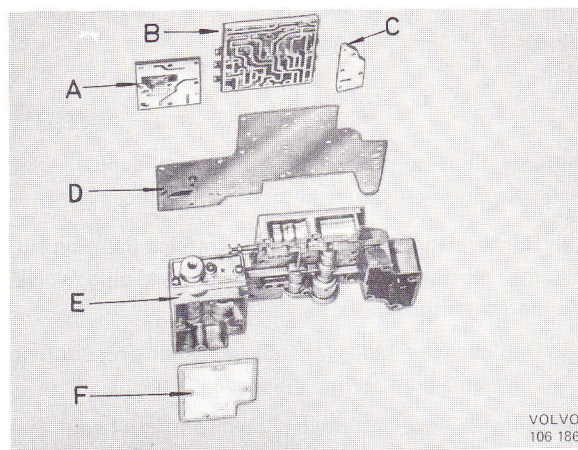


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Oil tubes

- A. Converter outlet
- B. Front piston release
- C. Front piston application
- D. Rear clutch
- E. Rear piston

Valve Bodies



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Main components of valve bodies assembly

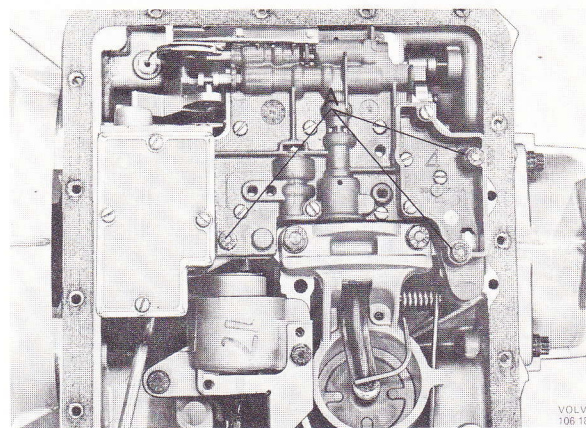
- A. Oil tube collector
- B. Upper valve body
- C. Governor line plate
- D. Separating plate
- E. Lower valve body
- F. Pump strainer

Work on the assembly should preferably be carried out in a Diesel test-room or in a room with a similar standard of cleanliness.

4. Disconnect the downshift valve cable from the downshift valve cam. Remove three screws which retain the valve bodies assembly to the transmission case, see Fig:

When the transmission is completely disassembled, follow the following procedures:

1. Remove six bolts and withdraw the converter housing.
2. Remove the "Wedglok" screw for the drive flange on the output shaft. Pull out the driver flange and catch the 3/8" plain washer. Loosen and withdraw rear housing. Remove speedometer gear.
3. Remove oil pan bolts and oil pan. Lever out the oil tubes B—E carefully as shown.



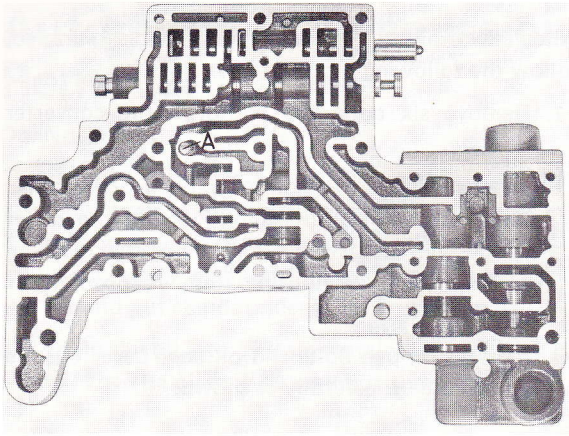
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Valve bodies assembly

- A. Attaching bolts

Lift the valve bodies assembly straight up so that it releases from the oil tubes at the front end.

5. Remove two screws for the bracket of the downshift valve cam.
6. Remove oil pump strainer.
7. Remove from above the screws which retain the upper valve body. Turn the valve bodies assembly round. Remove the other six screws from underneath.



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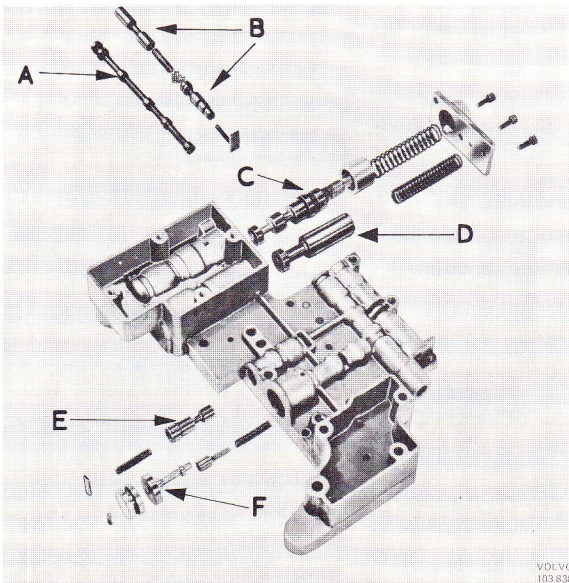
Check valves in lower valve body

A. Check valve for fast 3-2

8. Remove eight screws retaining the oil tube collector.
9. Remove four screws retaining the governor line plate. Note that two screws are under one of the strainers.
10. Remove separating plate. Remove check valve for fast 3-2 shifting.

Withdraw the manual control valve, see "A".

11. Remove the stops for the throttle valve and the return spring. Then withdraw downshift valve, spring and throttle valve, see "B".

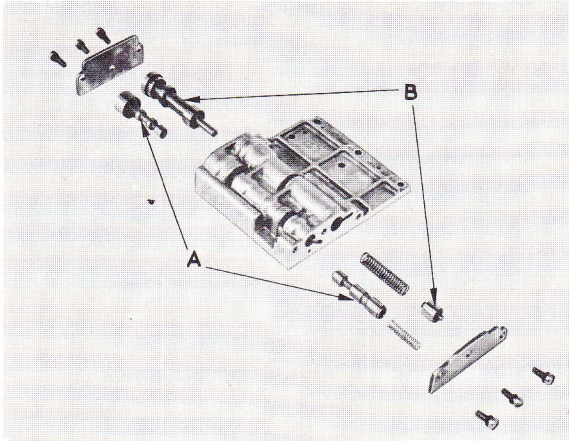


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Lower valve body

- A. Manual control valve
- B. Downshift and throttle valve
- C. Primary regulator valve
- D. Secondary regulator valve
- E. Servo orifice control valve
- F. Modulator valve

12. Remove the dowel pin which retains the plug for the modulator valve. Then remove plug, valve and then spring and valve.
13. Remove the stop for the servo orifice control valve and then spring and valve.
14. Remove the following components from the manual valve side of the lower valve body: three screws, lower body and plate, primary regulator spring, primary regulator valve sleeve, primary regulator valve, secondary regulator valve spring and secondary regulator valve.

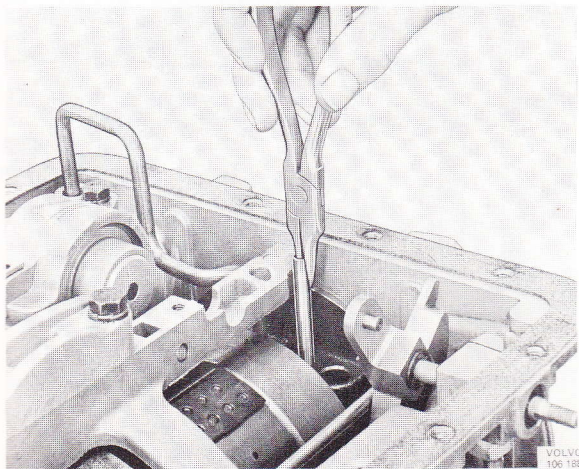


Upper valve body

- A. 1-2 shift valve and plunger
- B. 2-3 shift valve and plunger

Pump

20. Remove the oil tubes in the housing. If necessary, pull them out with needle-nose pliers as shown:



Removing converter inlet and outlet tubes using needle-nose pliers

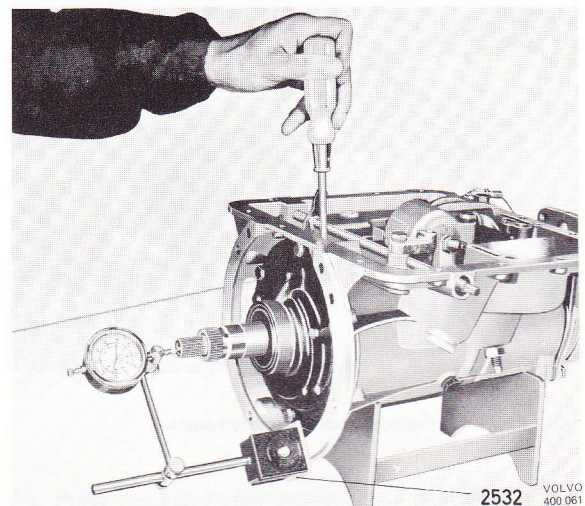
15. Remove the six screws and end plate from the upper valve body, see Fig.

Remove the following parts from the rear end of the body: shift valve 2-3 inner spring and plunger together with shift valve 1-2. Spring and plunger for shift valve 1-2 are removed in the other direction.

Front and rear pistons

16. Remove the two screws which retain the front piston assembly to the body, withdraw the assembly and the strut for the band.
17. Remove the snap ring in the cylinder with a small screwdriver. Take out the piston and separate the various parts. Drive out the clotted spring pin and lever pivot pin if necessary.
18. Remove the two screws which retain the rear piston assembly and withdraw this and the strut.
19. Unhook the spring. Drive out the pivot pin and the lever. Pull out the piston.

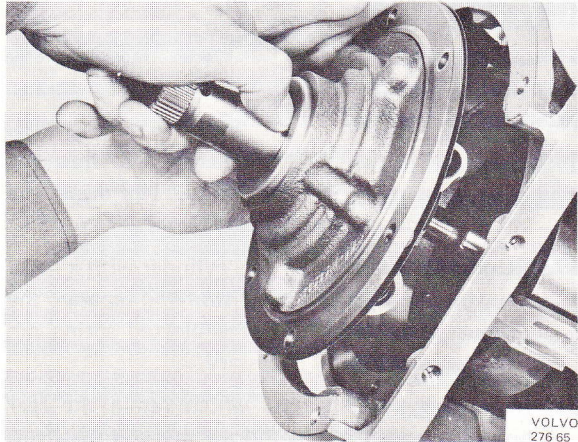
21. Set up the dial indicator gauge, as shown below, with plate 2532 and magnetic attachment:



Checking end float

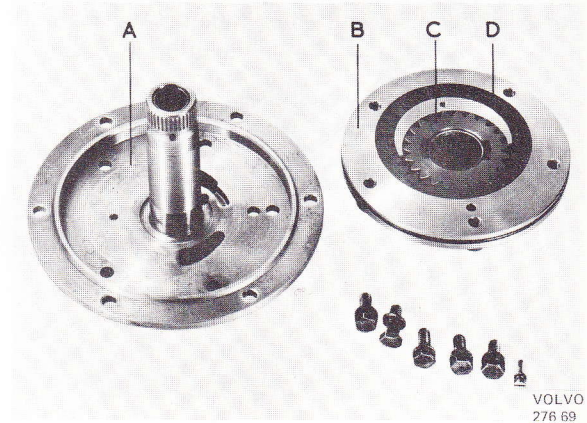
Place the point of the gauge against the shaft end, move the shafts and gears backwards and forwards and read the end-float. It should be $0.010-0.030'' = 0.25 - 0.75 \text{ mm}$. Note the play.

22. Remove the six bolts securing the pump to the body. Withdraw the pump and remove the gasket. Push the shaft inwards when withdrawing the pump.



Pump removal

23. Remove the five bolts and the slotted screw. Separate pump body, gears and other parts:

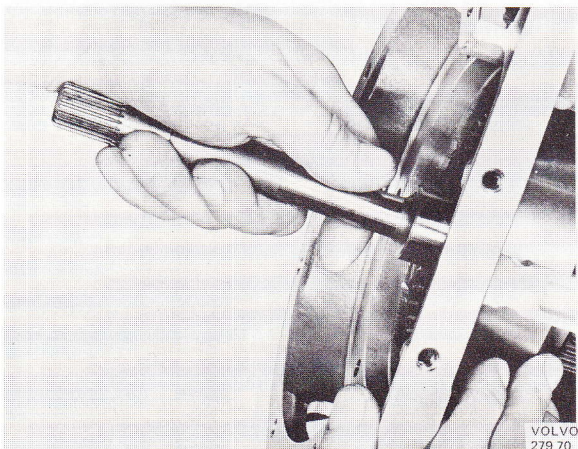


Converter support separated from pump

- A. Pump adapter and converter support assembly
- B. Body and bushing assembly
- C. Driving gear
- D. Driven gear

Front Clutch

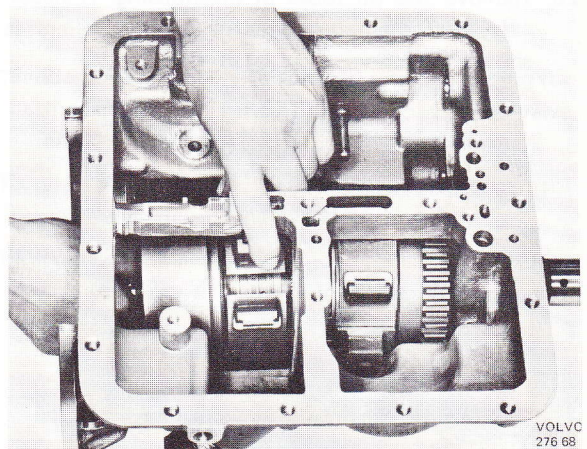
24. Withdraw front clutch assembly and input shaft complete:



Front clutch assembly removal

Rear Clutch

27. Withdraw the rear clutch assembly together with the forward sun gear shaft:

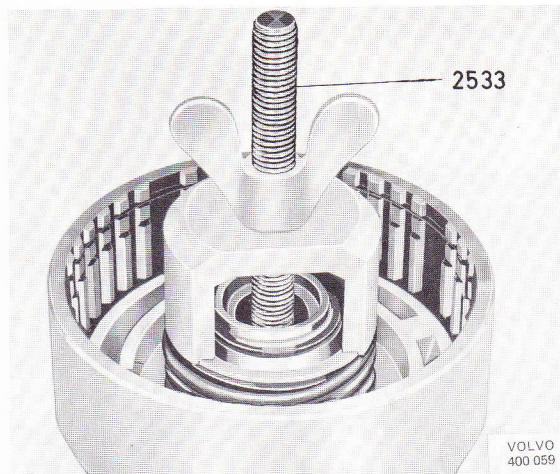


Withdrawing rear clutch and forward sun gear assembly

25. Remove snap ring with a screwdriver. Withdraw input shaft. Take out inner and outer plates and clutch hub.
26. Remove snap ring, spring and piston. If the piston is tight, lay the clutch body with the opening downwards on a bench and blow out the piston with compressed air.

28. Remove the two oil rings at the front of the shaft. Then withdraw the shaft. Take care of the two needle thrust bearings.
29. Remove three oil rings from the clutch body hub.
30. Remove snap ring and take out the pressure plate, inner and outer plates.

31. Place special tool 2533 on the clutch as shown:

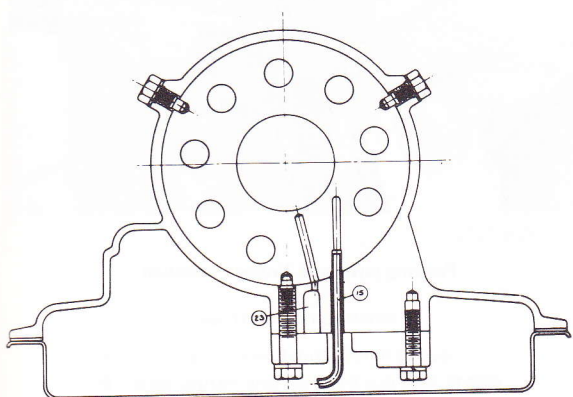


Rear clutch disassembly

Tighten the wing nut until the snap ring releases. Remove the snap ring and screw back the wing nut. Remove the special tool, then retainer and spring. Withdraw the piston. If necessary blow out the piston with compressed air.

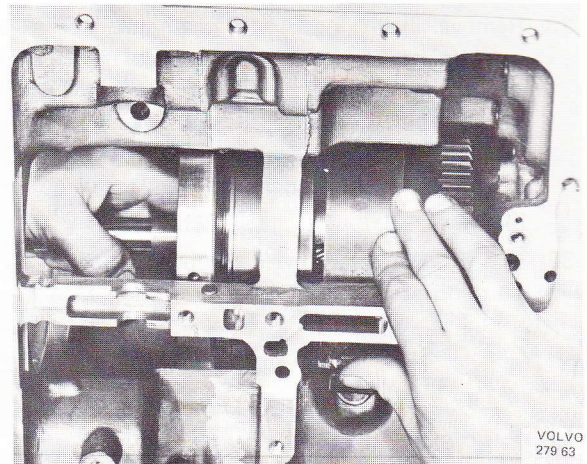
Center Support and Planetary Gears

32. Remove the two center support screws from the outside of the transmission case:



Center support, retention and passages

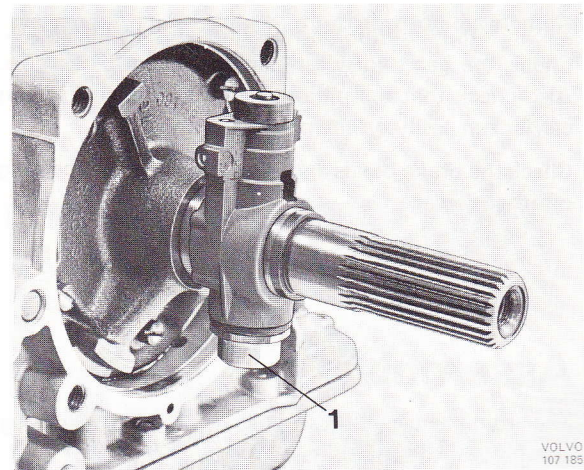
Withdraw the center support and planetary gears, see Fig. below. Remove the rear brake band. Separate the center support, one-way clutch and planet gears. Remove the snap ring and the outer race of the one-way clutch.



Withdrawing center support planetary gears

Governor

33. Release the bolt (1) and pull the governor off the shaft:



Governor removal

1. Bolt

34. Press the valve unit together and remove the clip. Remove the various parts.

Oil deflector flange

35. Remove the five slotted screws. Withdraw the oil deflector flange.
36. Remove the three oil sealing rings from the driven shaft.

Driven shaft

37. Withdraw the driven shaft. Remove the thrust washer. If necessary remove the snap ring and separate the ring gear from the driven shaft.

Shaft, parking pawl, and levers

38. Remove all locking clips. Push the manual valve lever in on the shaft and remove the slotted spring pin. Separate the parts. The anchor pin for the parking pawl can be withdrawn with a magnet or shaken out. If the manual valve lever shaft is to be removed, drive the spring pin out of the housing.
39. The throttle cable and other parts in the body are removed as necessary.

Inspection

After cleaning, all parts should be thoroughly checked for wear or damage. Check the white metal bushing for the driven shaft and the pins for the parking pawl linkage are firmly secured in the case. If they are loose, the case must be replaced. Check the thrust washers and needle bearings for wear and any seizing. If the end-float is within the permissible limits, it can be taken for granted that the thrust washers are not worn.

Check the gears for wear, seizing or tooth fractures. Also check that the pinions in the planet gear pinion carrier run easily on the needle bearings.

Check the brake bands and discs for wear, overheating or other damage.

Assembly

The utmost cleanliness must be observed during assembly of the transmission.

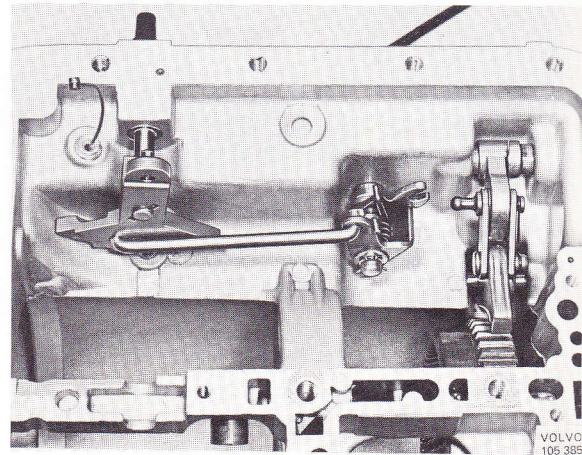
Before assembly, all parts must be carefully cleaned in alcohol or suitable solvent.

Use new gaskets when assembling. Lubricate the parts with "Automatic Transmission Fluid, type F (USA: FLM)".

Tighten all bolts with a torque wrench according to "Specifications". Use sealing compound 277961 on the threads of inhibitor switch, pressure point plug and oil drain. Locking fluid "Loctite CV" or corresponding is used for the flange bolt and "Loctite AV" for oil cooler connection nipples. Note that items not described in this section are assembled in the reverse order to disassembly.

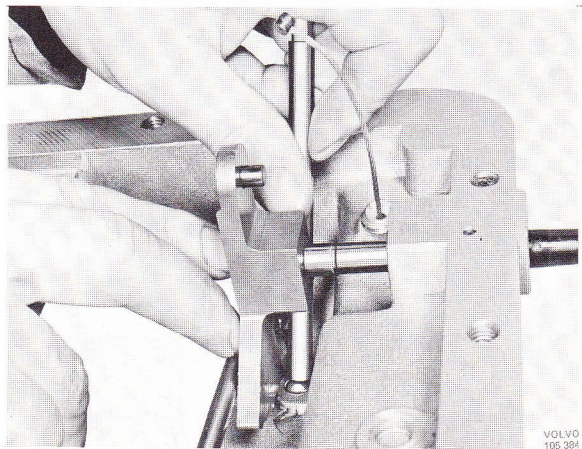
Transmission case, shaft, parking pawl and levers

1. The transmission case is inverted on the bench cradle or in the fixture.
2. Assemble shaft, parking pawl and levers in the reverse order to disassemble. Make sure that the springs for the levers are correctly installed:

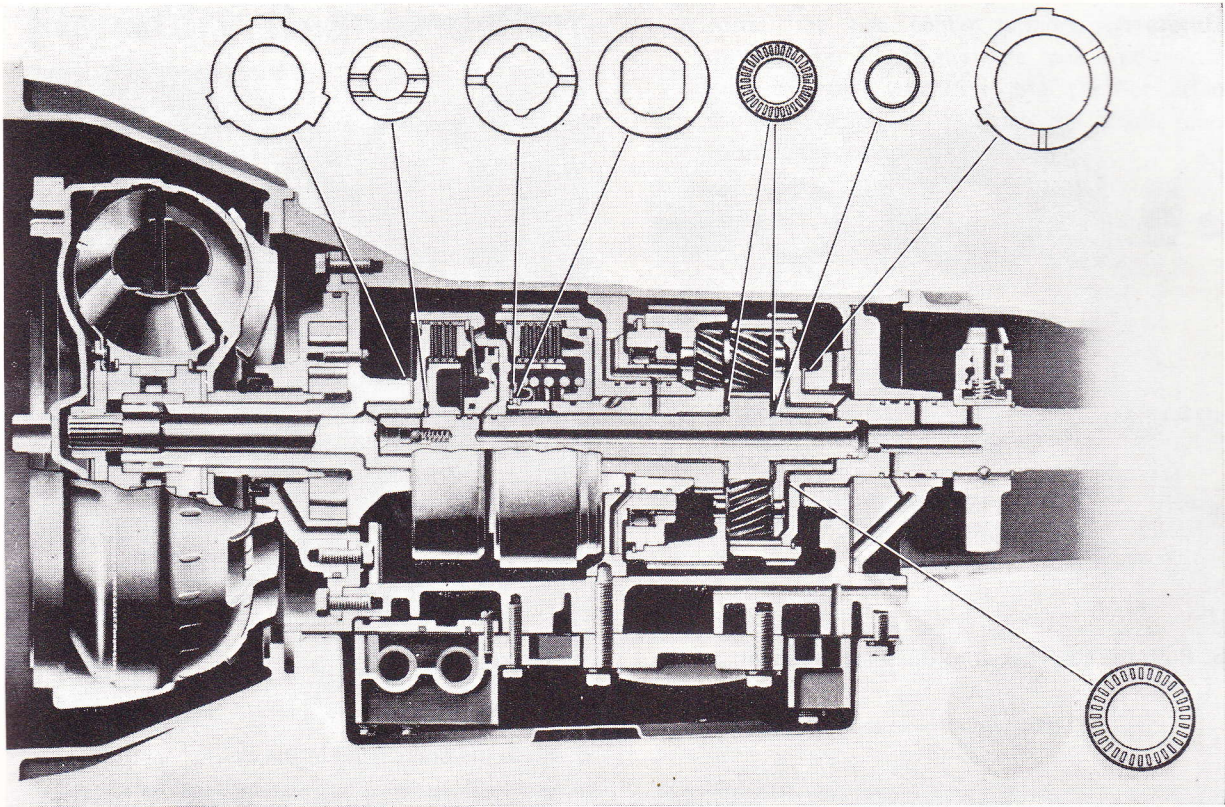


Locating manual valve lever on detent ball spring

Installation of the detent ball is facilitated by pressing down the ball, using a short piece of tubing as shown:



Parking pawl and linkage installed



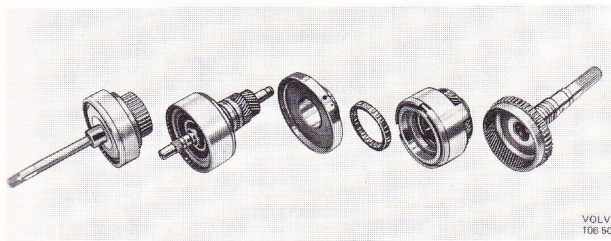
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Location of thrust washers

Driven shaft

3. The thrust washers for the driven shaft, see Fig. above, are stuck onto the transmission case with vaseline. The driven shaft complete with ring gears is then installed into the transmission case.

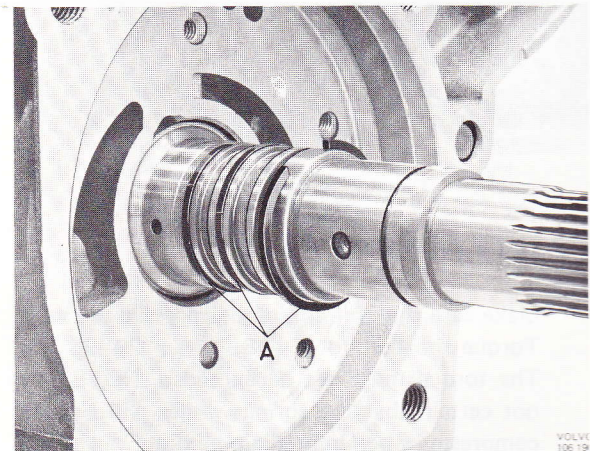
4. Install the three oil seal rings on the shaft:



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Gear train components

- A. Input shaft and front clutch group
- B. Rear clutch and forward sun gear group
- C. Center support
- D. One-way clutch
- E. Planet gears and rear drum assembly
- F. Driven shaft and ring gear assembly

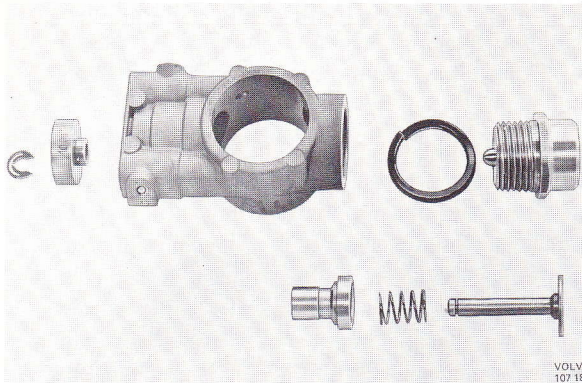


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Installation of oil rings on driven shafts

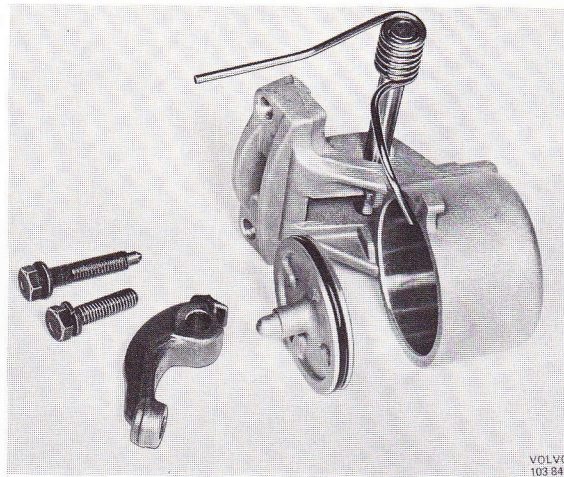
Exercise care when doing this as the oil seal rings are very fragile. Stand the box on its front end and support under the shaft. Center the oil rings. The oil deflector is then installed.

Governor



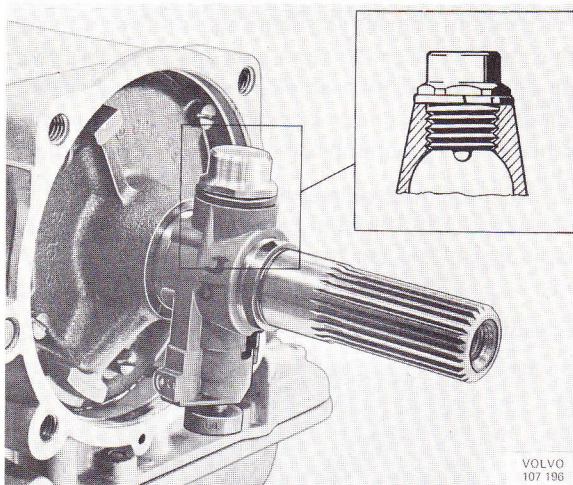
Governor disassembled

Rear brake band and servo



Rear Servo disassembled

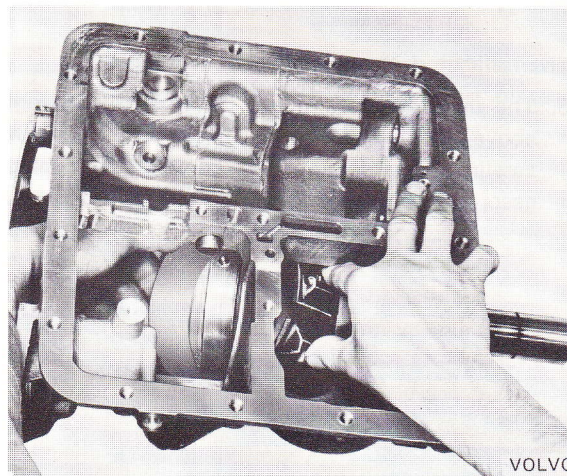
5. Push the governor onto the shaft as shown:



Governor and driven shaft

Make sure the bolt enters the recess in the shaft. Torque the bolt to 15–18 lb.ft. = 20–25 Nm. The torque must not be exceeded. NOTE: It is not certain that the spring washer will be fully compressed when tightening the bolt.

6. Place the brake band in the case:

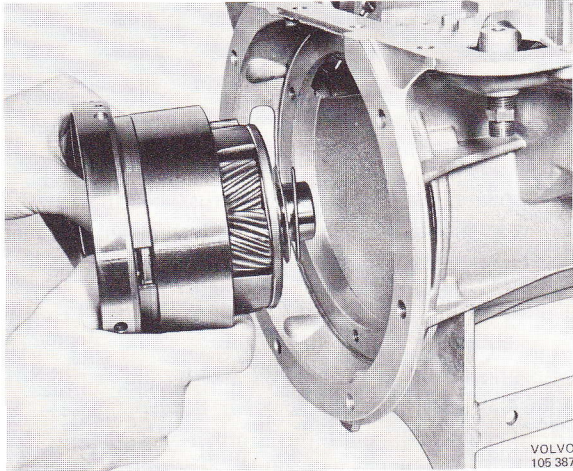


Rear brake band installation

Install rear servo assembly. Tighten only the rear (short) piston screw since the long one also locates the center support.

Planetary Gear and Center Support

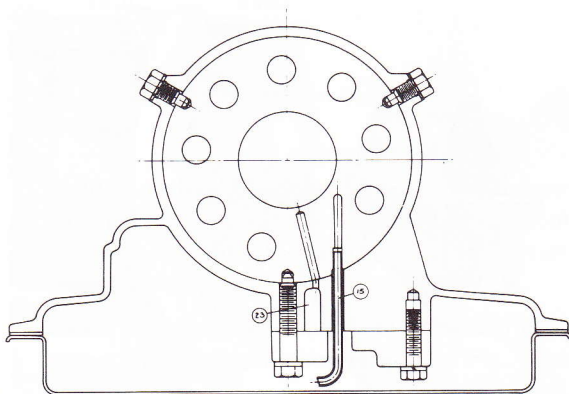
7. Assemble planetary gear, one-way clutch and center support: see



Installation of center support and planet gears with needle thrust bearing and plate washer

Stick the thrust plate and needle thrust bearing to the planet cover with vaseline.

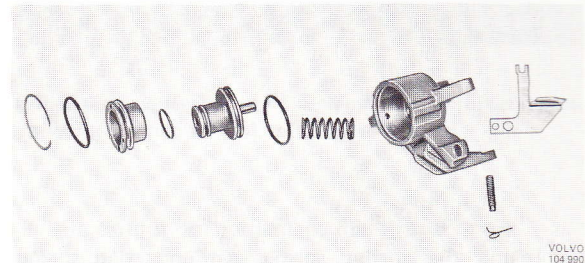
8. Turn the fluid passage holes in the support upwards and install the assembled unit into the transmission case. Note that the holes point down when the transmission is turned up:



Center support, retention and passages

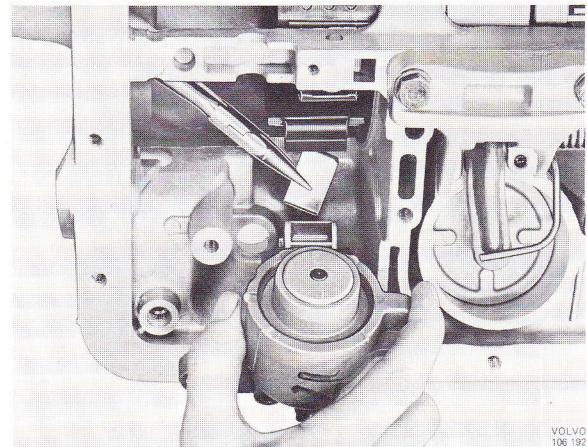
9. Install the two center support screws from outside. Remember that the lock washers also serve as sealing washers so that the flat surface should face inwards. Tighten the piston screw locating the support.

Front Brake Band and Piston



Front servo disassembled

10. Position the front brake band:

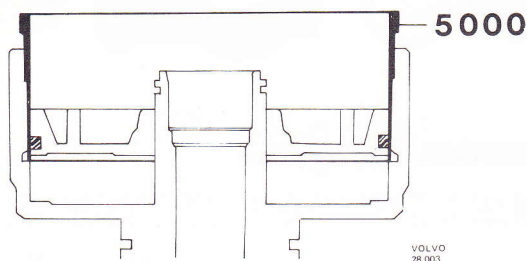


Front servo and strut installation

Stick the strut to the piston lever with vaseline. Install the piston. The shorter bolt is installed at the front. Make sure the piston strut is correctly engaged with the slot in the brake band. The cam for self-adjusting is installed later.

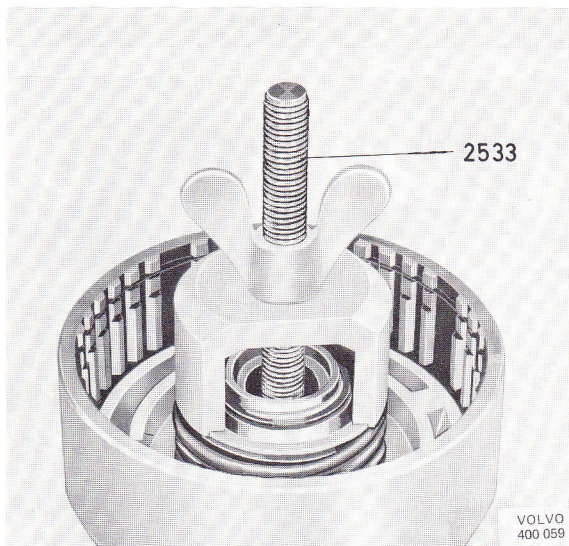
Rear clutch

11. Install the seal rings for the piston. Use installation ring 5000 and install the piston in the clutch case:



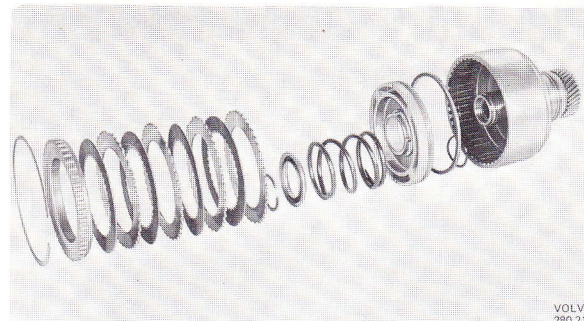
Installation of piston for rear clutch

12. Install the spring, spring seat and snap spring using special tool 2533, which also was used for disassembly:



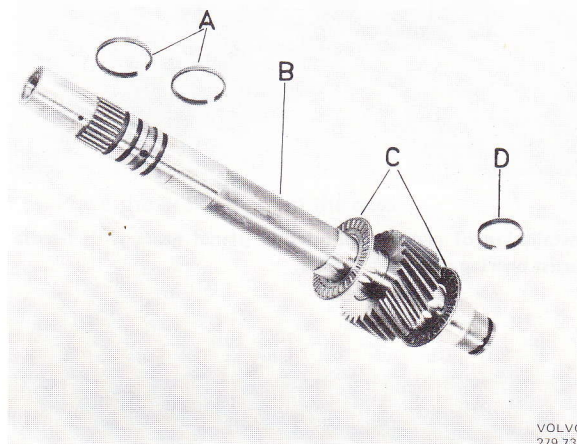
Rear clutch disassembly

13. Install the clutch plates. Note that the outer plates are coned and that all the plates should be installed with the cone facing in the same direction. Begin with an outer plate and then install inner and outer plates alternately. Install the pressure plate and snap ring.



Rear clutch disassembled

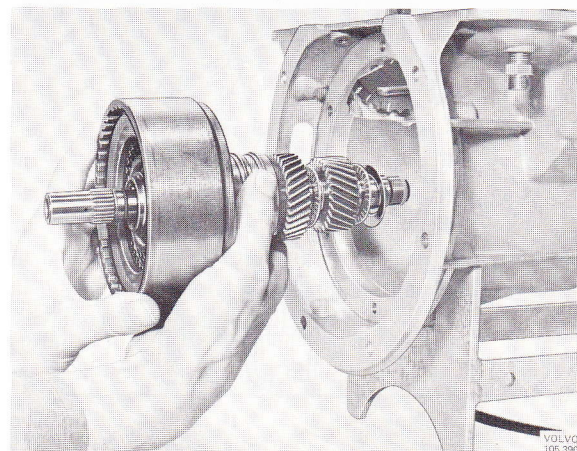
14. Locate the front needle thrust bearing on the rear sun gear shaft. Install the shaft in the rear clutch assembly. Install the oil seal rings:



Forward sun gear components

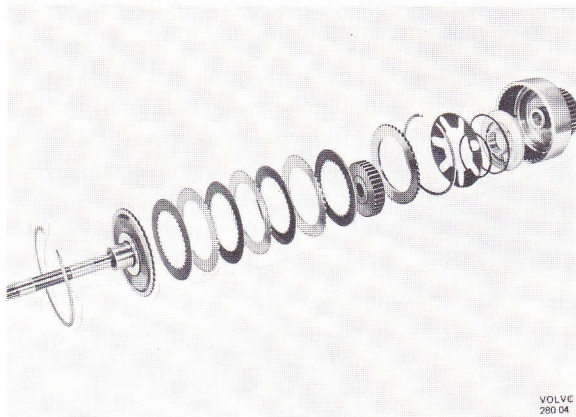
- A. Oil seal rings, front clutch
- B. Forward sun gear assembly
- C. Needle thrust washers
- D. Oil seal ring, governor feed

15. Install rear needle thrust bearing. Install the clutch in the transmission:



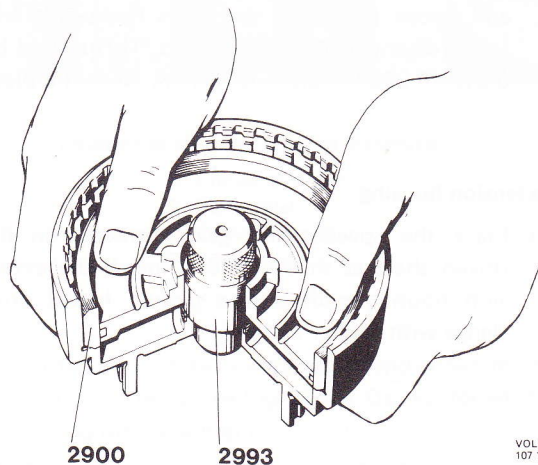
Rear clutch and forward sun gear group installation

Front Clutch



Front clutch disassembled

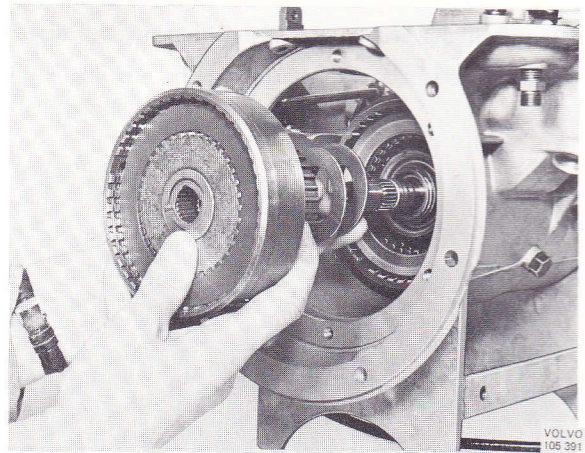
16. Place the guide 2993 in the clutch housing (drum). Install the seal ring on the piston and a new O-ring in the drum. Place the piston in the installation ring 2900. Press it down until it is level with the lower edge of the ring. Place the piston over the guide in the clutch housing according to Fig. below:



Installation of piston for front clutch

Hold the housing in your hands and push down the piston with the thumbs. Remove the tool. Install the spring with the dished side facing rear. Install the snap ring.

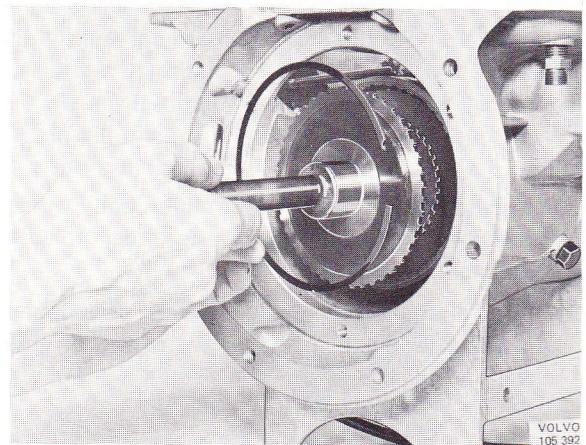
17. Install the clutch assembly with its two different thrust washers in the transmission, see Fig., right.



Installation sequence, front clutch cylinder, thrust and backing washers

Be careful not to damage the oil seal rings.

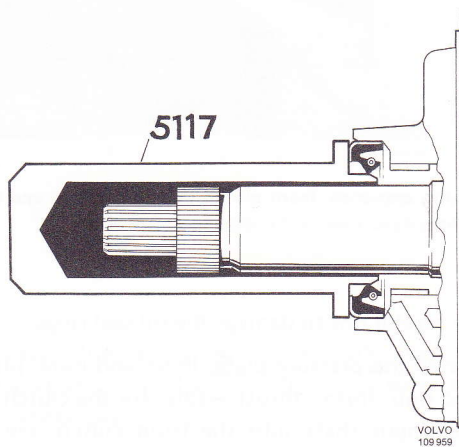
18. Install the pressure plate, inner and outer plates, and hub. Install thrust washer for the clutch hub and input shaft into the front clutch, see Fig. Install the snap ring.



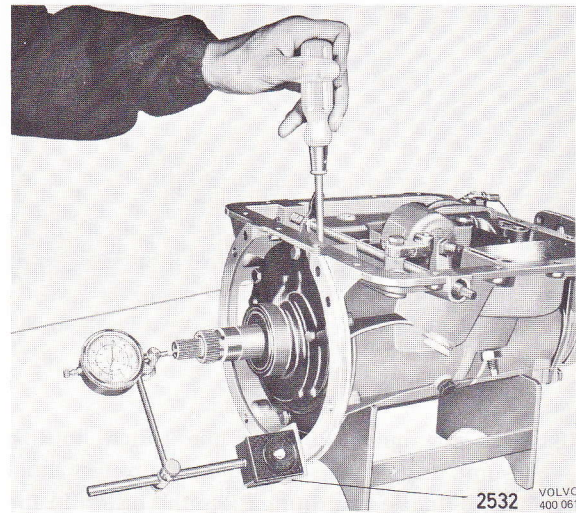
Installation sequence, front clutch snap ring, input shaft and thrust washer

The front and rear clutches can also be installed in transmission as an assembly. In this case they are first assembled individually. The rear clutch is then stood straight up, the thrust washer for the clutch hub centered, both the rear thrust washers placed on, and then the rear clutch and sun gear are assembled with the front clutch.

19. Install the seal in the pump housing. Use driver 5117, see Fig.



22. Recheck the axial play. Set up the dial indicator gauge as shown in Fig. below, with plate 2532 and magnetic attachment.

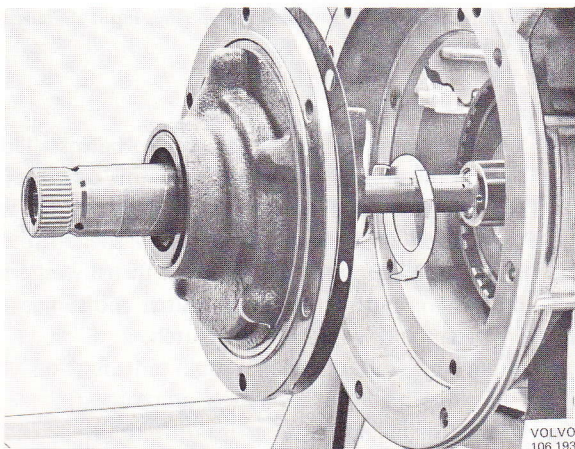


Checking end float

Place the point of the gauge against the shaft end, move the shafts and gears backwards and forwards and read the end-float. This should be $0.010-0.030'' = 0.25-0.75 \text{ mm}$. Note the play.

Pump

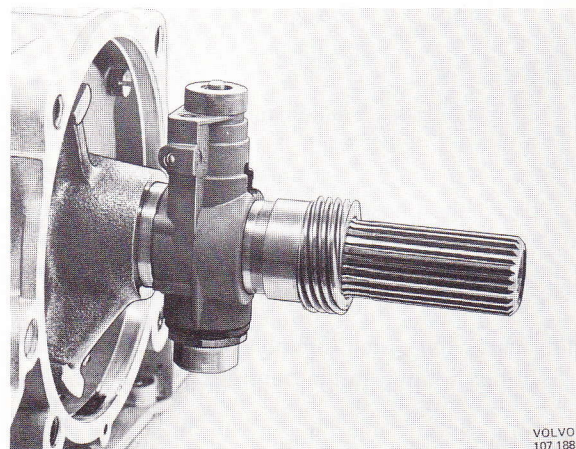
20. Install the O-ring on the pump body, then assemble the pump in reverse order to disassemble.
21. Stick on the thrust washer with vaseline and then install the pump with a new gasket on the transmission case.



Installation sequence, front pump assembly, thrust washer and gasket

Extension housing

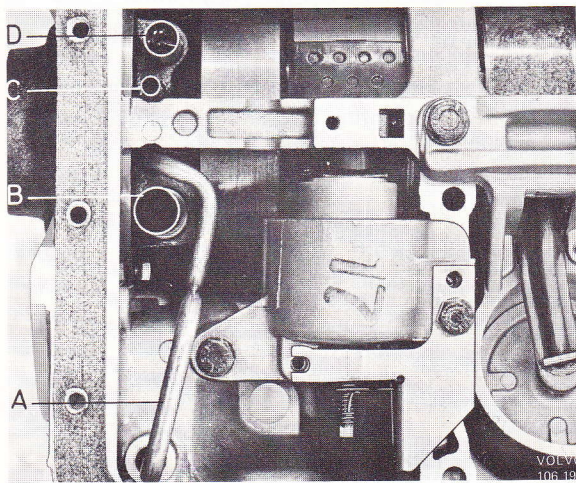
23. Place the speedometer gear correctly on the driven shaft as shown below. Install the extension housing with a new gasket. Install drive flange with washer and nut.



Speedometer gear installation

Valve bodies assembly

24. When assembling, all the component parts which have been disassembled should be thoroughly cleaned and lubricated with oil approved as "Automatic Transmission Fluid, type F (USA: FLM)" prior to reassembly in the reverse order to disassembly. Line up the component parts of the valve bodies assembly by using two of the retaining bolts. Check free movement of all valves in their bores. Check that the strainer is flat so that it makes a complete seal when screwed down. Tighten the screws to the specified torque.



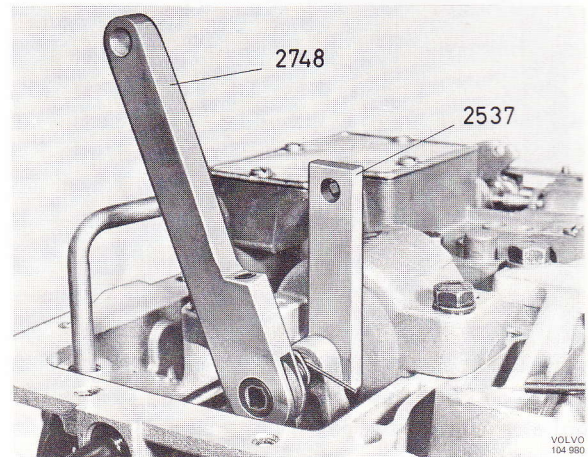
Location of oil tubes, front of transmission

- A. Converter outlet
- B. Pump inlet
- C. Converter inlet
- D. Pump outlet

25. Install the oil tubes for the pump and converter on the pump body, see Fig. above. Do not forget the O-ring for the pump inlet tube.
26. Install the valve bodies assembly to the transmission. Connect the throttle cable.

Miscellaneous

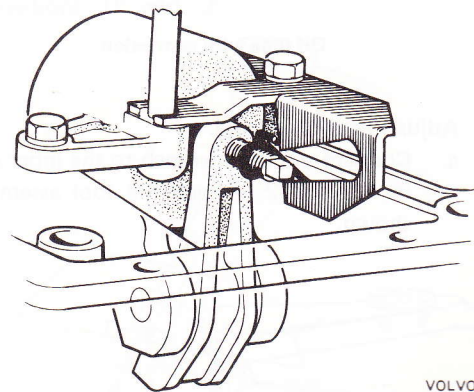
27. Place the spacer block 2537 between bolt and cylinder:



Front brake band adjustment

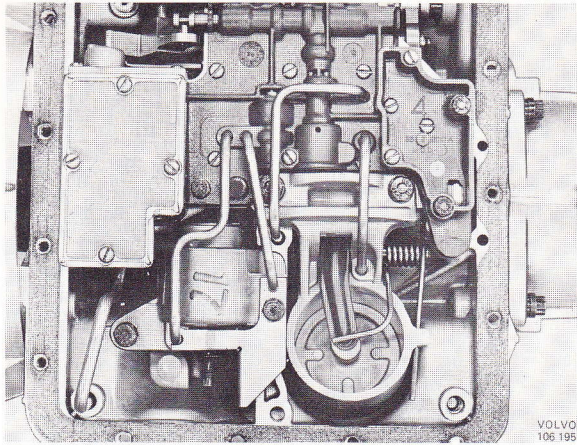
Tighten the bolt with torque wrench 2748 until the ratchet handle clicks out. This corresponds to a torque of 10 lb.in. = 115 Ncm.

28. Adjust the position of the spring on the adjusting screw. It should be 1–2 threads from the lever. Remove torque wrench and spacer block and install the cam. Insert the longer end of the spring in the cam.



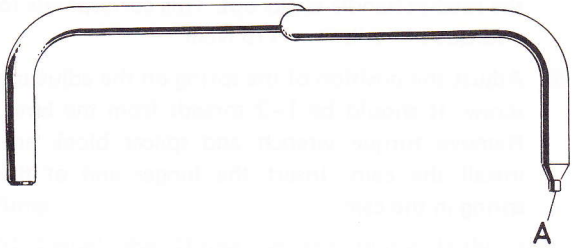
Self-adjustment device

29. Install the four oil tubes according to Fig. below.



Retention of pump strainer

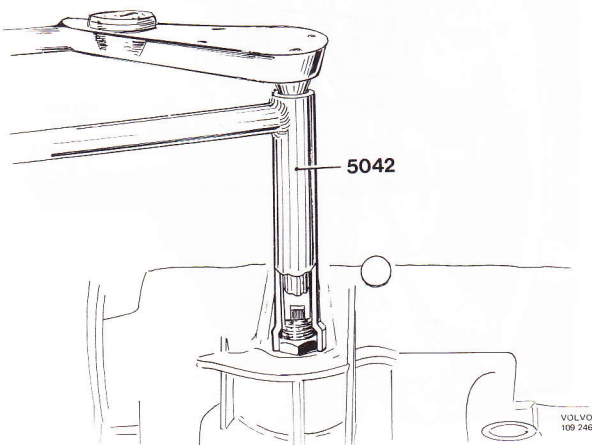
NOTE: The oil tube for releasing the front control cylinder is provided with a restriction (A) below. This end is installed in the control system.



Oil tube with restriction

30. Adjust rear brake band.

- a. Connect a torque wrench to the inner socket in tool 5042. Attach the tool assembly as shown.

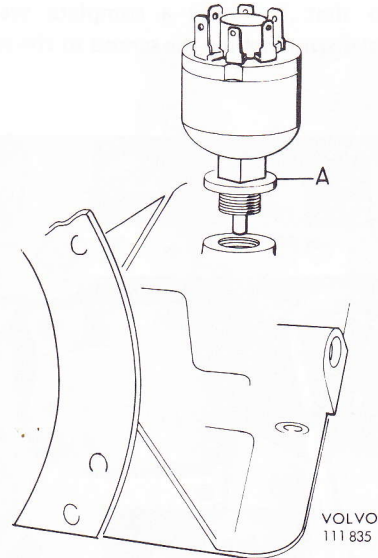


Rear brake band adjustment

- b. Slacken the lock nut for the adjusting screw. Tighten the screw to 10 lb.ft. = 14 Nm. Back off the adjusting screw one turn.
- c. Tighten the lock nut and restore.

31. Adjust starter inhibitor switch.

- a. Install new gasket (A) on the contact. Screw in the contact and torque to 6–8 lb.ft. = 8–11 Nm. Use tool 2975. Connect the wires.



Starter inhibitor installation

A. Gasket

- b. Check that the engine can only be started with the shift selector in positions "P" and "N", that the back-up lights go on with the selector in position "R" and that the seat belt reminder functions in "D", "2" and "1".

32. Place the magnet in the oil pan. Install the oil pan with a new gasket.

Transmission Installation

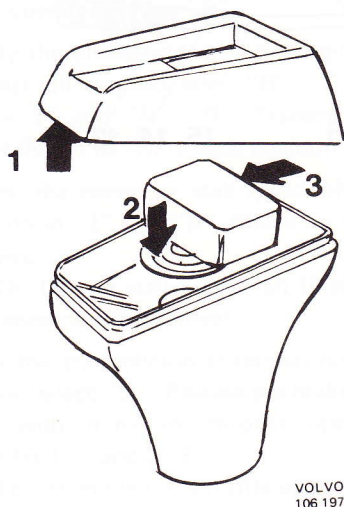
Op. No. 44276

The converter, converter housing and transmission are installed in the reverse order to removal.

Selector Controls

Removal and disassembly

1. Set the selector control in position "P". Put the vehicle on stands. Remove the shift rod from the selector lever on the selector lever housing.
2. Use a knife to pry up the front edge of the cap on the selector lever knob and remove it. Press down the spring washer and push the button forwards so that it releases from the trust rod. Remove the washer and spring and pull up the lower part of the selector lever knob.



Knob disassembly

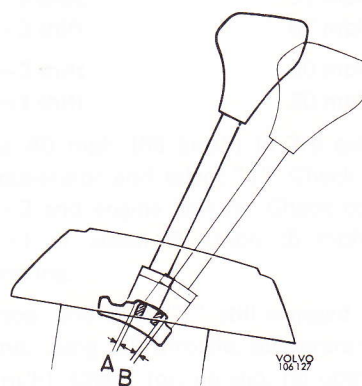
3. Remove retaining screws and lift off the console. Remove the socket for the console light. Remove the selector lever housing screws and lift up the selector lever housing.
4. Release the nut and remove the lever. Remove the screws and take the cover off the selector lever housing.
5. Knock up the tubular studs. Remove push rod and inhibitor. Drive out the shaft. Release the screws from the gating. Drive out the bushings from the bracket.

Inspection

Check the various parts, especially for wear. Replace worn bushings, link rods, etc.

Assembly and installation

1. Press the bushings into the bracket and tighten the gating. Grease the slide surfaces on the bushings, inhibitor and lower part of the push rod.
2. Assemble the selector lever and bracket and press in the shaft. Lock it with the tubular stud.
3. Install push rod and inhibitor. Drive in the tubular stud. Assemble selector lever housing and gear positions console.
4. Grease the seal. Install it together with washer and lever on the shaft.
5. Adjust the sealing strip round the tunnel opening. Install the complete selector lever housing. Note that the ground cable for the gear positions console light should be connected to one of the screws. Install light socket and then console for the gear positions.
6. Install the lower part of the selector lever knob. Put on washer and spring. Press down the washer and install the button. Snap the selector lever knob cap into position. Set the selector lever to position "P".
7. If the shift rod has been disassembled, its length should be $16'' = 405 \text{ mm}$ from the center for the bolts. Grease the bushings and then connect the shift rod to the levers. Make sure that the lock on the shift rod comes on the inside of the lever on the selector lever housing.
8. Check the clearance for the selector gating in positions "D" and "2".



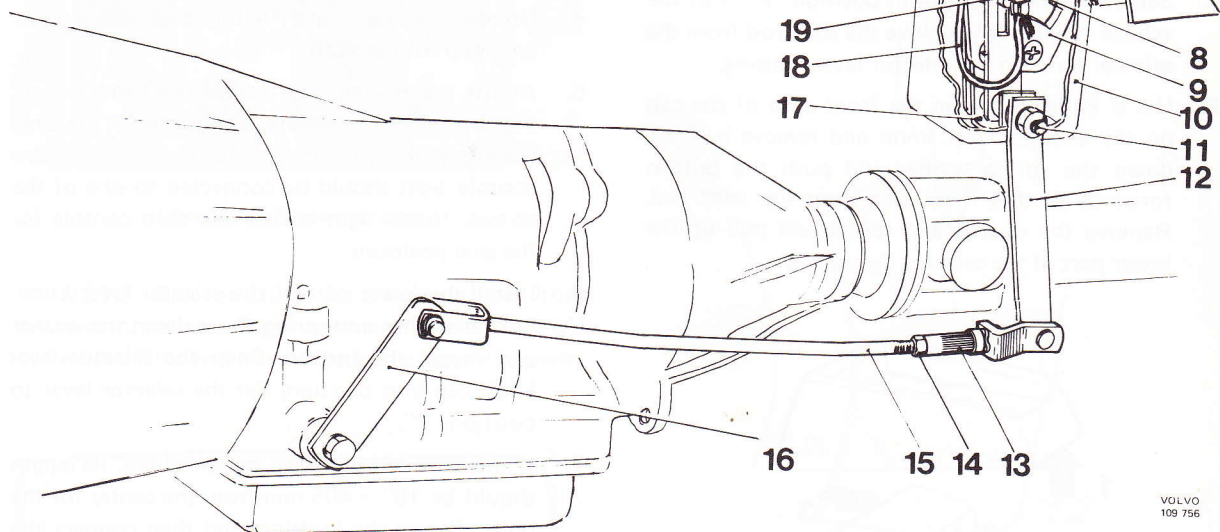
Selector controls adjustment

The clearance A and B, should be the same in both shift positions or somewhat greater in position "D". Min $0.04'' = 1 \text{ mm}$. Adjust if necessary. Check that there is still the same clearance after the selector lever has been shifted to positions "1" and "P". Also check that the output shaft is locked with the lever in position "P".

9. Lower the vehicle.

Selector controls

- | | |
|---------------------------------------|----------------------------------|
| 1. Selector lever knob, upper section | 11. Shaft |
| 2. Selector lever knob, lower section | 12. Lever |
| 3. Washer | 13. Gearshift rod adjuster |
| 4. Spring | 14. Lock nut |
| 5. Push rod | 15. Control rod |
| 6. Selector lever | 16. Lever |
| 7. Shift positions cover | 17. Bracket |
| 8. Shift positions light | 18. Cable, shift positions light |
| 9. Inhibitor plate | 19. Detent |
| 10. Housing | 20. Button |



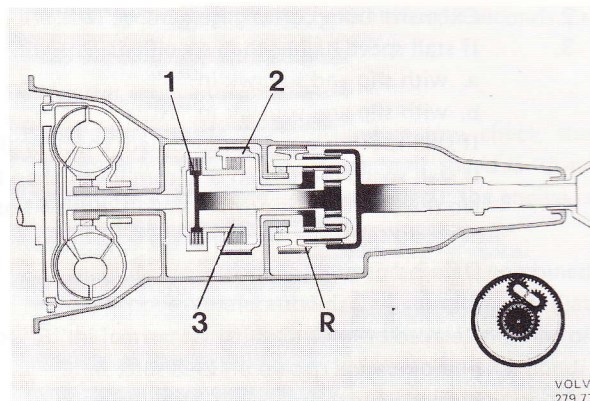
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Service Diagnosis

Road test

(Used together with the service diagnosis chart)

It is important to gain as much information as possible on the precise nature of any fault. If possible, have the customer demonstrate the fault. The following road-test procedure should be carried out completely as there may be more than one fault.



Test No.

1. Check that the starter only operates with the selector in "P" and "N" and that the back-up light operates only in "R".
2. Apply the brakes and, with the engine running at normal idling speed, select "N"—"D", "N"—"2", "N"—"1" and "N"—"R". Transmission engagement should be felt in each position selected.
3. Check the converter stall speed with the transmission in "1" and "R". Check for slip or clutch squawk.
NOTE: Do not stall more than 10 seconds or the transmission will overheat.
4. With the transmission at normal running temperature, select "D". Release the brakes and accelerate with minimum throttle opening. Check upshifts 1—2 and 2—3.
NOTE: At minimum throttle openings, the shifts may be difficult to detect. Confirmation that the transmission is in 3rd gear may be obtained by selecting "2" or "1" when a 3—2 downshift should be felt.
- 5b. At 25 mph (40 km/h) in 3rd gear, depress the accelerator pedal to full throttle position. The car should now downshift to 2nd gear. Repeat at 40 mph (65 km/h). The car should accelerate in 3rd gear and should not downshift.
- c. At 30 mph (50 km/h) in 3rd gear, depress the accelerator pedal to the kick-down position. The transmission should downshift to 2nd gear.
- d. At 15 mph (25 km/h) in 3rd gear, depress the accelerator pedal to the kick-down position. The transmission should downshift to 1st gear.

Principle diagram for service diagnosis

1. Front clutch gives 1st gear
2. Front brake band gives 2nd gear
3. Rear clutch gives 3rd gear
- R. Rear brake band gives reverse and engine braking in "L"

- 6a. Stop and restart using forced acceleration. Check upshifts 1—2 and 2—3 according to the shift speed table below:

Approximate speed shifts at kick-down.

Models	242, 244, 245
Engine	B 20F
Rear axle ratio	4.10:1
1—2 shift	37 mph = 60 km/h
2—3 shift	67 mph = 108 km/h
3—2 shift	60 mph = 98 km/h
3—1 shift	30 mph = 50 km/h

- b. At 40 mph (65 km/h) in 3rd gear, release the accelerator and select "1". Check for downshift 3—2 and engine braking. Check coast downshift 2—1 at about 8 kmph (5 mph) and engine braking.
7. Stop, and with "1" still engaged, release brakes and, using full throttle, accelerate to 20 mph (30 km/h). Check for: no slip, no upshifts, or clutch squawk.
8. Stop and select "R". Release brakes and reverse using full throttle if possible. Check for no slip or clutch squawk.
9. Stop on the brakes, facing downhill on a gradient, and select "P". Release the brakes and check that the parking pawl will hold the car. Re-apply the brakes before disengaging the parking pawl. Repeat with the car facing uphill. Check that the selector is trapped by the gate in "P".

Test	Action	Possible cause
1.	Starter will not operate in "P" or "N"	19
	Starter operates in all selector positions	20
2.	Excessive bump on engagement of "D", "1" or "R"	4, 3
3.	If stall speed higher than specified:	
	a. with slip and squawk in "1"	1, 2, 3, 13, 11
	b. with slip and squawk in "R"	1, 2, 3, 13, 12
	If stall speed lower than specified, check engine performance	
	If stall speed more than 600 rpm lower than specified	21
4.	No drive in "D" (if normal in "1", omit 11 and 13 if no drive in "D", "2", "1" or "R", and 17)	1, 2, 3, 13, 11, 16
	Delayed or no 1-2 shift	3, 14, 13, 5, 6
	Slip on 1-2 shift	2, 3, 5, 6, 7, 13
	Delayed or no 2-3 shift. (If normal in "R", omit 12)	3, 14, 13, 5, 6, 12
	Slip or engine run-up on 2-3 shift	2, 3, 5, 13, 12
	Bumpy gear shifts	3
	Drag in "D2" and "D3"	8
	Drag on 2-3 shift	5, 6
5a.	Slip and squawk or judder on full throttle take-off in "D"	1, 2, 3, 13, 11
	Loss of performance and overheating in "D3" (seized stator)	21
	Continue as for test 4 above	
b.	Transmission downshifts too easily	3
c. d.	Transmission will not downshift	3, 13, 14
6a.	As test 6a above	
b.	No 3-2 downshift or engine braking	1, 5, 6, 7, 12
	No 2-1 downshift or engine braking	8, 9, 10
7.	Slip and squawk or judder on take-off in "1"	1, 2, 3, 13, 11
	Transmission upshifts	1
8.	Slip and squawk or judder on take-off in "R"	1, 2, 3, 13, 12
	Slip but no judder on take-off in "R" (if engine braking available in "1", 1st gear omit 8, 9, 10)	1, 2, 3, 8, 9, 10
	Drag in "R"	5
	No drive in "R" (if engine braking available in "1", 1st gear omit 8, 9, 10)	1, 2, 3, 8, 13, 9, 10, 12
9.	No park	1, 15
Mis-	Screech or whine, increasing with engine speed	17
cell-	Grinding or grating noise from transmission	18
aneous	Knocking noise from torque converter area	22
	At high speeds in "D3", transmission downshifts to "D2" and immediately back to "D3"	12

Possible cause

1. Check manual linkage adjustment
2. Check fluid level
3. Check adjustment of downshift valve cable using pressure gauge and tachometer
4. Reduce engine idling speed
5. Check front band adjustment
6. Check front piston seals and tubes for leakage
7. Check front band for wear
8. Check rear band adjustment
9. Check rear piston seal and attachment of tubes
10. Check rear band for wear
11. Examine front clutch and seals, also front sun gear shaft rings. Verify that cup plug in driven shaft is not leaking or dislodged
12. Examine rear clutch, check valve and seals. Check attachment of tubes
13. Strip valve bodies and clean
14. Strip governor valve and clean
15. Examine parking pawl, gear and internal linkage
16. Examine one-way clutch
17. Strip and examine front pump and drive fingers
18. Strip and examine gear train
19. Adjust start inhibitor switch outwards
20. Adjust start inhibitor switch inwards
21. Replace torque converter
22. Examine torque converter drive plate for cracks or fractures

Converter service diagnosis

The converter housing is welded together and cannot be repaired and has to be replaced if defective. There is no drain plug since fluid changes do not occur and fluid filling is done through the transmission.

The stall speed means the speed obtained at full throttle with the engine engaged but the car braked. Check that the transmission has the correct running temperature and that the fluid level is correct before the stall speed test. Test no more than 10 seconds, or the transmission will overheat.

Converter service diagnosis:

1. If the vehicle performance is low check the converter stall speed. If the stall speed is up to 300 rpm below the specified speed, the engine is not developing its full power.
2. Inability to start on steep gradients combined with poor acceleration from rest indicates that the converter stator one-way clutch is slipping or that the stator support is fractured. This condition permits the stator to rotate in an opposite direction to the turbine and torque multiplication cannot occur. Check the stall speed and, if it is more than 600 rpm below the specified speed, the converter assembly must be replaced.
3. Incorrect acceleration in 3rd gear above 30 mph (50 km/h) combined with a substantially reduced maximum speed, indicates that the stator one-way clutch has locked in the engaged condition. The stator will then not rotate with turbine and impeller the fluid phase of the converter performance cannot occur. This condition will also be indicated by excessive overheating of the transmission, the stall speed will remain as specified. In this case converter assembly must be replaced.
4. Stall speed which is higher than specified, indicates that the converter is not receiving required fluid supply or that the automatic transmission clutches are slipping.

Fault investigation key

Preliminary adjustment faults

- A. Incorrect front brake band adjustment.
- B. Incorrect rear brake band adjustment.
- C. Fluid level incorrect.
- D. Downshift valve cable incorrectly assembled or adjusted.
- E. Manual linkage incorrectly assembled or adjusted.
- F. Incorrect engine idling speed.

Hydraulic control faults

- a. Oil tubes missing or not installed correctly.
- b. Sealing rings missing or broken.
- c. Valve bodies assembly screws missing or incorrectly tightened.
- d. Primary regulator valve sticking.
- e. Secondary regulator valve sticking.
- f. Throttle valve sticking.
- g. Modulator valve sticking.
- h. Governor valve sticking, leaking or incorrectly fitted.
- i. Orifice control valve sticking.
- m. 1-2 shift valve sticking.
- n. 1-2 shift valve sticking.
- p. 2-3 shift plunger sticking.
- s. Pump check valve missing or sticking.

Quick-reference trouble shooting chart for automatic transmissior

Mechanical faults

- N. Front clutch slipping due to worn plate or faulty parts.
- O. Front clutch seized or plates distorted.
- P. Rear clutch slipping due to worn plates or faulty check valve in piston.
- Q. Rear clutch seized or plates distorted.
- R. Front band slipping due to faulty servo, broken or worn brake band.
- S. Rear brake band slipping due to faulty servo, broken or worn brake band.
- T. One-way clutch slipping or incorrectly fitted.
- U. One-way clutch seized.
- V. Input shaft broken.
- W. Front pump drive fingers on converter hub broken.
- X. Front pump worn.
- Z. Converter blading and/or one-way clutch fails.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Bumpy	2	1	—	—	5	3	4	—	—	—	—	—	—	6	7	—	—	—	—	—	—	—	—	—	—	—
Delayed	1	2	3	—	4	7	6	5	—	—	—	—	—	8	9	10	—	11	—	—	—	—	—	12	—	—
Stone	1	2	—	—	3	4	5	6	—	—	—	—	—	—	—	—	—	—	—	—	—	7	8	9	10	—

Starting from rest

None forward	.....	-	1	-	-	3	2	-	-	-	-	-	4	-
None reverse	.....	-	1	-	2	7	6	5	-	-	6	3	4	-
Seizure reverse	.....	-	-	2	-	-	-	-	-	-	-	-	-	2
No neutral	.....	-	1	2	-	8	9	3	-	-	-	-	-	2

Upshifts

No 1-2	1	2	8	9	10	—	6	7	3	—	—	—	—	—
No 2-3	—	—	8	9	10	—	6	7	2	—	3	4	—	5
Above normal shift speeds	—	1	—	—	8	9	10	—	2	1	3	4	5	6
Below normal shift speeds	—	1	—	—	5	6	—	2	—	3	—	—	4	—

Upshifts quality

[illegible]

Downshifts

[illegible]

Downshift quality

Slip on 2-1	1	6	7	8	4	5	3	2	1
Slip on 3-2	1	6	7	8	4	5	3	2	1
Rough on 2-1	1	6	7	8	4	5	3	2	1
Rough on 3-2	1	6	7	8	4	5	3	2	1

Line pressure

Low, idling	.....	1	-	2	3	-	-	6	8	5	4	-	-	-	-	-	-
High, idling	.....	-	1	-	2	-	-	-	-	-	3	5	4	-	-	-	-
Low at stall	.....	-	-	-	-	-	-	6	8	7	9	-	5	4	9	-	-
High at stall	.....	-	-	-	-	-	-	-	-	-	4	1	-	2	3	-	-

Stall speed

[illegible]

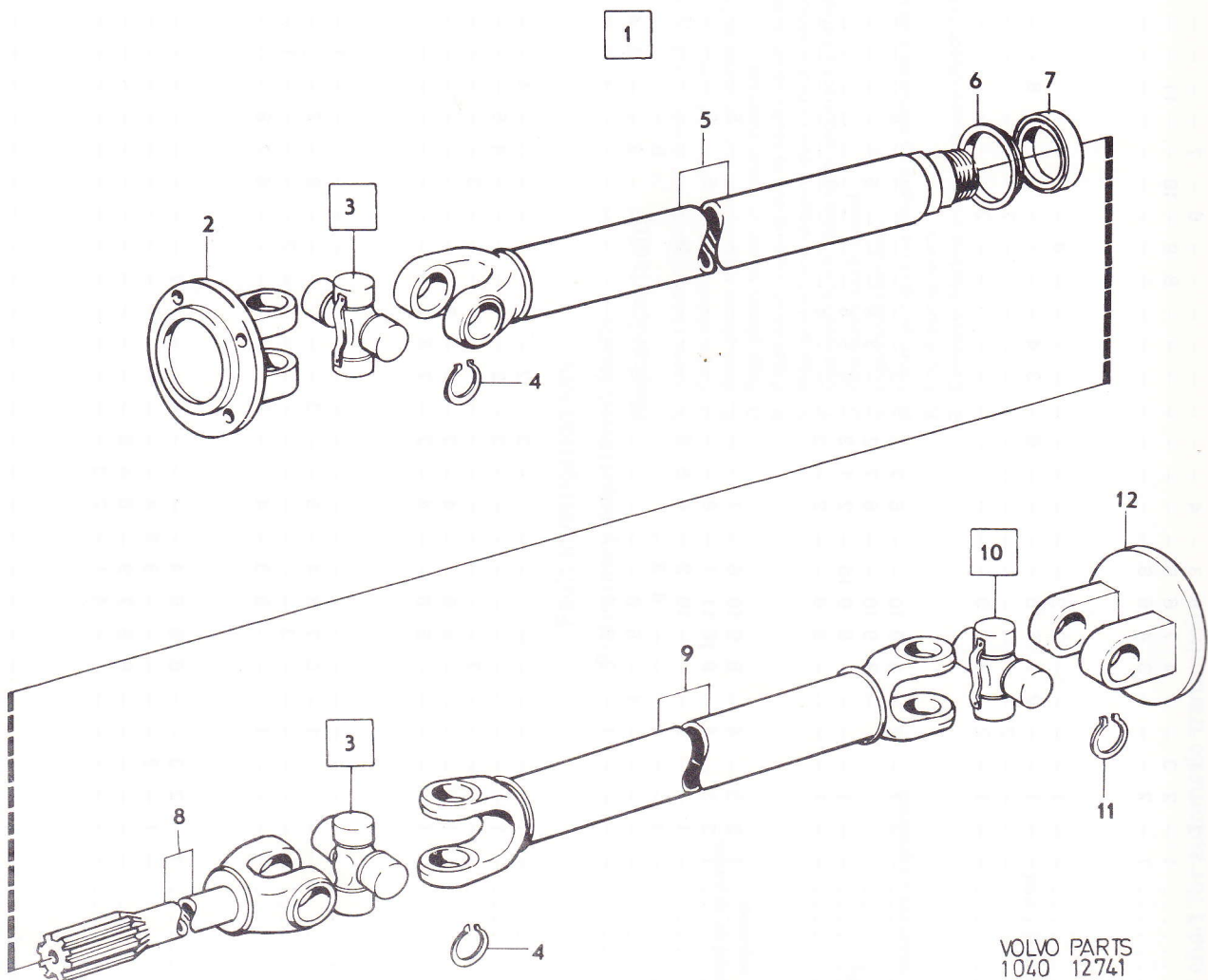
Overheating

Overheating

The numbers indicate the recommended sequence of fault investigation

Group 45

Propeller Shaft

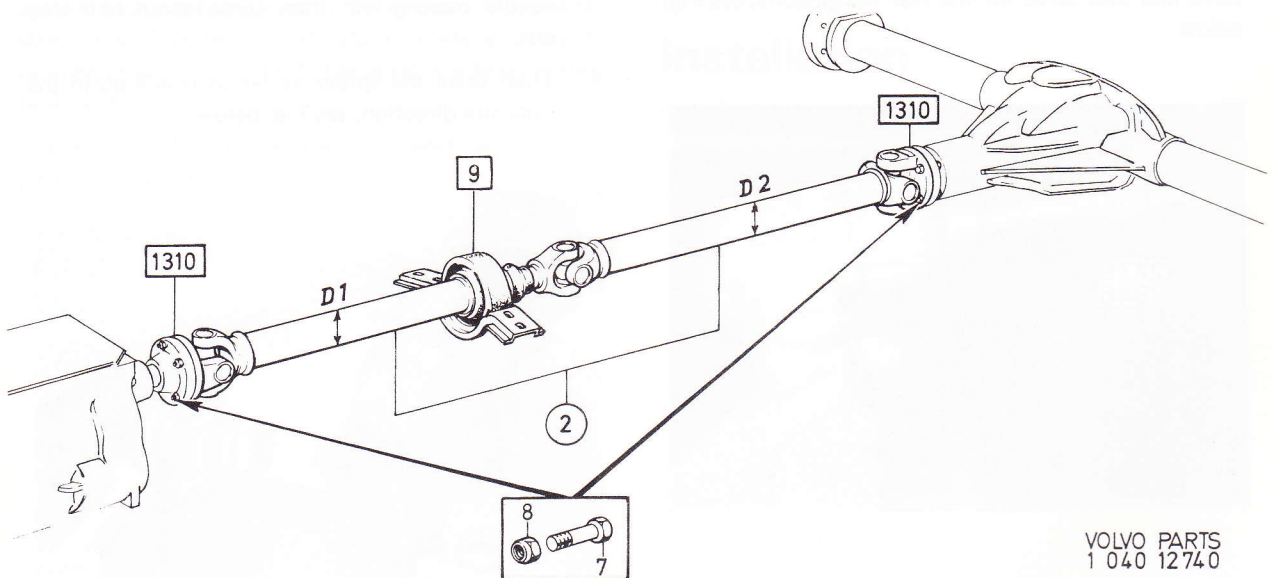
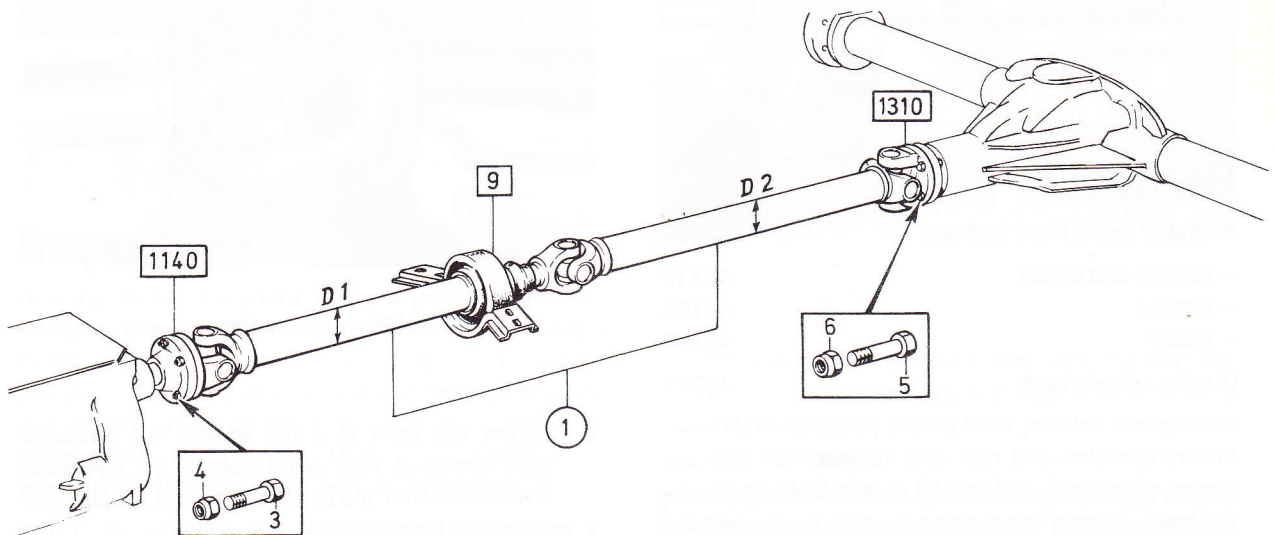
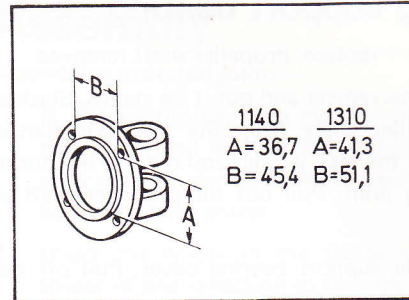
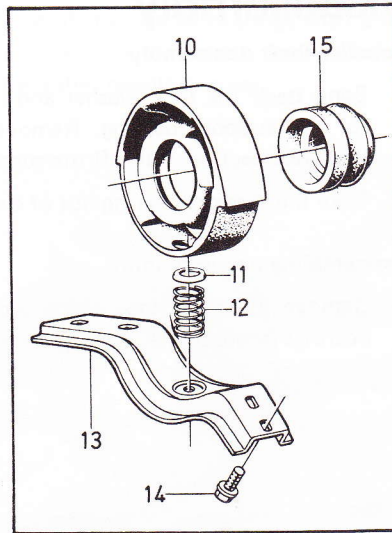


VOLVO PARTS
1040 12741

Illustrations from Spare Parts Catalogue

Complete Propeller Shafts and parts pertaining to these should be ordered in accordance with type of transmission, size of flange with the measurements in the illustration and (to a certain extent) to the

diameter of the tubular shaft. The support bearing is depending on sizes 1140 and 1310. In this case 1140 agrees with tube diameter 44.5 mm = 1.752" (242, 244) and 1310 with tube diameter 50.8 = 2" (245).



VOLVO PARTS
1 040 12740

Replacing support bearing

Op. No. 45371 = replace, propeller shaft removed

1. Jack up the vehicle and put it on stands. Slacken the propeller shaft from the rear axle flange. Bend back the lock washer and remove the nut at the sliding joint. Pull out the propeller shaft to the rear.
2. Loosen the support bearing cover. Pull off the complete support bearing.
3. Press the old bearing out of the rubber housing. Install the new bearing.
4. Install support bearing and other parts in reverse order to removal. If the splined joint appears dry, lubricate it with grease mixed with molybdenum disulphide (Molykote).
Make sure that the arrows point towards each other on propeller shafts paired and balanced together.

Removal

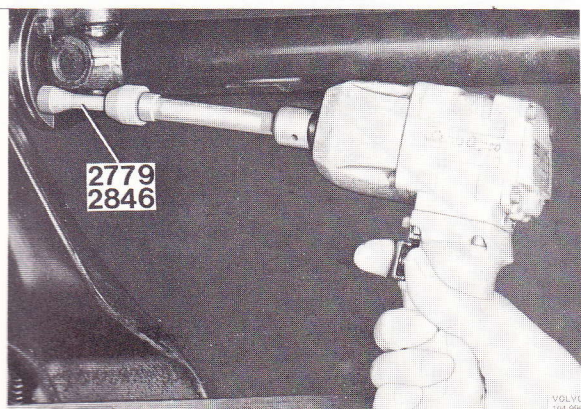
Propeller shaft, front and rear

— remove and install	Op. No. 45112
— remove	45188
— install	45190

U-joint, rebuild each 45271

Jack up the vehicle. Slacken the propeller shaft from the transmission and rear axle flanges. For 245 use impact air wrench and special socket 2846 to loosen the bolts. Loosen the support bearing cover and take down the complete propeller shaft.

For 242 and 244 use tool 2779 for the front flange bolts and tool 2846 for the rear flange bolts, see Fig. below:



Removing bolts

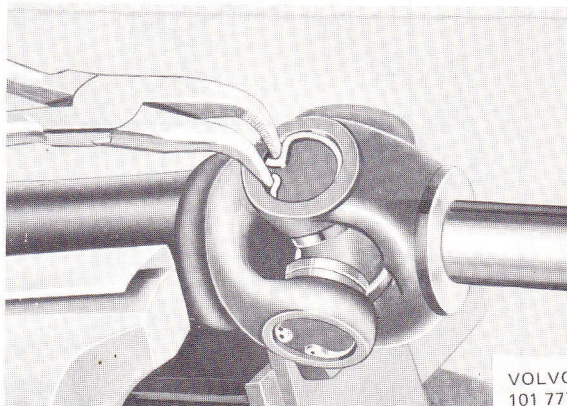
Disassembly

Propeller shaft disassembly

1. Bend back the lock washer and remove the nut for the support bearing. Remove the propeller shaft rear section. Pull off the support bearing.
2. Take the support bearing out of the housing.

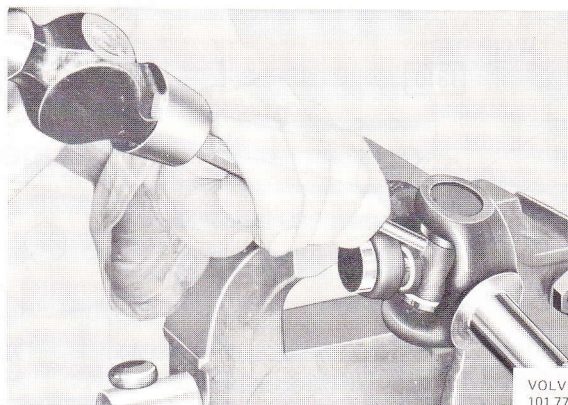
Disassembling universal joints

1. Remove the snap rings which secure the needle bearings in the yokes, see Fig. below:



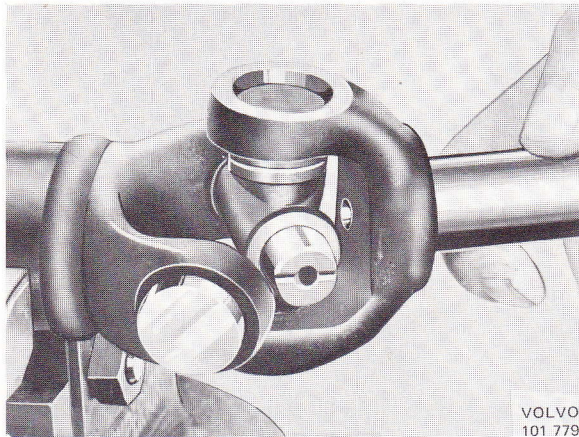
Removing snap ring

2. Secure the shaft in a vise so that the universal joint comes as near as possible to the vise jaws. Remember that the propeller shaft is tubular and can easily be deformed.
3. Use a hammer and metal punch to drive the spider as far as it will go in one direction. The needle bearing will then come about half way out.
4. Then drive the spider as far as it will go in the opposite direction, see Fig. below:



Removing spider, first step

5. Drive out one of the needle bearings with a thin metal punch. Remove the spider, see Fig. below. Drive out the other needle bearing.



VOLVO
101 779

Inspection

It is extremely important that the propeller shaft is straight. The inspection must be careful since even minor damage on the propeller shaft can cause vibration. The shaft should be set up between centers and checked along its entire length with an indicator gauge while it is rotating. If it is out-of-true more than 0.010" (0.25 mm) the shaft must be replaced.

NOTE: No attempt should be made to straighten a damaged propeller shaft; replace it.

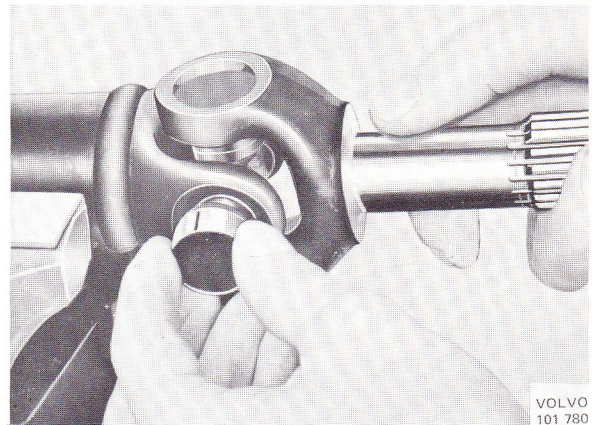
Examine the support bearing. Press the bearing races against each other by hand and turn them in opposite directions. The bearing should run easily without binding at any point. If it binds, scrap the bearing and replace it.

Check needle bearings and spiders, worn or damaged parts should be replaced.

Assembly

Assembling universal joints

1. If old needle bearings are installed, check that they are filled with grease and that the rubber seals are not damaged. New bearings should be half-filled with grease.
2. Insert the spider in the flange yoke. Push the spider in one direction so that the needle bearing can be installed in the trunnion, see Fig. below:



VOLVO
101 780

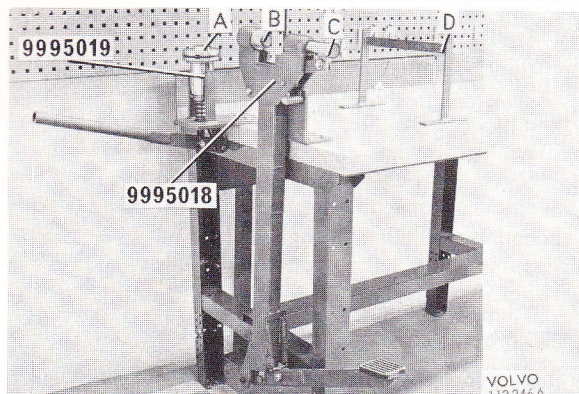
Then press in the needle bearing so far that the snap ring can be installed. Use a drift with a diameter slightly less than that of the needle bearing sleeve.

3. Install the other needle bearing and snap ring in the same way. Install the spider in the other yoke in the same way as now described.

Installation

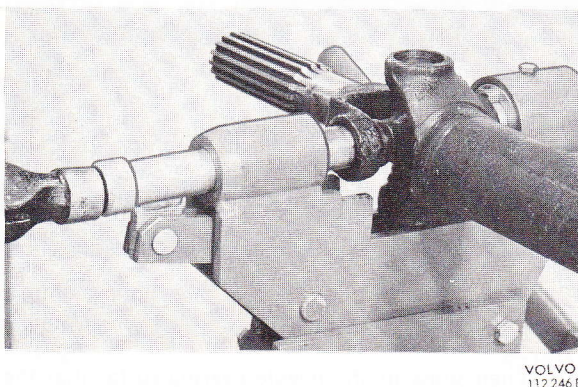
Installation is in reverse order to removal.

Re-building U-joints



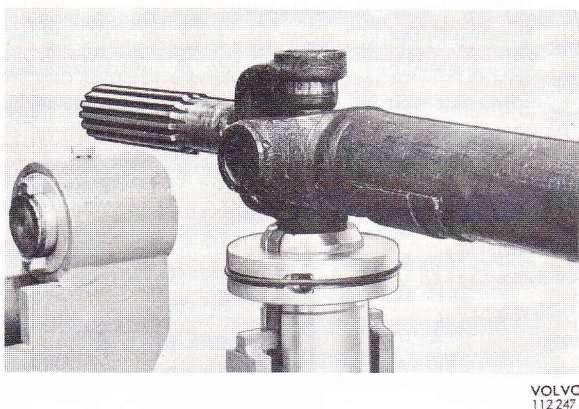
Instructions for press tool 999 5018 and puller 999 5019

- A. Jaws
- B. Arbor
- C. Rod
- D. Support. Part of 999 5018

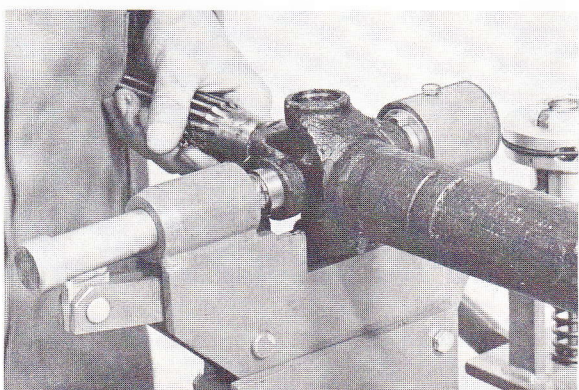


Disassembling universal joint

Remove the lock rings and position the U-joint in the press tool. Use the pedal to move the spider. If the power is not sufficient, use a hammer on the rod.



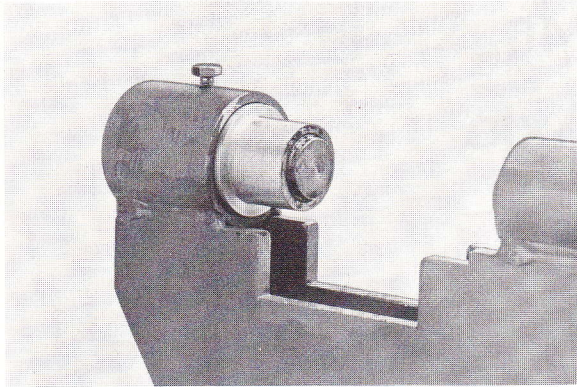
Move the U-joint to the puller. Align the needle bearing between the jaws. Press down the handle which will remove the needle bearing.



Assembling universal joint

Locate the spider with seals in one of the coupling flanges. Locate one needle bearing. Position the U-joint in the press tool and press in the needle bearing until the lock ring can be installed. Turn the U-joint over and press in the other needle bearing. Install spider and needle bearings in the same way in the other coupling flange.

Install the lock rings.

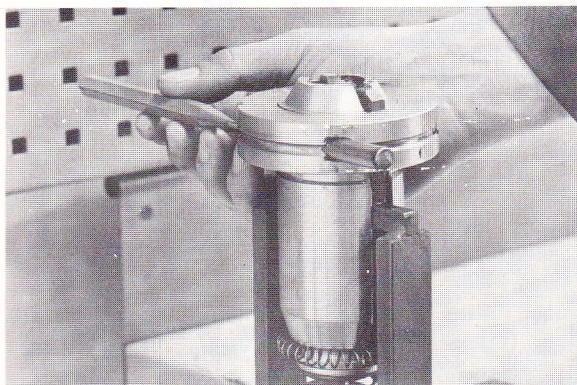


VOLVO
112 248 A

Replacing press tool arbor

Loosen the screw and remove the arbor. Position the other arbor and tighten the screw.

NOTE: The large arbor has two recesses to be positioned vertically. For this reason it is provided with a hole corresponding with the screw.



VOLVO
112 248 B

Replacing puller jaws

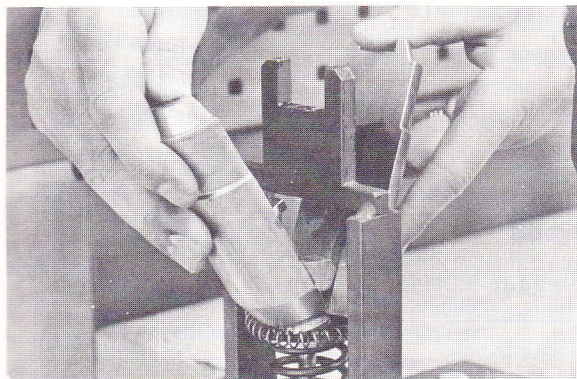
Remove the O-ring and use a punch to press out the pins.

Jaws for small U-joints

9999 026

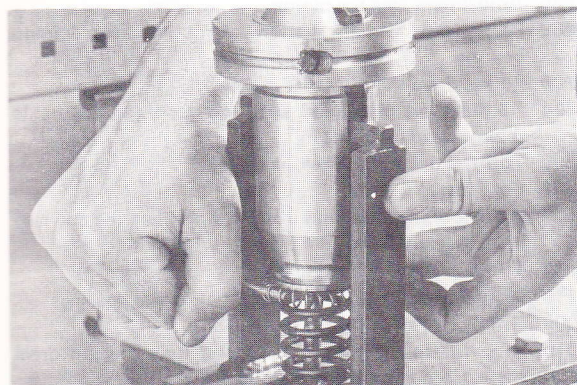
Jaws for large U-joints

9999 027



VOLVO
117 249 B

Lift the ring and bend the jaws aside.



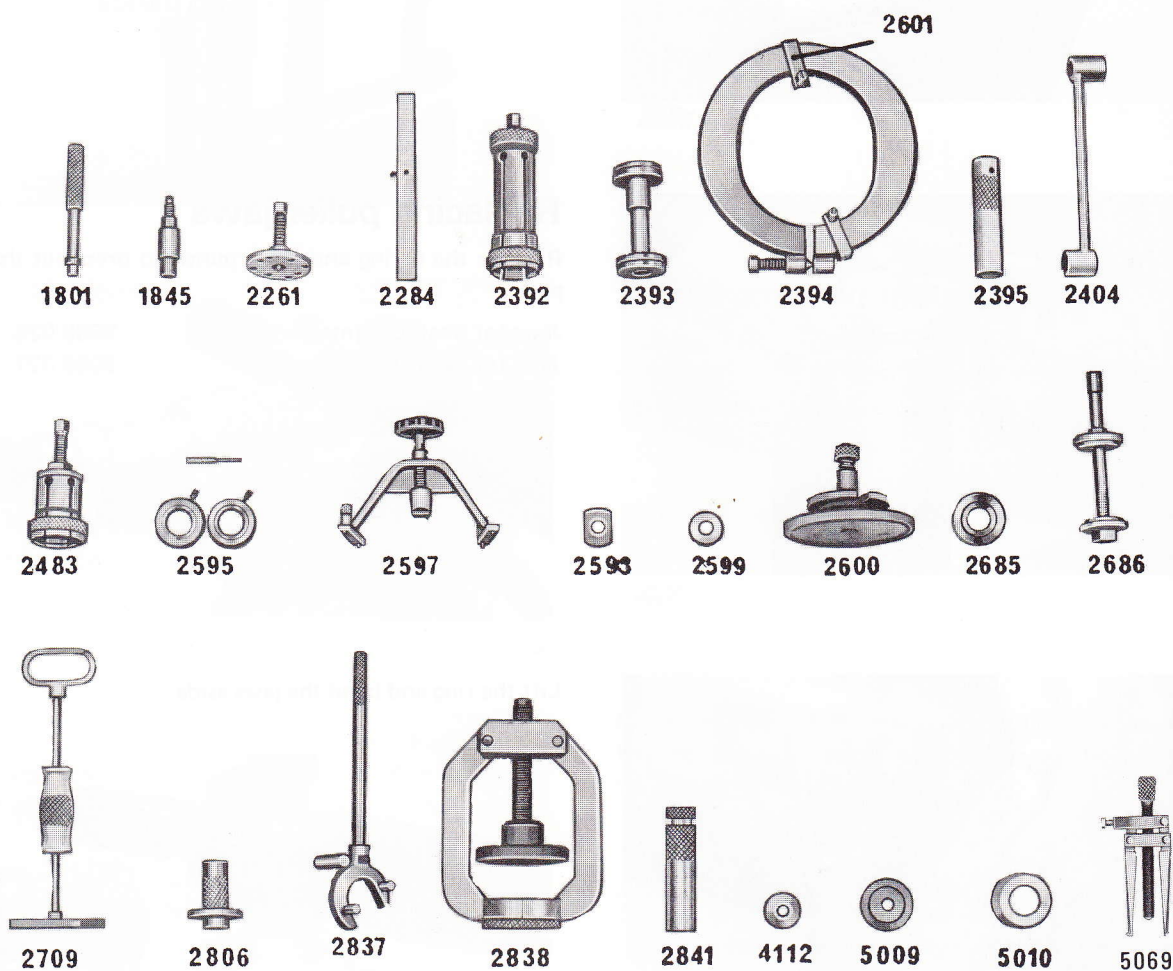
VOLVO
112 249 A

Hold the lever in the upper position and press the jaws into position. Position the ring with the side marked "upp" upwards. Install the pins. Bend the spring, which retains the lower ends of the jaws, into position. Install the O-ring.

Group 46

Rear Axle

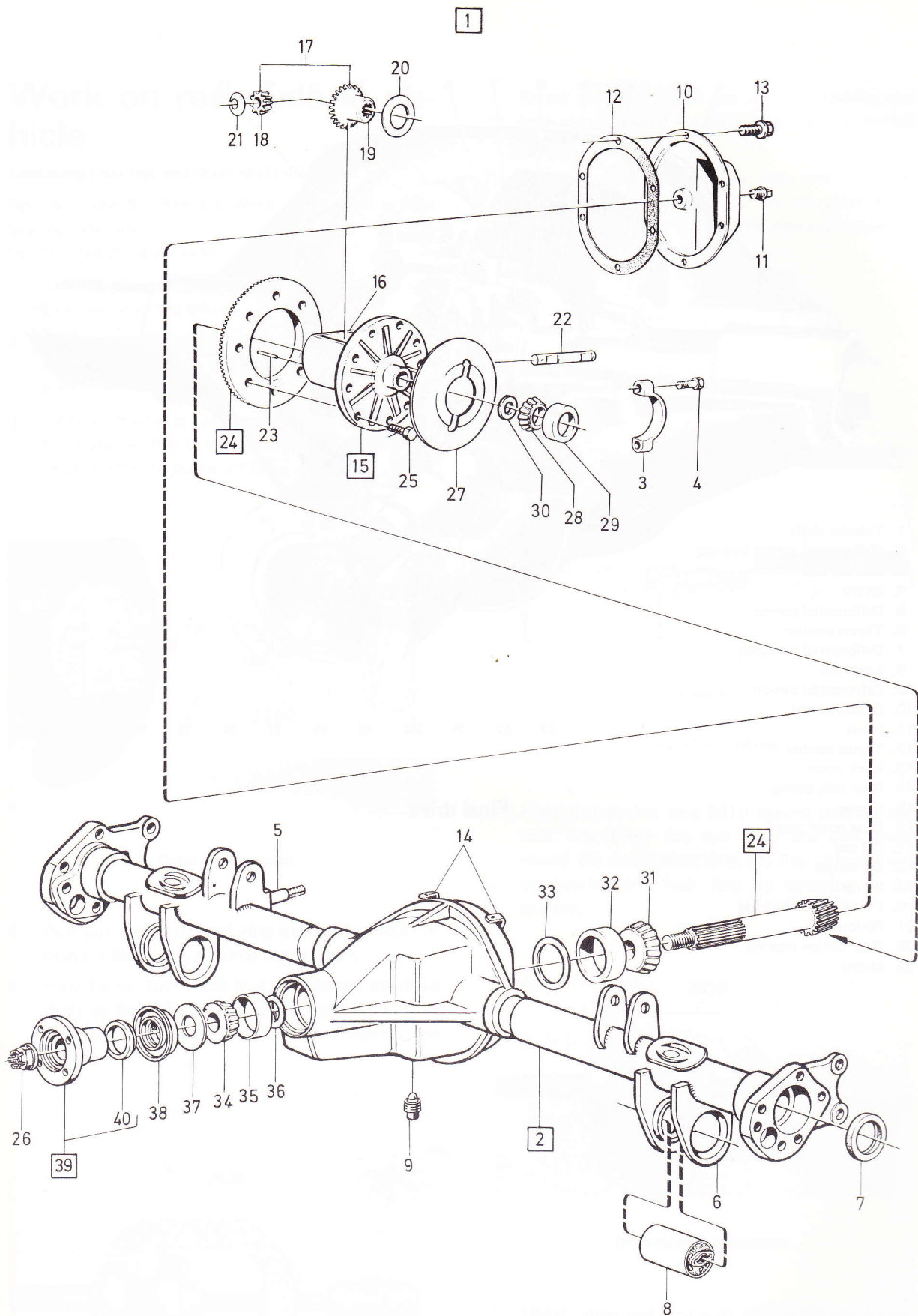
Tools



999
(SVO)

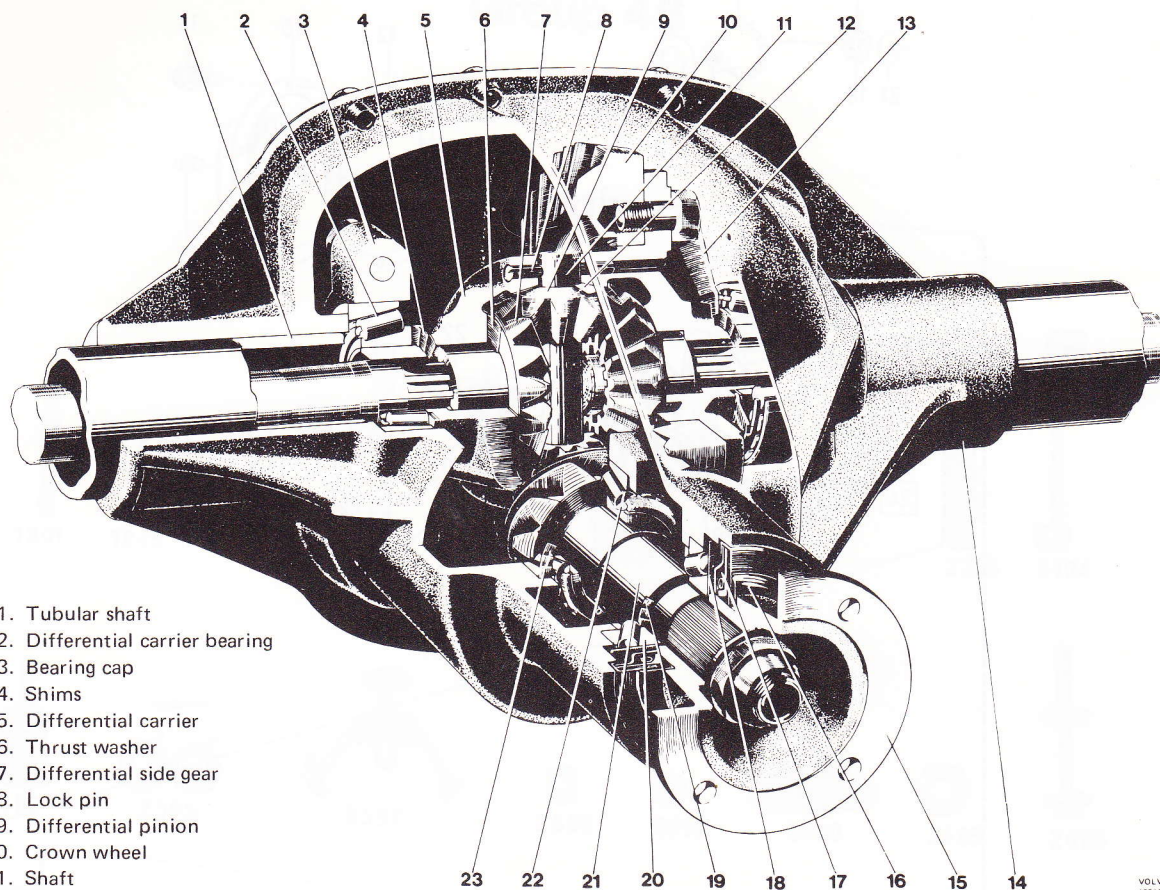
Special tools for rear axle

- | | |
|---|--|
| 1801 Standard handle 18x200 mm | 2601 Holder for expander tool 2394 (installed on tool) |
| 1845 Press tool for flange installation | 2685 Adjustment ring for pinion |
| 2261 Flange puller | 2686 Press tool for installation of outer races, pinion bearing |
| 2284 Indicator retainer, final drive adjustment | 2709 Puller, drive shaft |
| 2392 Rear pinion bearing puller | 2714 Fixture for rear axle, used on jack for rear axle removal and installation |
| 2393 Measuring tool, pinion adjustment | 2806 Tool, installation oil seal in flange |
| 2394 Expander tool, differential removal and installation | 2837 For flange |
| 2395 Sleeve, rear pinion bearing inner ring installation | 2838 Press tool, removal and installation of bearing and ring on drive shaft lock |
| 2404 Tool, front pinion bearing installation | 2841 Tool for adjustment ring 2685 |
| 2483 Puller, differential carrier bearings | 4112 Drift for installation of differential carrier bearings |
| 2520 Stand | 5009 Drift, drive shaft bearing seal |
| 2522 Fixture for rear axle (used with stand 2520 for work on the final drive) | 5010 Ring for installation bearing and lock ring on drive shaft. Used together with 2838 |
| 2595 Adjusting rings, differential | 5069 Puller, oil seal in flange |
| 2597 Brake for ring gear, used when checking tooth contact | |
| 2598 Drift for removing outer ring, rear pinion bearing | |
| 2599 Drift for removing outer ring, front pinion bearing | |
| 2600 Measuring fixture for adjusting rings | |



VOLVO PARTS
1 040 12883

Illustration from Spare Parts Catalogue



1. Tubular shaft
2. Differential carrier bearing
3. Bearing cap
4. Shims
5. Differential carrier
6. Thrust washer
7. Differential side gear
8. Lock pin
9. Differential pinion
10. Crown wheel
11. Shaft
12. Thrust washer
13. Lock cover
14. Rear axle casing
15. Flange
16. Dust cover plate
17. Oil seal
18. Oil slinger
19. Shims
20. Front pinion bearing
21. Pinion
22. Rear pinion bearing
23. Shims

Final drive

VOLVO
108168

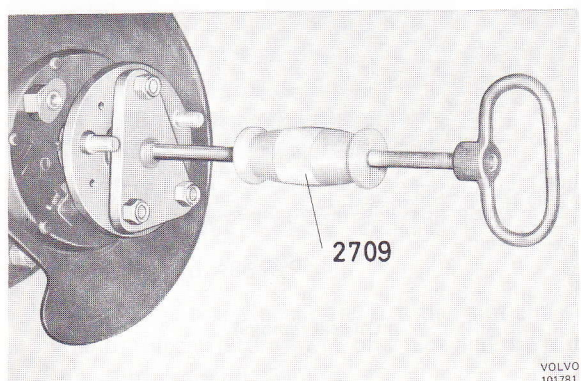
Work on rear axle in vehicle

Replacing bearings and drive shaft oil seals

Op. No. 46606: Replace drive shaft seals and/or bearing, one side

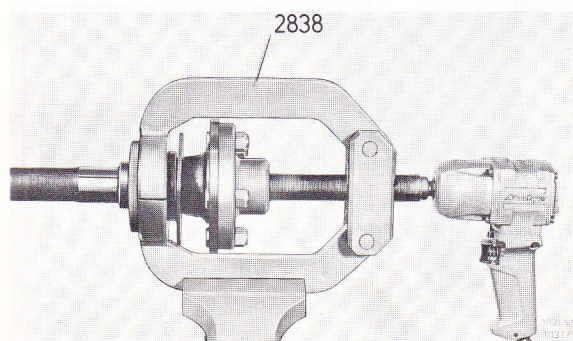
Op. No. 46620: Both sides

1. Jack up the vehicle and put stands under the rear axle. Remove the wheels.
2. Disconnect brake line from brake caliper. Remove the bolts for the brake disc. Remove the disc.
3. Remove the bolts for the thrust washer, through the holes in the drive shaft flange. Pull out the drive shaft with puller 2709:



Drive shaft removal

4. Pull out the inner seal ring with puller 4030 or brake it out, using a sturdy screwdriver.
5. Install press tool 2838 in a vise. Secure the drive shaft to the spindle plate. Screw in the spindle so that the tool arms can be placed against the bearing:

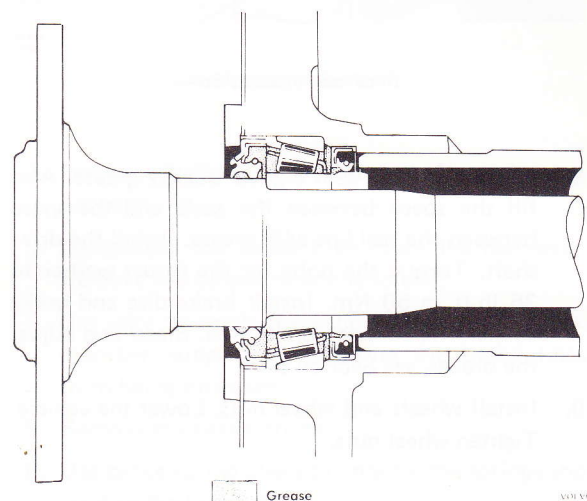


Drive shaft bearing removal

Screw out the spindle and press off bearing and lock ring. Discard the lock ring. Remove the oil seal.

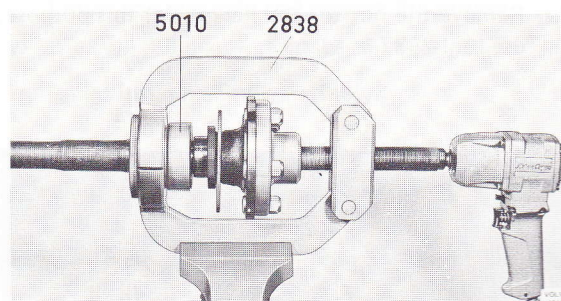
6. Fill the space between the new seal lips with grease. Then install the seal on the drive shaft, install lock ring. Position the bearing correctly, see Fig. below.

NOTE: Always use a new lock ring.



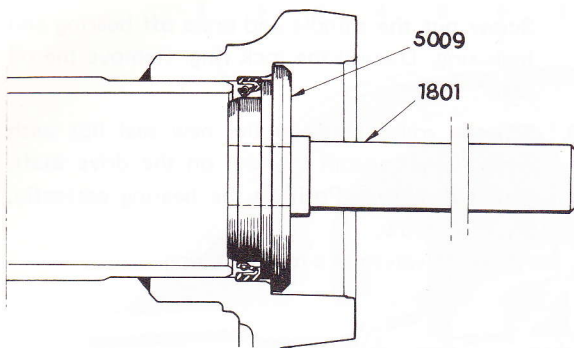
Drive shaft journaling

Place installation ring 5010 against bearing and lock ring. Close the tool arms and lock them round the installation ring, see Fig. below. Press on bearing and lock ring by screwing in the spindle.



Drive bearing installation

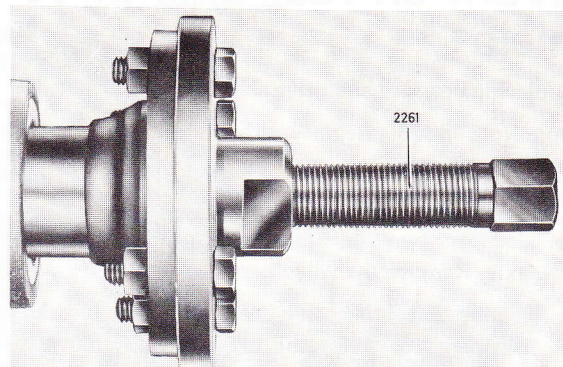
7. Install inner seal ring with drift 5009 and handle 1801. The drift will automatically accomplish correct seal installation, see Fig. next page:



Inner seal installation

VOLVO
108 161

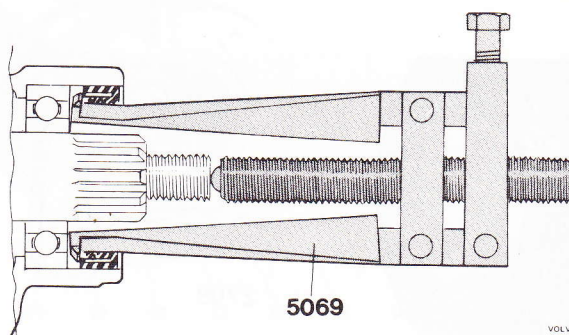
Pull off the flange with puller 2261:



Flange removal

8. Fill the bearing with a good quality grease. Also fill the space between the seals and the space between the seal lips with grease. Install the drive shaft. Torque the bolts for the thrust washer to 36 lb.ft. = 50 Nm. Install brake disc and brake caliper. Re-connect brake line. Bleed and adjust the brakes, see Section 5.
9. Install wheels and wheel nuts. Lower the vehicle. Tighten wheel nuts.

Pull out the old seal with puller 5069:



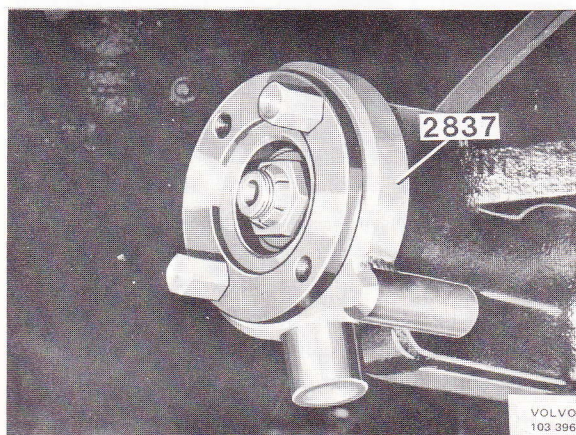
Oil seal removal

VOLVO
108 245

Pinion oil seal replacement

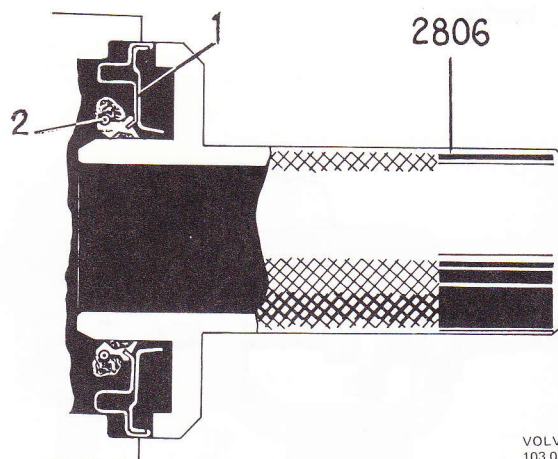
Op. No. 46514

1. Disconnect the rear section of the propeller shaft from the flange on the pinion. Check for looseness of the pinion in its bearing. If loose, remedy before a new oil seal is installed. See instructions under the "Assembly".
2. Remove the nut for the flange. For this purpose, use tool 2837 as adaptor:



Adaptor for flange

VOLVO
103 396

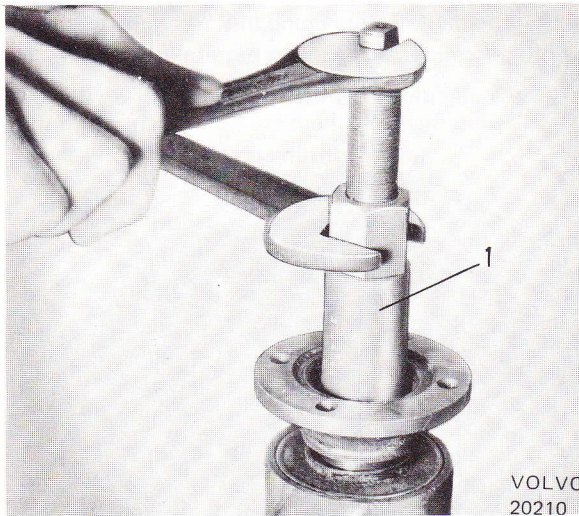


Oil seal installation

1. Pinion oil seal
2. Spring coil with grease

VOLVO
103 031

4. Press on the flange with press tool 1845, see Fig. below. Install washer and nut. Torque to 200–220 lb.ft. = 280–300 Nm.



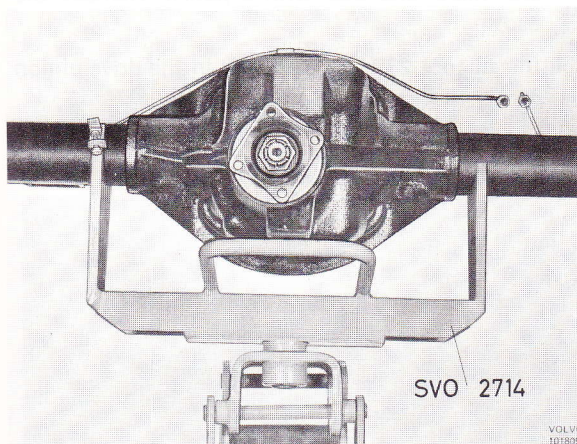
Flange installation

1. Press tool 1845

Removing rear axle

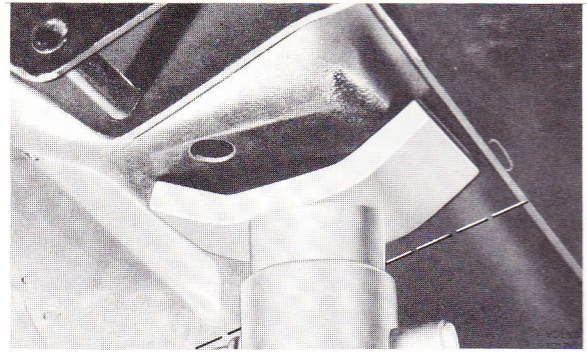
Replace = Op. No. 46016

1. Loosen the rear wheel nuts. Put the front end on stands. Place fixture 2714 on a jack and use it to hoist the rear end. See Fig.



Rear axle fixture

Put stands in front of the rear jack supports, see Fig. below and lower the jack slightly. Note that the stands may not be positioned further front than shown by the dotted line. Remove the rear wheels.



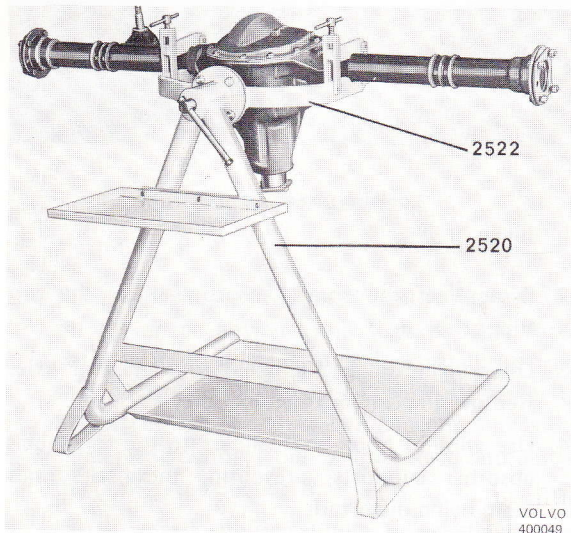
Locating rear axle stand

2. Disconnect the shock absorbers from the top supports.
3. Disconnect the brake lines from the rear axle. Remove the caliper retaining screws.
4. Use wire to hook the calipers to the top shock absorber supports, preventing the brake lines from being distorted.
5. Remove the brake drums.
6. Use brake spring pliers to unhook the springs and remove the brake shoes.
7. Press out the pin securing the brake cables to the levers.
8. Remove the screws. Pull out cable and plastic hoses with rubber seals. Remove the springs retaining the cables to the rear axle.
9. Disconnect the propeller shaft at the flange.
10. Disconnect the track rod (Panhard rod) from the body bracket.
11. Disconnect the springs from the trailing arms. Lower the rear axle and remove the springs.
12. Remove the screws retaining the rear axle.
13. Pull out the rear axle assembly.

Rear Axle disassembly

Op. No. 46502 comprises Re-build rear axle, including removal and installation.

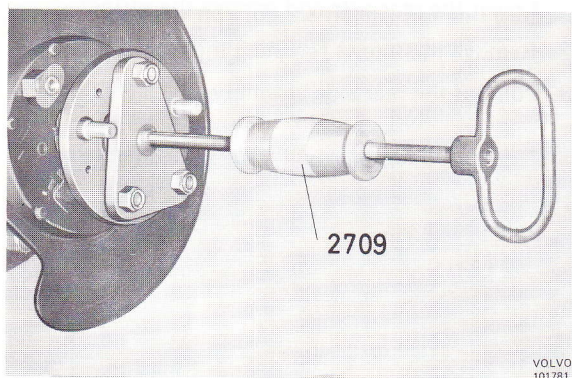
1. Place the rear axle in fixture 2522.



Stand and fixture for rear axle

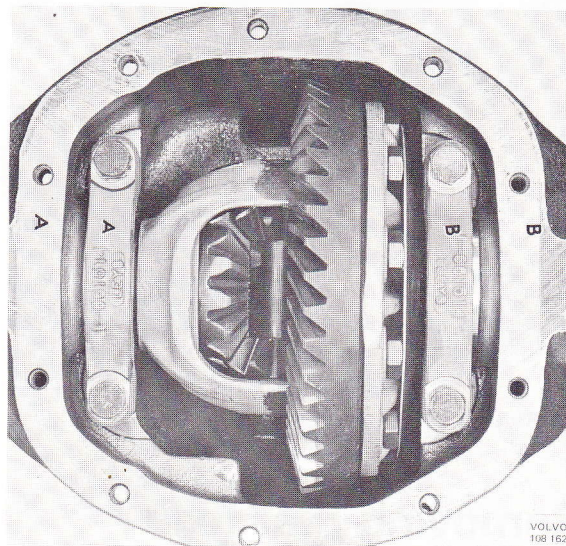
Place the rear axle with the underside facing inwards to the fixture support, when the pinion is pointing downwards. Remove the brake lines.

2. Loosen the bolts for the brake backing plates and brake shoe retainer. They are loosened through the holes in the drive shaft flanges. Pull out the drive shafts with puller 2709:



Drive shaft removal

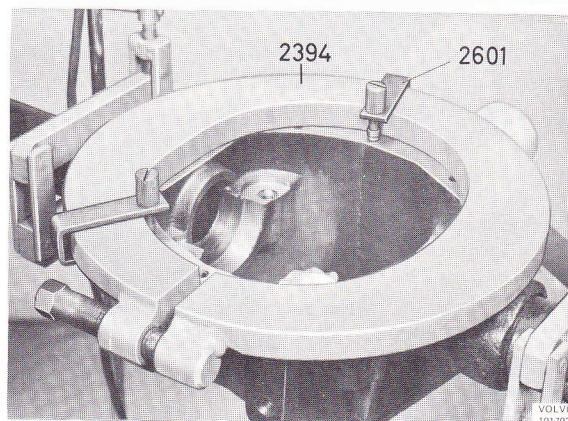
3. Remove the inspection cover.
4. If the final drive is being reconditioned because of noise, the contact pattern should be checked before disassembly, as this might assist in locating the fault. Before doing this, clean the teeth so that no misleading contact pattern is obtained.
5. Check alignment marks on cap and carrier:



Alignment marking on cap and carrier

If there are no marks or if they are difficult to see, mark one side with a punch. Remove the cap.

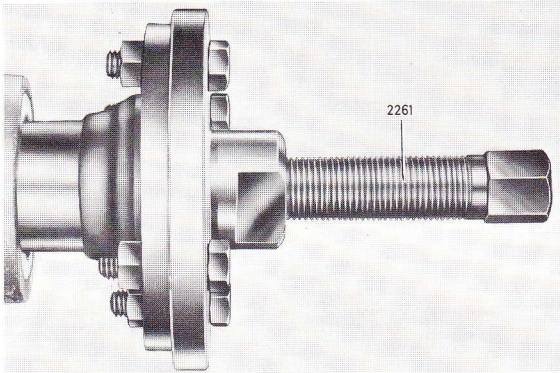
6. Install tool 2394 in the holes in the drive pinion carrier as shown:



Expanding drive pinion carrier

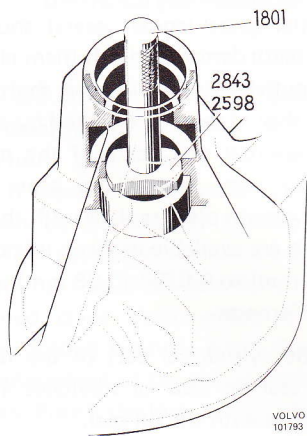
Install the tool with retainers 2601. Tension the tool until it fits exactly in the holes in the carrier. Then tension the bolt a further 3–3 1/2 turns. Lift out differential carrier with ring gear. Tool 2337 can be used for this purpose.

7. Turn the rear axle and drain the oil. Remove the nut for the flange. Use tool 2837 resp. 2854 for this purpose. Pull off the flange with puller 2261, see Fig. below. Press out the pinion.



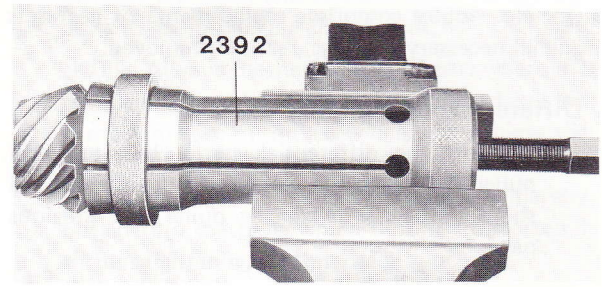
Flange removal

8. Drive out the front pinion bearing, the washer and the oil seal with standard handle 1801 and drift 2599.
9. If necessary, drive the rear bearing out of position, see Fig. below. Use standard handle 1801 and drift 2598.



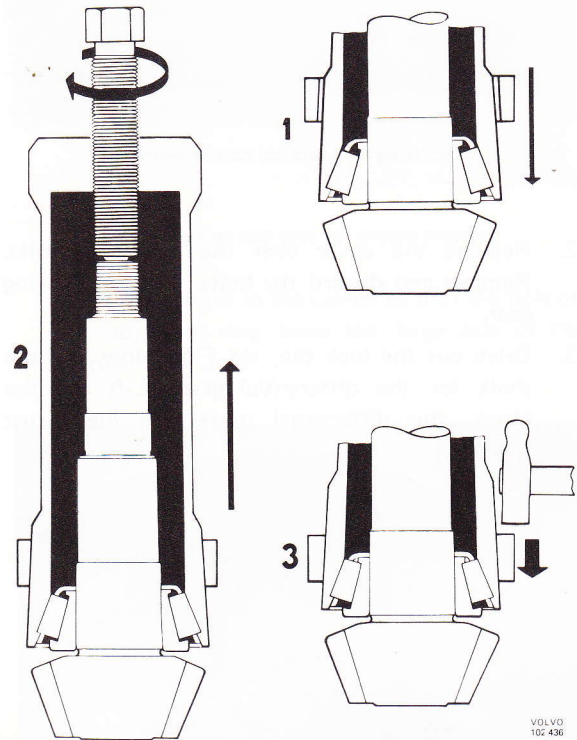
Rear pinion bearing race removal

10. Clean the gasket surface. File off all burr on the surface on which the indicator retainer 2284 will slide.
11. If necessary, pull off the rear bearing from the pinion with puller 2392:



Rear pinion bearing removal

The puller is fitted in the following way: Move the puller down over the rollers and press down the lock ring. Then pull up the puller with the bolt until the rollers lie flush with the edge of the inner race and the edge on the puller. Knock out the lock ring with a hammer.



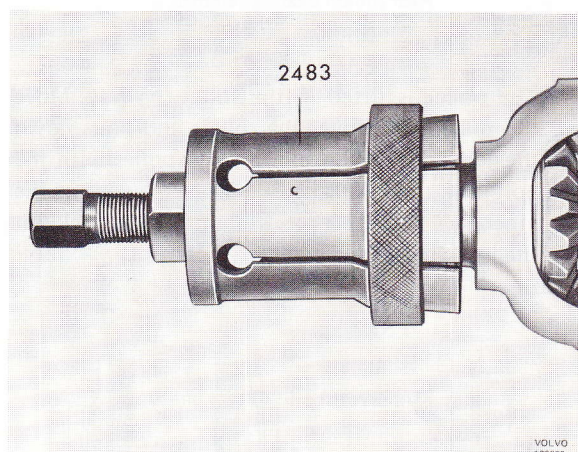
Puller installation

Differential disassembly

Op. No. 46599 comprises replacements of gear sets and all necessary bearings, rear axle removed.

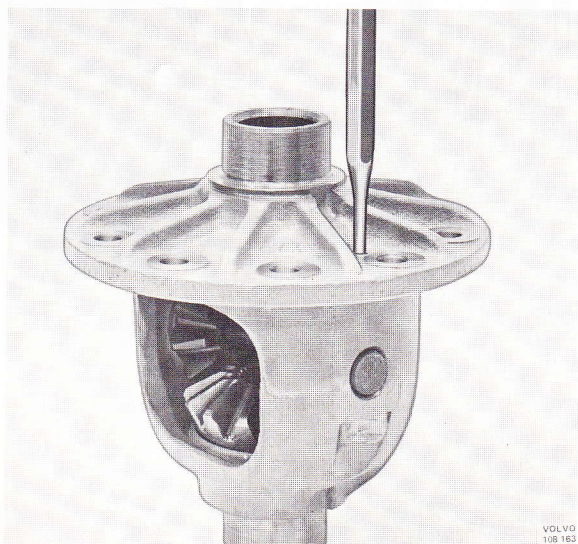
Differential disassembly

1. Pull off the differential carrier bearings with puller 2483, see Fig. below. Do not remove the shims. How to install the puller, see previous page.



Removing differential carrier bearings

2. Remove the cover over the ring gear bolts. Remove and discard the bolts. Remove the ring gear.
3. Drive out the lock pin, see Fig. below, and the shaft for the differential gears. Lift out the block, the differential gears and the thrust washers.

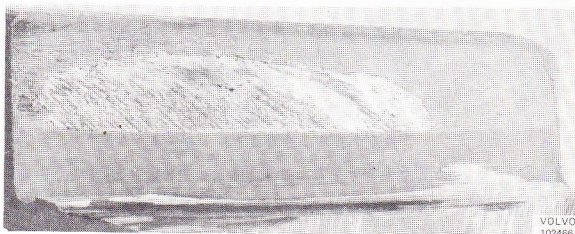


Removing lock pin

Inspection

First clean all the parts thoroughly. Check all bearing races and bearings. Races, rollers or roller retainers must not be scratched or damaged. All damaged bearings and bearing races must be replaced.

Check pinion and ring gear carefully for teeth damage. The most common damage is from seizing gear teeth, see Figs. below:



Gear seizure

This is caused by incorrect running-in, wrong oil, insufficient tooth flank clearance or faulty tooth contact. If the cause of the seizing is not remedied at an early stage, the whole gear can be damaged.

The differential gears (spider gears) should also be examined for teeth damage. Install them clean and dry in the differential carrier with the shaft and thrust washers. Play should then be checked by steel blue on both the differential side gears. If the play exceeds 0.0024" (0.06 mm) where the gears have been rotated to maximum play, replace with thicker spacer washers. These are available in seven thicknesses from 0.024" (0.74 mm) to 0.039" (0.98 mm) with 0.016" (0.04 mm) difference.

Also check the cylindrical part of the flange which goes into the seal for wear or scratches. If necessary, replace the flange with the oil seal.

The pinion nut is provided with a slot for locking. In time, this slot loses its locking effectiveness. For this reason, the nut should be replaced if it has been removed a couple of times. The washer under the nut should also be replaced if deformed.

Check the oil seals and replace them if they are damaged or worn.

Make sure that there are no cracks in the rear axle housing. Check that brackets for trailing arms and Panhard rod are intact.

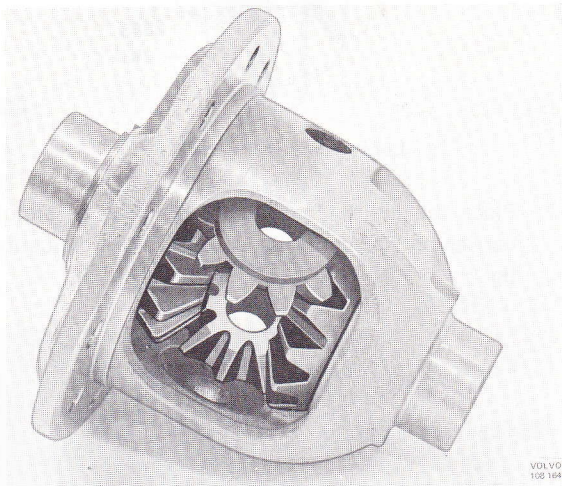
Assembly

Observe greatest cleanliness when assembling and adjusting final drives. Dirt in a taper roller bearing can result in completely inaccurate measurements.

If a bearing is measured for clearance or pre-load, it should be oiled and rotated several turns under load.

Differential assembly

1. Place the differential side gears and the thrust washers in the differential carrier. Then "roll" in the differential pinions both simultaneously with the dished thrust washers, see Fig. below. Drive in the shaft.



Differential gear installation

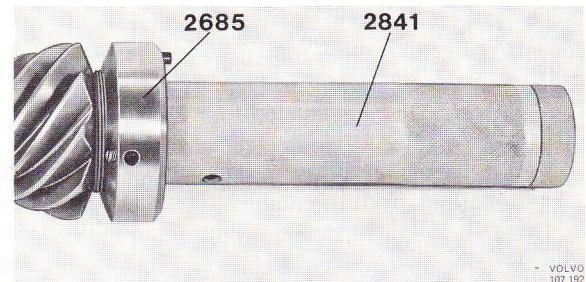
2. Check the differential. If the gear play has not been determined, check it according to the instructions given under the heading "Inspection". If oversize spacer washers are installed, the play can be checked by turning the gears one turn. The necessary torque should not exceed. The tool for this check can easily be made from a shortened drive shaft which is adapted to a suitable torque wrench. After the checking and any replacement of the thrust washers, install the lock pin. Punch the lock pin in place.

3. Install the ring gear. Make sure that the contact surfaces are clean and without burr. Torque the bolts to 45–60 lb.ft. = 65–90 Nm.

NOTE: Always use new bolts for gears where the bolts are locked by friction in the thread and the contact surface of the screw head. To achieve the effect intended, the bolts are tightened to their limit. A certain permanent elasticity is thereby obtained in the bolt, which becomes distorted if further tightening is attempted.

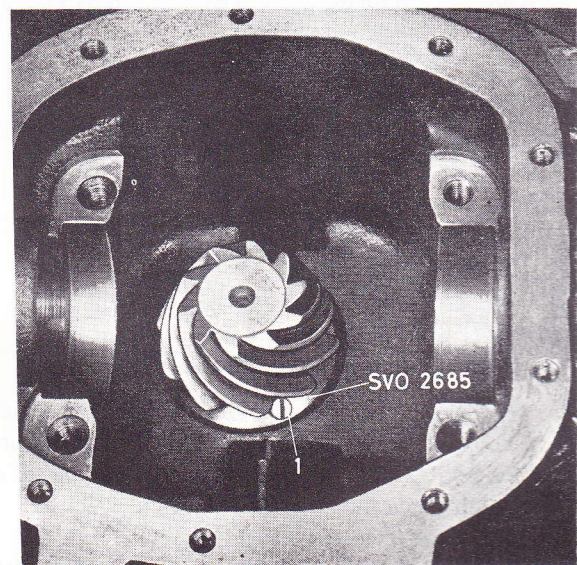
Pinion installation

1. Clean the marking surface on the pinion with extremely fine emery cloth. Install the adjusting ring 2685 and tool 2841 (or 2684) on the pinion:



Adjusting ring and tool for pinion location

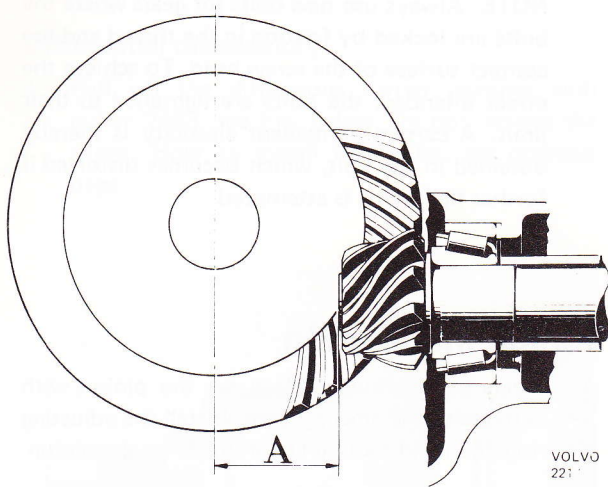
Place the pinion in the carrier so that the bolt on the adjusting ring faces the large side of the carrier.



Locating pinion with adjusting tool

1. Lock screw

- The pinion should have a certain nominal measurement (A, Fig. below) to the center line of the ring gear.



Pinion location

A. Nominal measurement = 2.55"

Due to tolerances in the manufacturing, there are deviations from the nominal measurements. This is indicated with a figure on the ground surfaces on the pinion. The surface is generally ground 0.012" (0.30 mm) so that the deviation is always indicated by plus tolerance and in hundredths of a millimeter. The plus sign is excluded.

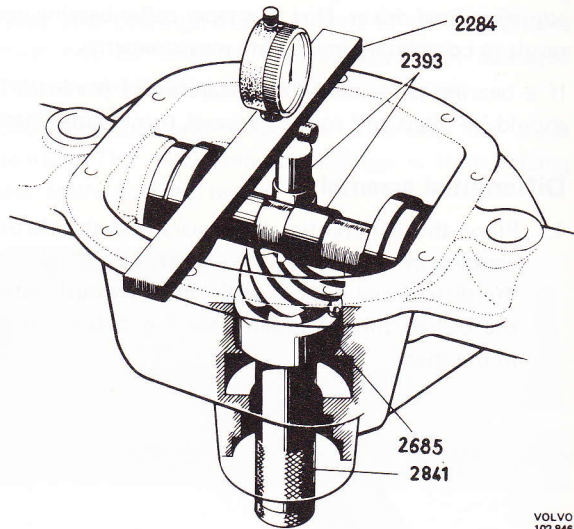
Conversion table, millimeters to inches			
mm	inches	mm	inches
0.20	0.0079	0.31	0.0122
0.21	0.0083	0.32	0.0126
0.22	0.0087	0.33	0.0130
0.23	0.0091	0.34	0.0134
0.24	0.0094	0.35	0.0138
0.25	0.0098	0.36	0.0142
0.26	0.0102	0.37	0.0146
0.27	0.0106	0.38	0.0150
0.28	0.0110	0.39	0.0154
0.29	0.0114	0.40	0.0157
0.30	0.0118		

To check the location of the pinion, use a dial indicator, indicator retainer 2284 and a measuring tool 2393, which consists of two parts: a pinion gauge and an adjuster fixture.

Check the following way:

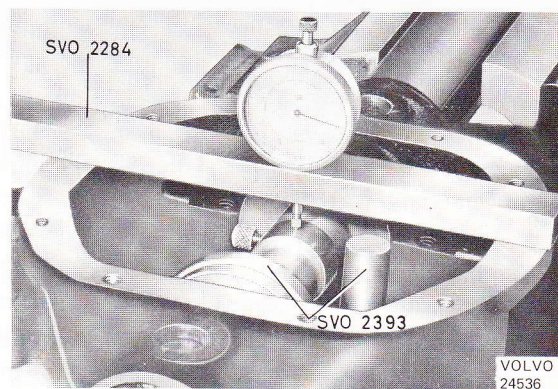
Place the pinion on the ground surface of the

pinion and the adjustment jig in the differential bearing position as shown:



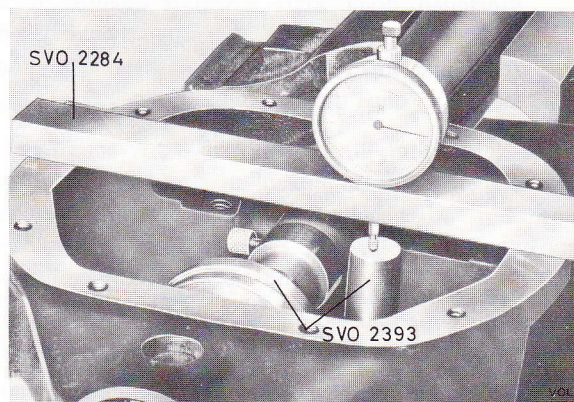
Locating measuring tools

Place the indicator retainer on the drive pinion carrier and zero the gauge against the adjusting jig:



Zeroing indicator

Then move the indicator retainer so that the indicator comes against the pinion gauge:

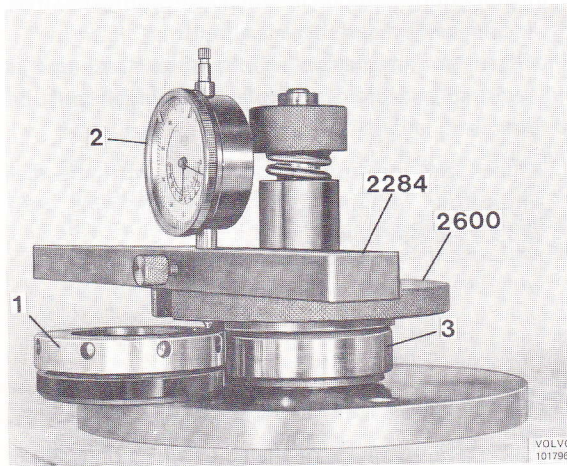


Measuring pinion location

If the pinion is for example, marked 33, the pinion gauge should lie 0.013" (0.33 mm) under the adjuster fixture.

The setting is adjusted by turning the cam on the pinion until the gauge dial shows the correct value. Then lock the adjusting ring with the lock screw. Remove the measuring tool and pinion.

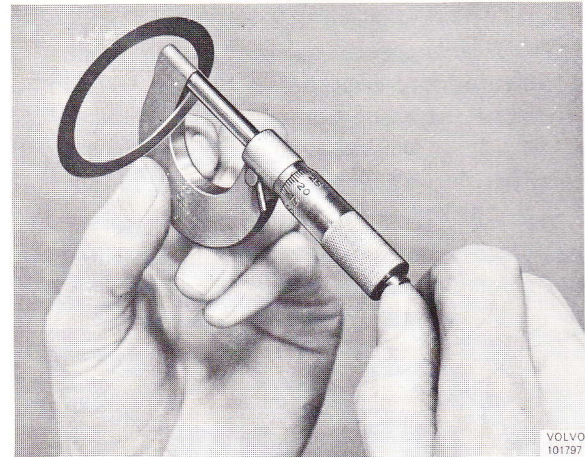
3. Place the complete rear pinion bearing with the outer ring in fixture 2600. Install plate, spring and nut. Turn the nut with the flat side upwards. The plate, and thereby the bearing, is turned forwards and backwards several times in order to achieve correct positions for the bearing rollers. Place the adjustment ring in the fixture as shown.



Determining shim thickness

1. Adjustment ring
2. Dial indicator
3. Bearing assembly

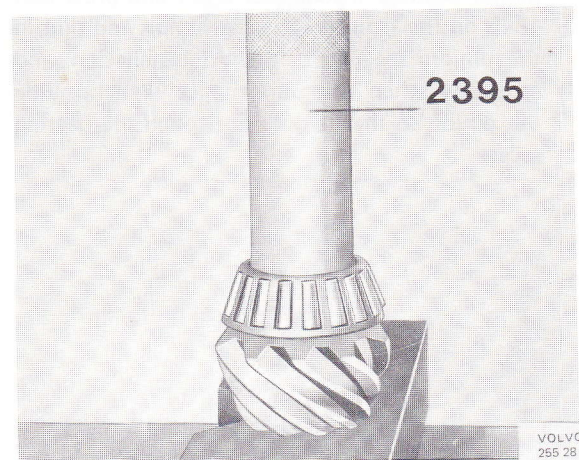
Use retainer 2284 and dial indicator and place the measuring point of the indicator opposite the adjustment ring and zero the indicator. Then set the indicator pointer to the outer ring of the bearing. The dial indicator now shows at once the thickness the shims should have. Measure shims for the correct thickness with a micrometer, see Fig.



Measuring shims

NOTE: It is almost impossible to obtain a shim with exactly the correct thickness. However, they must not be 0.0012" (0.03 mm) thicker than the measured value, but up to 0.002" (0.05 mm) thinner.

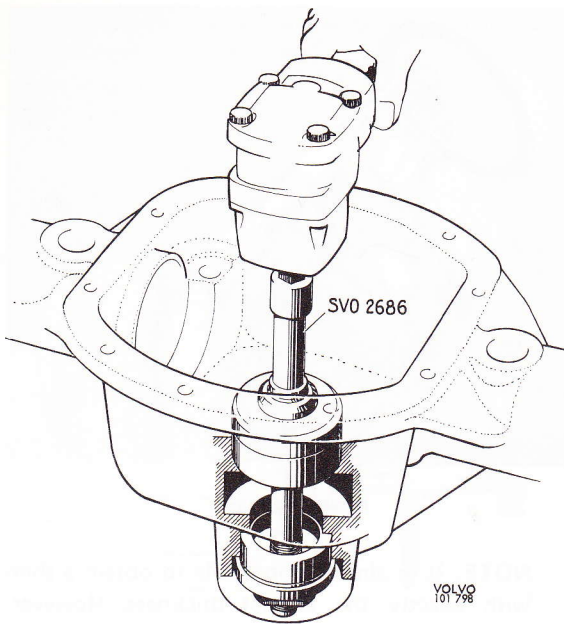
4. Press the rear bearing on the pinion with sleeve 2395:



Rear pinion bearing installation

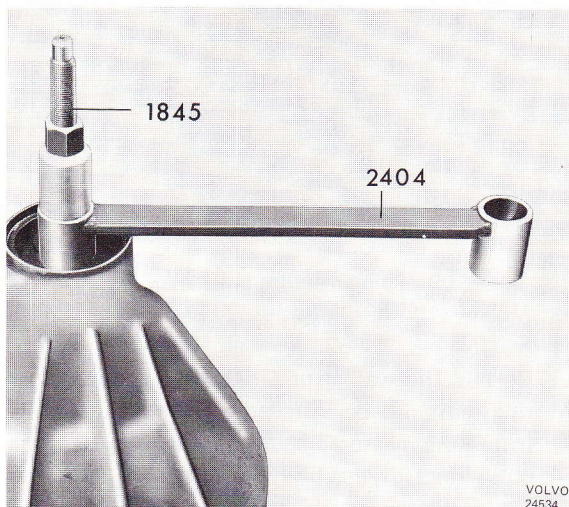
1. Sleeve 2395

NOTE: The washer under the rear bearing inner ring must not be installed when reconditioning. Install the measured shims and press in both the outer rings of the bearings with tool 2686, see Fig. next page:



Installing bearing races

5. Insert the pinion in the housing and install three 0.03" (0.75 mm) thick shims and the front pinion bearing. Install tool 2404 and press tool 1845 on the front end of the pinion and pull in the pinion, see Fig. below. At installation, and especially when using an impact wrench, guide the pinion so that it does not touch the bearing races.

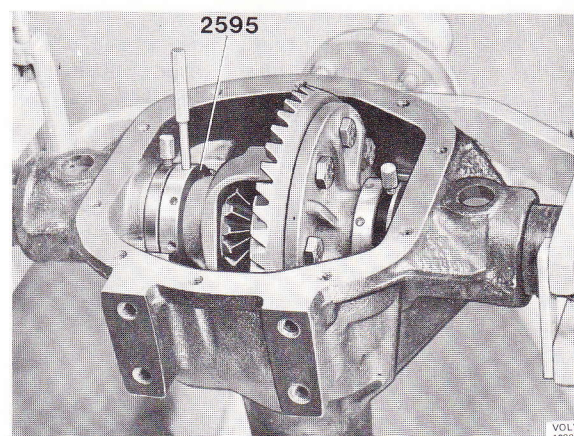


Installing pinion

6. Replace press tool 1845 with washer and nut. Torque the nut to 200–220 lb.ft. (280–300 Nm). Install the pinion gauge and the dial indicator retainer. Pull down the pinion while turning it forwards and backwards at the same time. Zero the indicator. Then press the pinion upwards, turning it at the same time forwards and backwards. Read the clearance.
7. Remove the pinion. Remove shims corresponding to clearance measured $+ 0.003'' = 0.07 \text{ mm}$ ($0.0030'' = 0.09 \text{ mm}$ when replacing a gear set).
8. Now use the torque gauge to check the pinion bearing installation. For use bearings the torque gauge should read 5.20–9.55 lb.in. = 60–110 Ncm, and for new bearings 9.55–20 lb.in. = 110–230 Ncm when the pinion rotates. On new final drive units, stresses can be higher due to installation method. In other words, higher stresses does not mean there is a fault. Often an alternation in the shim thickness is required because of the tolerances which must be present.
9. Check the location of the pinion with the dial indicator, retainer 2284 and measuring tool 2393, see also point 2.

Differential Installation

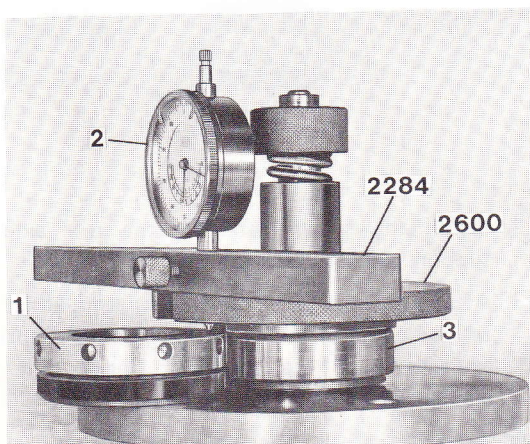
1. Lubricate the inside of the adjustment rings 2595 and install them on the differential carrier. The ring with the black-oxidized adjustment ring should be placed on the ring gear side. Also lubricate the bearing location in the carrier. Install the differential carrier and the adjustment rings in the final drive housing:



Adjustment rings for differential

Use the dial indicator and adjust the rings so that correct backlash $0.006'' = 0.15 \text{ mm}$ is obtained. The tooth flank clearance may be $0.005'' - 0.007''$ ($0.12 - 0.18 \text{ mm}$) but should be kept as near $0.06'' = 0.15 \text{ mm}$ as possible. Tighten the lock screws in the adjustment rings.

2. Previously the gear set contact pattern could be used to determine correct installation of gears. This is no longer possible because of altered manufacturing and test procedures. The pinion gear should always be installed in its marked position regardless of the contact pattern. A gear set which is correctly installed but still causes noise may be tried by re-positioning the pinion gear $0.002'' = 0.05 \text{ mm}$ plus or minus (try plus first). This may help if the pinion gear for any reason has been incorrectly marked.
3. When correct backlash is obtained, remove differential and adjustment ring. Then place the center washer on the measuring fixture. Install a bearing into the measuring fixture, as well as plate, spring and nut. Install the nut, with the flat side facing downwards. Rotate the plate forwards and backwards several times. Put on dial indicator and retainer 2284. Zero the indicator to the adjustment ring and then place the measuring point facing the bearing, see below:



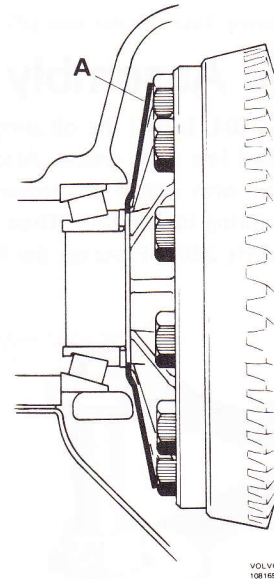
Determining shim thickness

1. Adjustment ring
2. Dial indicator
3. Bearing assembly

Read the indicator. Use a micrometer to measure the shims to a thickness corresponding to $0.003'' = 0.07 \text{ mm}$. Place the shims together with the measured bearing to the one side. Repeat the procedure with the other bearing.

NOTE: Make sure which side the respective bearing and shims are to be installed on.

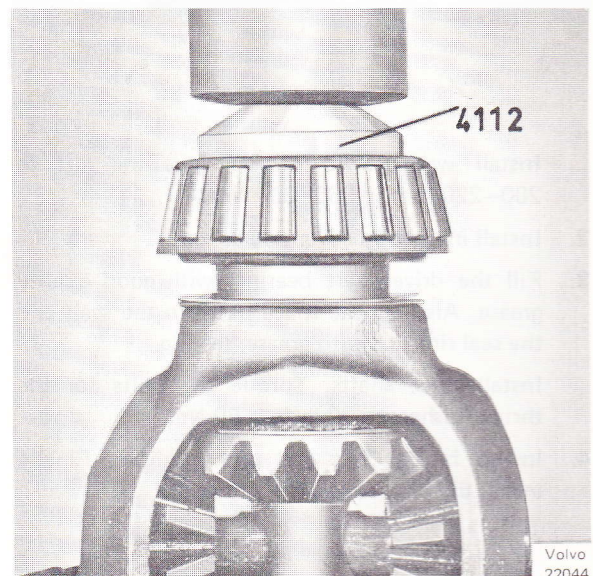
4. Install the shims on the differential carrier and press on the bearings. Do not forget the lock cover for the ring gear bolts.



Lock cover for ring gear bolts

A. Lock cover

Use drift 4112, see Fig. below:



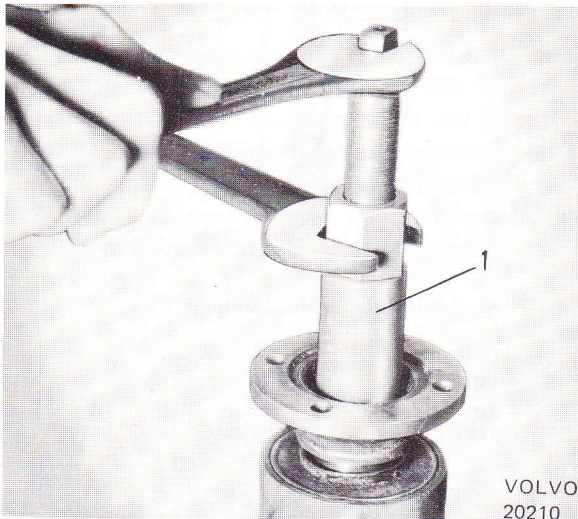
Installing differential bearings

When the second bearing is installed, use drift 2599 as a cushioning ring in order to prevent damage on the first bearing already pressed on.

5. Install tool 2394 and pinion carrier. Expand the tool until the pins are exactly flush against the hole edges in the carrier and then tighten the screws another 3–31 1/2 turns. Install the differential and outer rings. Remove tool 2394. Install the cap and torque the bolts to 36–50 lb.ft. = 50–70 Nm.

Rear Axle Assembly

1. Remove tool 2404. Install the oil slinger. Lubricate the oil seal lips with grease. Also lubricate the spring coil with grease to prevent it from jumping out during installation. Then install the oil seal with drift 2806. Press on the flange with tool 1845:



Flange installation

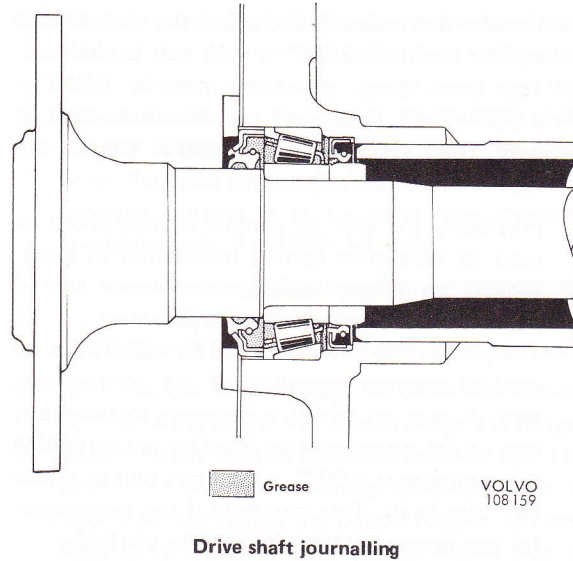
1. Press tool 1845

Install washer and nut. Torque the nut to 200–220 lb.ft. = 280–300 Nm.

2. Install inspection cover and gasket.
3. Fill the drive shaft bearings with good quality grease. Also fill the space between the seals and the seal ring lips with grease, see Fig.

Install drive shafts. Torque the bolts for the thrust washers to 36 lb.ft. = 50 Nm.

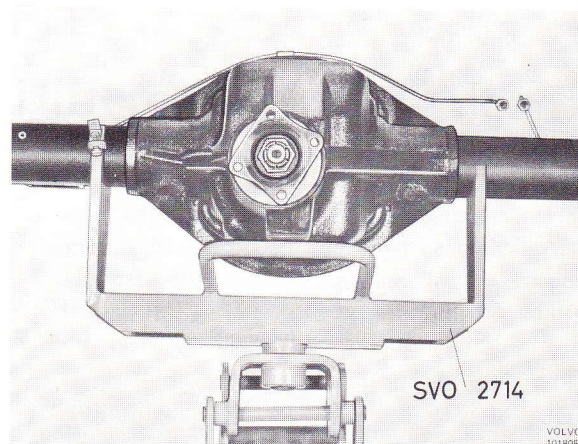
4. Install brake discs and brake caliper. Finally install the brake lines.



Rear Axle Installation

Installing rear axle

1. Place the rear axle in fixture 2714 and push it under the vehicle.



Rear axle fixture

2. Install the screws retaining the rear axle to support rod and track rod.
3. Attach the springs to the trailing arms. Hoist the rear axle and at the same time guide the springs towards their top supports. Check that the rubber dishes are correctly aligned.
4. Attach the track rod to the body bracket.
5. Re-attach the propeller shaft to the flange.
6. Route the brake wires through the plastic hoses and attach them to the brackets. Re-hook the springs retaining the cables to the rear axle.

7. Lubricate the lever joints and their corresponding surfaces for the brake shoes with a thin layer heat resistant graphite grease. Attach the levers to the cables.
8. Push in the cables and position the levers behind the rear axle flanges.
9. Apply a thin layer of graphite grease on the pivot points of the shoes. Install brake shoes and lower return springs.
10. Install upper return springs and adjustment devices.
11. Install brake drums and calipers. Use locking fluid for the caliper retaining screws. Check that the brake discs are free from the brake pads.
12. Attach the brake pipes to the rear axle.
13. Position the brake drum hole in line with the adjustment screws. Adjust the shoes by turning the tooth wheel of the adjustment rings with a screwdriver. When the drums start to get hard to turn, return the adjustment 4—5 teeth. Turn the brake drums and check that the shoes do not drag. If this is the case slacken another 2—3 teeth.
14. Re-attach the shock absorbers to the top supports.
15. Install the rear wheels and restore.

Section 4

Transmission, Rear Axle

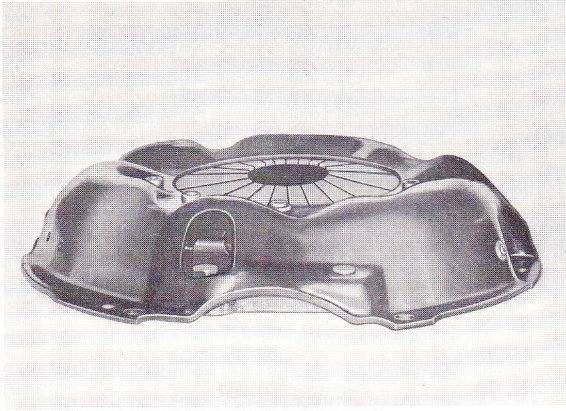
Design and theory of operation

Index

Group 41:	Clutch	1
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Group 43B:	Overdrive	4
Group 44:	Automatic Transmission Borg-Warner 35	8
Group 45:	Propeller Shafts	12
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Group 41

Clutch



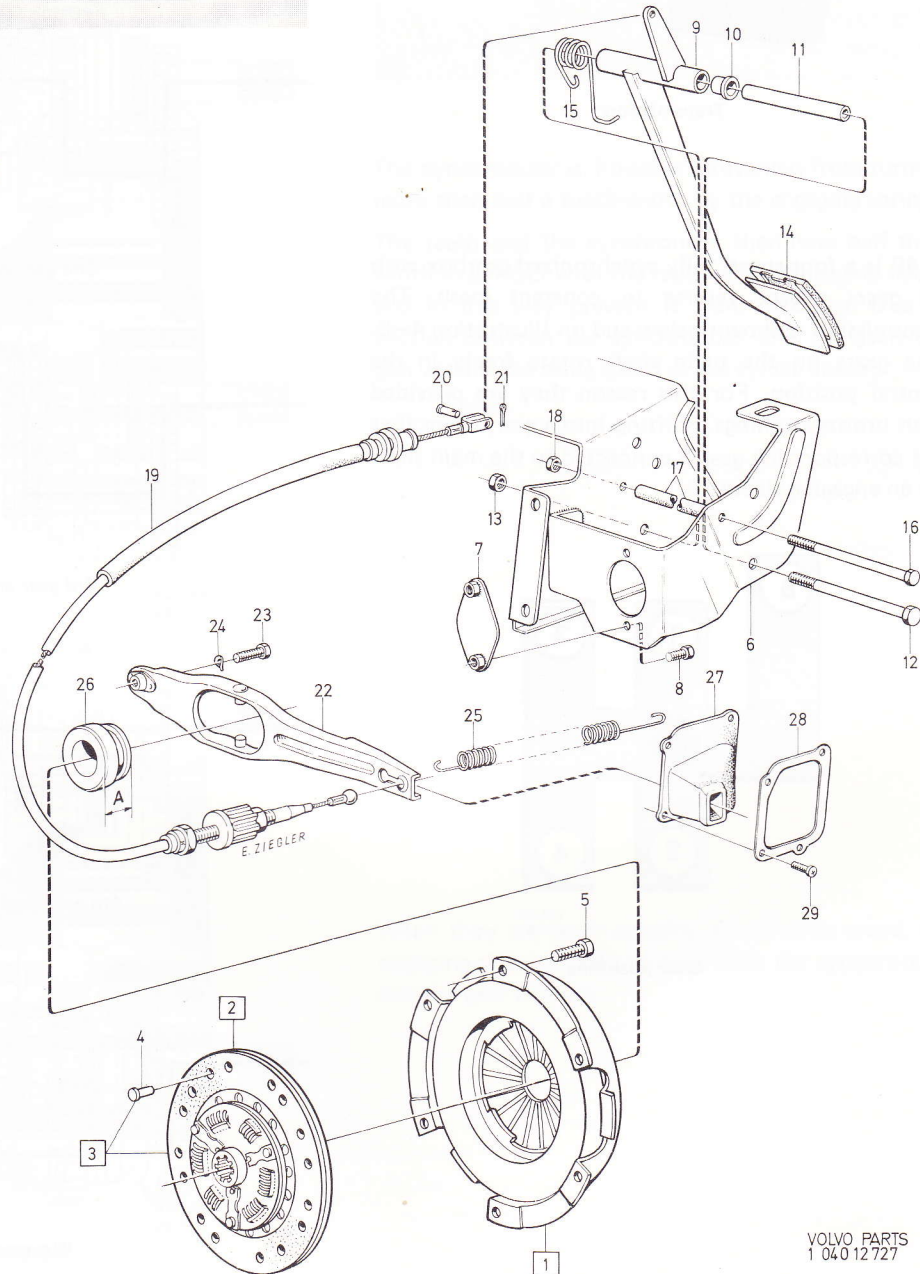
Clutch and Clutch Control

The clutch is of the diaphragm spring type. It comprises:

- a pressure plate.
- a diaphragm spring and
- a clutch cover.

The diaphragm spring has a double function: that of a clutch lever when declutching and that of a pressure spring when engaging.

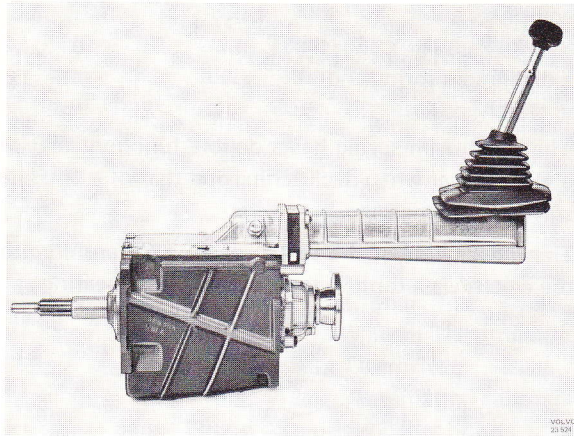
The movements of the clutch pedal are transferred to the clutch via a cable, a lever and a release bearing.



Group 43 A

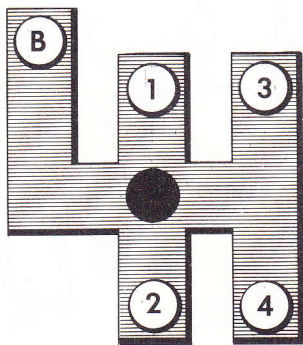
Transmission

(Transmission M 41 with overdrive, see also Group 43 B "Overdrive")



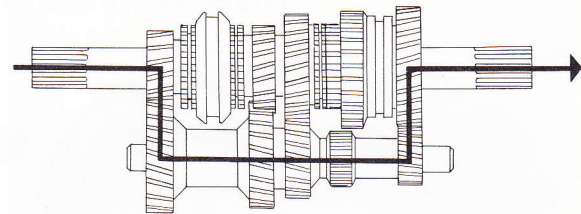
Transmission

M 40 is a four-speed fully synchronized gearbox with all gears except reverse in constant mesh. The transmission is shown below and on Illustration 4—B. The gears on the main shaft rotate freely in the neutral position. For this reason they are provided with bronze bushings. Shifting into a gear means that the corresponding gear is connected to the main shaft by an engaging sleeve.



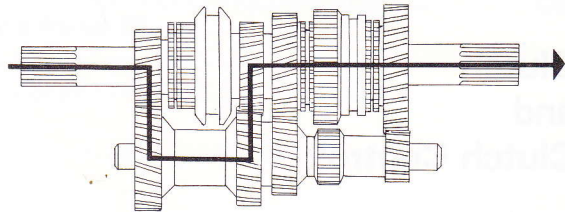
VOLVO
261 92

Gear positions



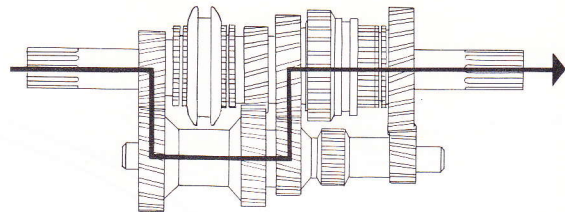
VOLVO
22 711

1st gear engaged



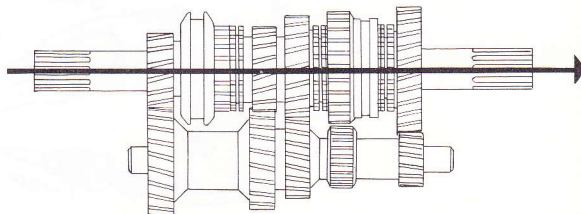
VOLVO
22 712

2nd gear engaged



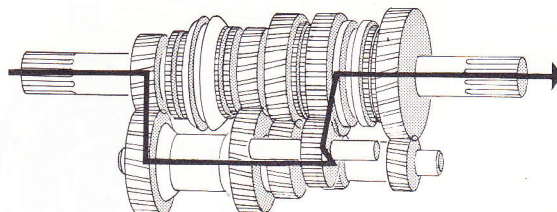
VOLVO
22 713

3rd gear engaged



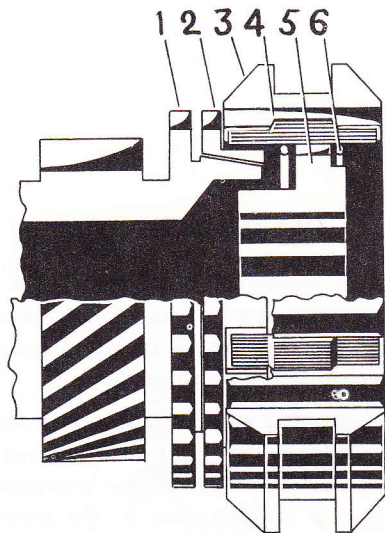
VOLVO
22 714

4th gear engaged



VOLVO
22 715

Reverse

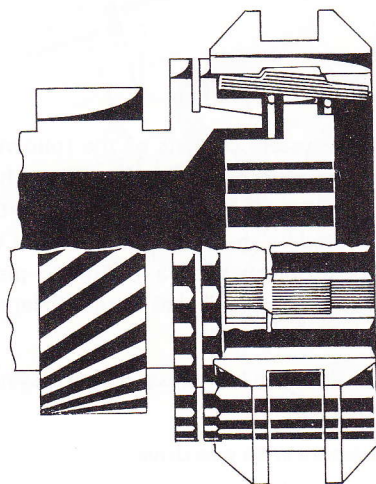


VOLVO
22 716

Neutral position

When a gear is engaged, the gear selector fork presses the engaging sleeve (3) towards the corresponding gear.

The inserts (4) then press the synchronizing cone (2) against the cone on the gear (1). If the hub and gear are rotating at different speeds, the synchronizer will turn in relation to the engaging sleeve.

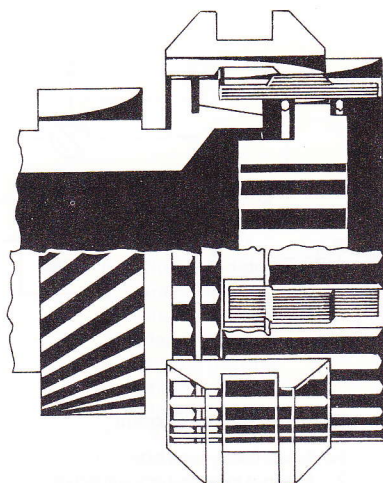


VOLVO
22 717

Synchronizing

The synchronizer is, however, prevented from turning more than half a tooth-width by the engaging springs.

The teeth and the synchronizer then have half their width in contact with the teeth on the engaging sleeve and in this way prevent it from engaging. Due to friction between the synchronizer and the gear, the gear attains the same speed as the synchronizer.



VOLVO
22 718

Gear engaged

When they are both rotating at the same speed, the engaging sleeve is able to turn back the synchronizer and the gear engages.

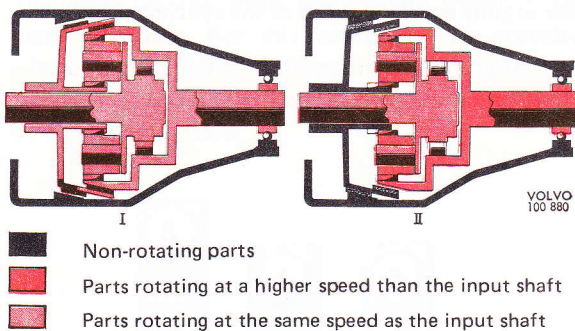
Group 43 B

Overdrive

The overdrive unit is of the epicyclic type and is attached to the rear end of the transmission. Its design is shown in Illustration 4—C. The working principle of the overdrive is as follows:

Direct Drive Position

When traveling forwards, power is transmitted from the gearbox main shaft through the one-way clutch to the output shaft of the overdrive. At the same time, the clutch sliding member (position 1), is pressed by four springs against the tapered part of the output shaft. When reversing or when the engine acts as a brake, torque is transmitted through the clutch sliding member.



- I. Direct drive position
II. Overdrive position

Overdrive

In the overdrive position, the clutch sliding member is pressed against the brake ring (see 2, above) with the help of pistons in the hydraulic cylinders. This also locks the sun wheel. Since the planet gear retainers are linked to the main shaft through the splines, the planet gears are forced to rotate around the sun wheel. As a result of this, the output shaft will rotate at a higher speed than the main shaft.

Electrical System

The overdrive is engaged electro-hydraulically. On the gearbox cover there is a contact which cuts in when 4th speed is engaged. Thus the overdrive can only be engaged when this speed is engaged.

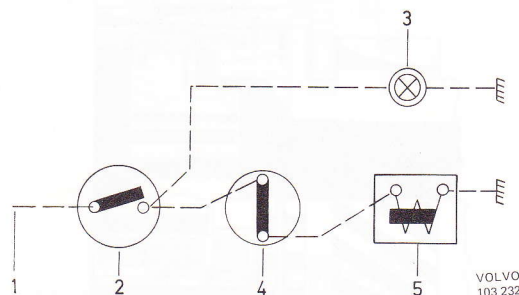
A manually operated switch placed underneath the steering wheel closes the circuit via the switch on the transmission to a solenoid on the overdrive. The solenoid moves a control valve to the position for overdrive.

Hydraulic System

The hydraulic system consists of the following main parts: pre-filter, plunger pump, fine filter, hydraulic cylinders and plungers, relief valve and a control valve which is operated by the solenoid. The relief valve has a special construction with a hydraulic piston and three different springs. It has three different functions:

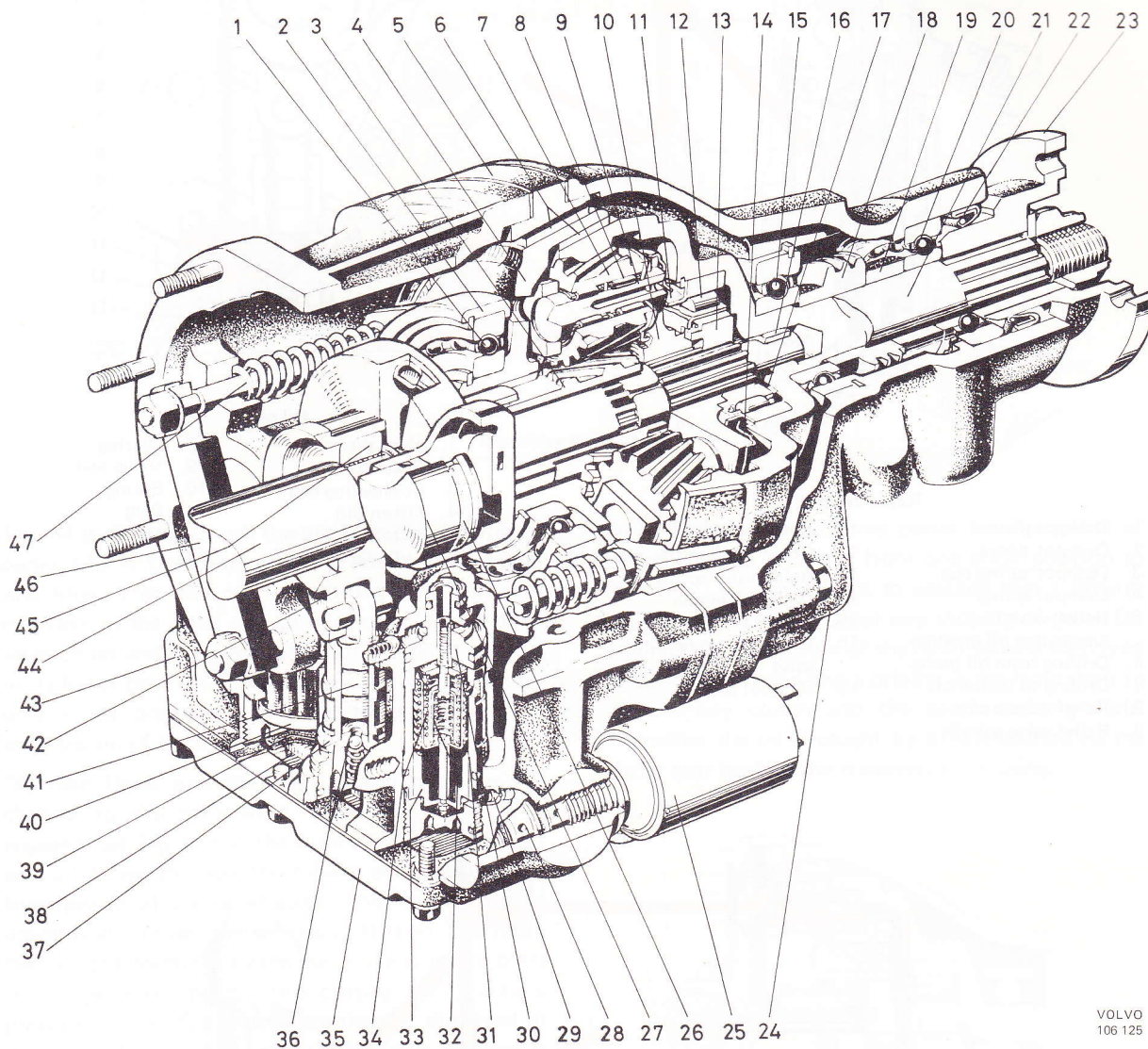
- it must maintain a low pressure in the system with direct drive
- a high pressure with overdrive
- provide smooth changing when shifting from overdrive to direct drive and vice versa

The relief valve function is described in more detail below.



Electrical circuit diagram

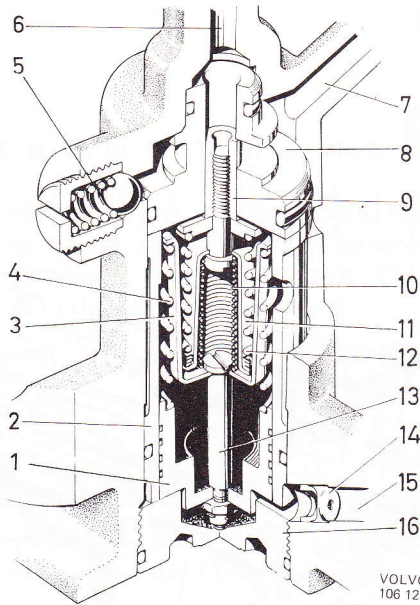
1. Lead from fuse box
2. Manual switch for overdrive
3. Overdrive warning lamp
4. Transmission switch
5. Solenoid on overdrive



VOLVO
106 125

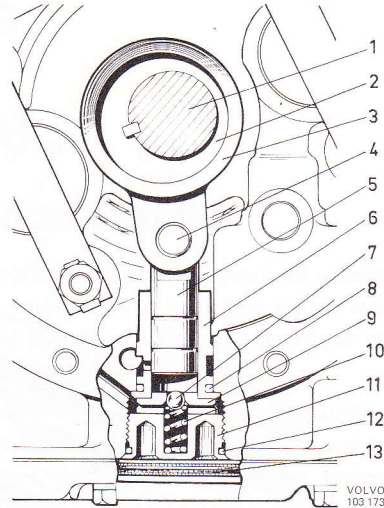
Overdrive

- | | | |
|----------------------------|------------------------------|--|
| 1. Thrust bearing | 17. Thrust washer | 34. Small piston |
| 2. Thrust bearing retainer | 18. Speedometer driving gear | 35. Base plate |
| 3. Sun wheel | 19. Spacer | 36. Check valve for oil pump |
| 4. Clutch sliding member | 20. Ball bearing | 37. Pump cylinder |
| 5. Brake ring | 21. Output shaft | 38. Magnet |
| 6. Clutch member linings | 22. Oil seal | 39. Pre-filter |
| 7. Planet gear | 23. Coupling flange | 40. Fine filter |
| 8. Needle bearing | 24. Rear casing | 41. Pump plunger |
| 9. Shaft | 25. Solenoid | 42. Connecting rod |
| 10. Planet carrier | 26. Piston seal | 43. Front casing |
| 11. Oil thrower | 27. Piston | 44. Input shaft
(transmission main shaft) |
| 12. One-way clutch rollers | 28. Operating valve | 45. Eccentric |
| 13. One-way clutch | 29. Orifice nozzle | 46. Bridge piece |
| 14. Oil trap | 31. Cylinder | 47. Spring |
| 15. Ball bearing | 32. Spring | |
| 16. Bushing | 33. Large piston | |



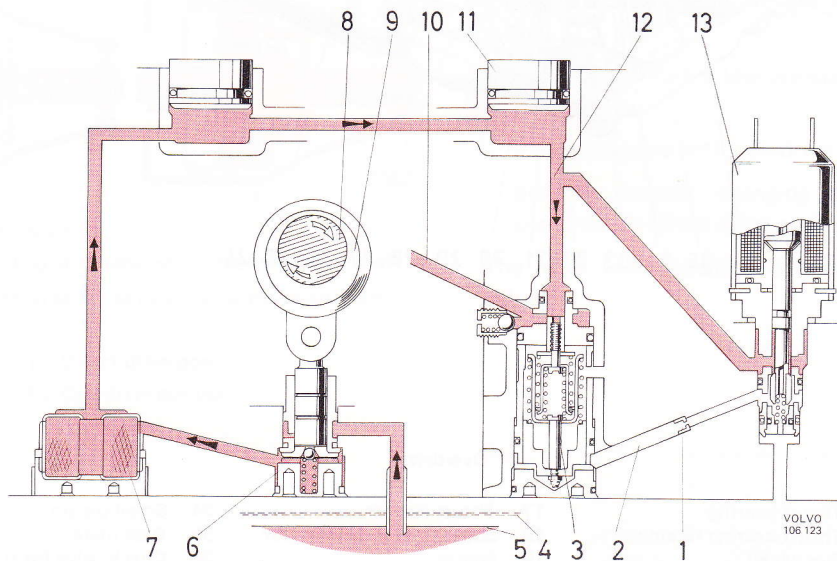
Relief valve

- | | |
|--|-----------------------------------|
| 1. Dashpot piston | 10. Residual spring |
| 2. Dashpot sleeve | 11. Relief valve spring cup |
| 3. Dashpot spring cup | 12. Relief valve spring |
| 4. Dashpot spring | 13. Dashpot spindle |
| 5. Relief valve for lubricating oil pressure | 14. Orifice nozzle |
| 6. Drilling from oil pump | 15. Drilling from operating valve |
| 7. Drilling to mainshaft | 16. Dashpot plug |
| 8. Relief valve body | |
| 9. Relief valve spindle | |



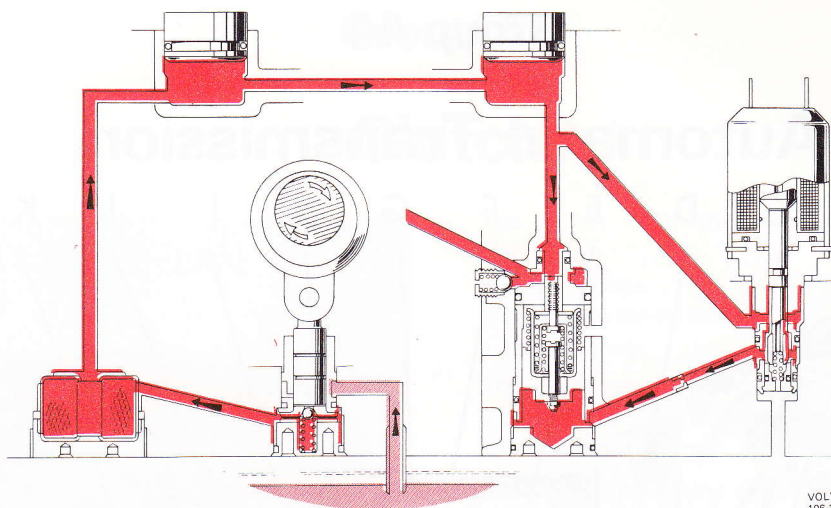
Oil pump

- | | |
|-------------------|----------------|
| 1. Main shaft | 8. Oil ring |
| 2. Eccentric | 9. Valve seat |
| 3. Connecting rod | 10. Spring |
| 4. Piston pin | 11. Plug |
| 5. Piston | 12. O-ring |
| 6. Cylinder | 13. Pre-filter |
| 7. Ball | |



Function, direct drive

- | | |
|--|---|
| 1. Nozzle | 10. Channel, relief valve — main shaft |
| 2. Channel, control valve — relief valve | 11. Piston |
| 3. Relief valve | 12. Channel, oil pump — hydraulic cylinder — control valve and solenoid |
| 4. Pre-filter | 13. Control valve and solenoid |
| 5. Oil pump | |
| 6. Oil pump | |
| 7. Fine filter | |
| 8. Transmission main shaft | |
| 9. Eccentric | |



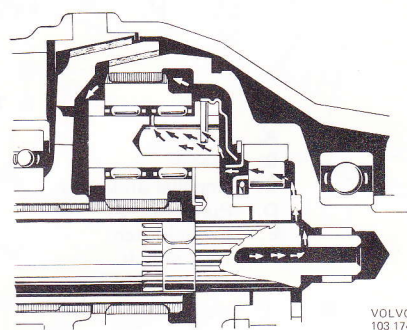
Overdrive in function

The oil is drawn through the pre-filter by the plunger pump and is conveyed under pressure through the fine filter. Then the oil flows through the hydraulic cylinders to the relief and control valves. The control valve closes and the large piston of the relief valve is in its lower position. This offloads the spring so that only a low pressure is required to press down the small piston of the relief valve.

Oil then flows past the small piston out into the channel to the main shaft. When the overdrive is engaged, see Fig. above, the control valve is displaced and oil flows through the oilway and operates the large piston of the relief valve. This is then moved upwards and causes the springs to tension. The more the springs tension the greater force is required to press down the small piston, this causing the hydraulic pressure to rise. The pistons are thereby displaced in the hydraulic cylinders, the clutch sliding member is pulled forwards and contact made with the brake ring.

With disengagement of the overdrive, the connection between channels 12 and 2 closes. The connection between channel 2 and the sump then opens. This permits oil under the large piston of the relief valve to flow out into the sump, the pressure in the system drops and direct drive is engaged. Because of the orifice nozzle in the channel and balancing of the

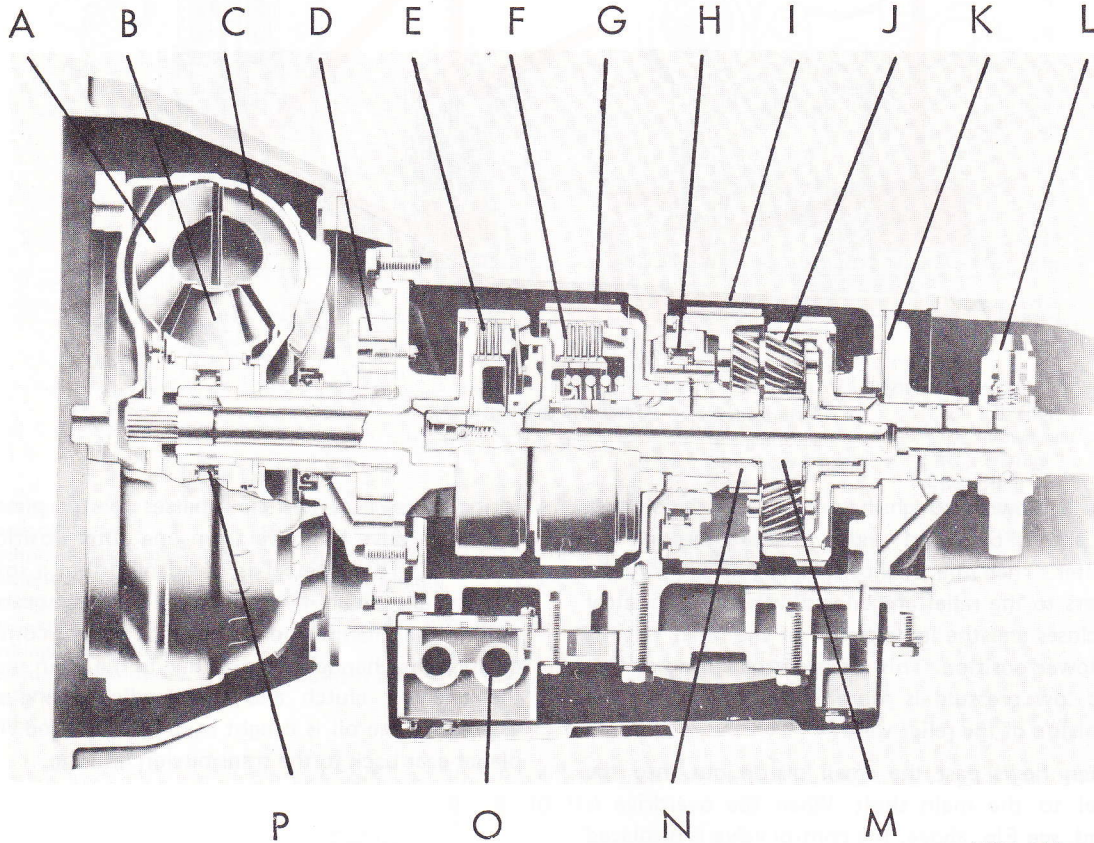
spring force, a certain time passes for the piston of the relief valve to move from one outer position to the other. This interval is so adapted that a smooth engagement occurs without any slipping of gears. Oil passing the small piston of the relief valve is conveyed through the channel and a drilling in the main shaft to the one-way clutch and the needle bearing shaft. Thereafter the oil is caught by a plate and led via the planet gear back to the transmission housing.



Lubricating system

Group 44

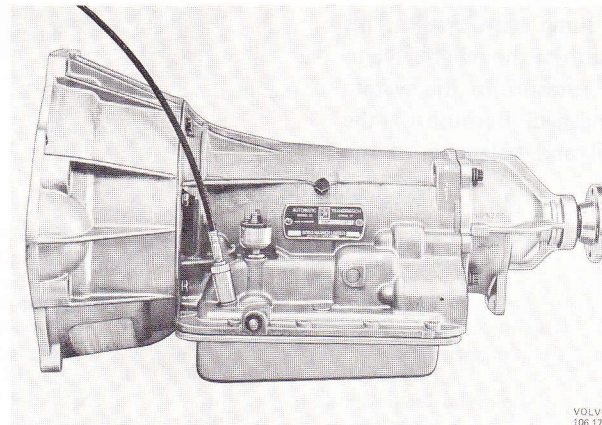
Automatic Transmission



VOLVO
106 176

Transmission sectional view

- | | | |
|-----------------------|-----------------------------------|--------------------------------|
| A. Turbine | G. Front brake band | L. Governor |
| B. Stator | H. One-way clutch in transmission | M. Reverse sun gear |
| C. Impeller and cover | I. Rear brake band | N. Forward sun gear |
| D. Pump | J. Planetary gear set | O. Control system |
| E. Front clutch | K. Oil deflector flange | P. One-way clutch in converter |
| F. Rear clutch | | |

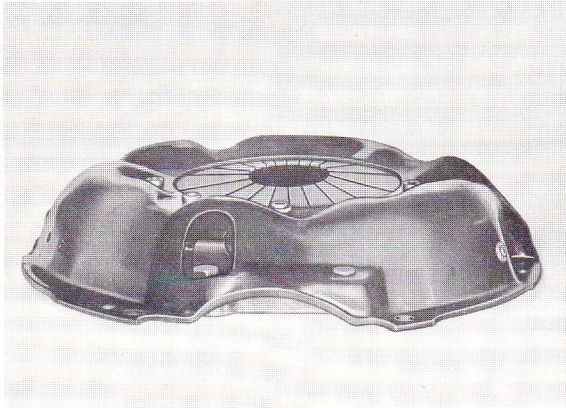


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106 177

The Borg-Warner Automatic Transmission Type 35

Group 41

Clutch



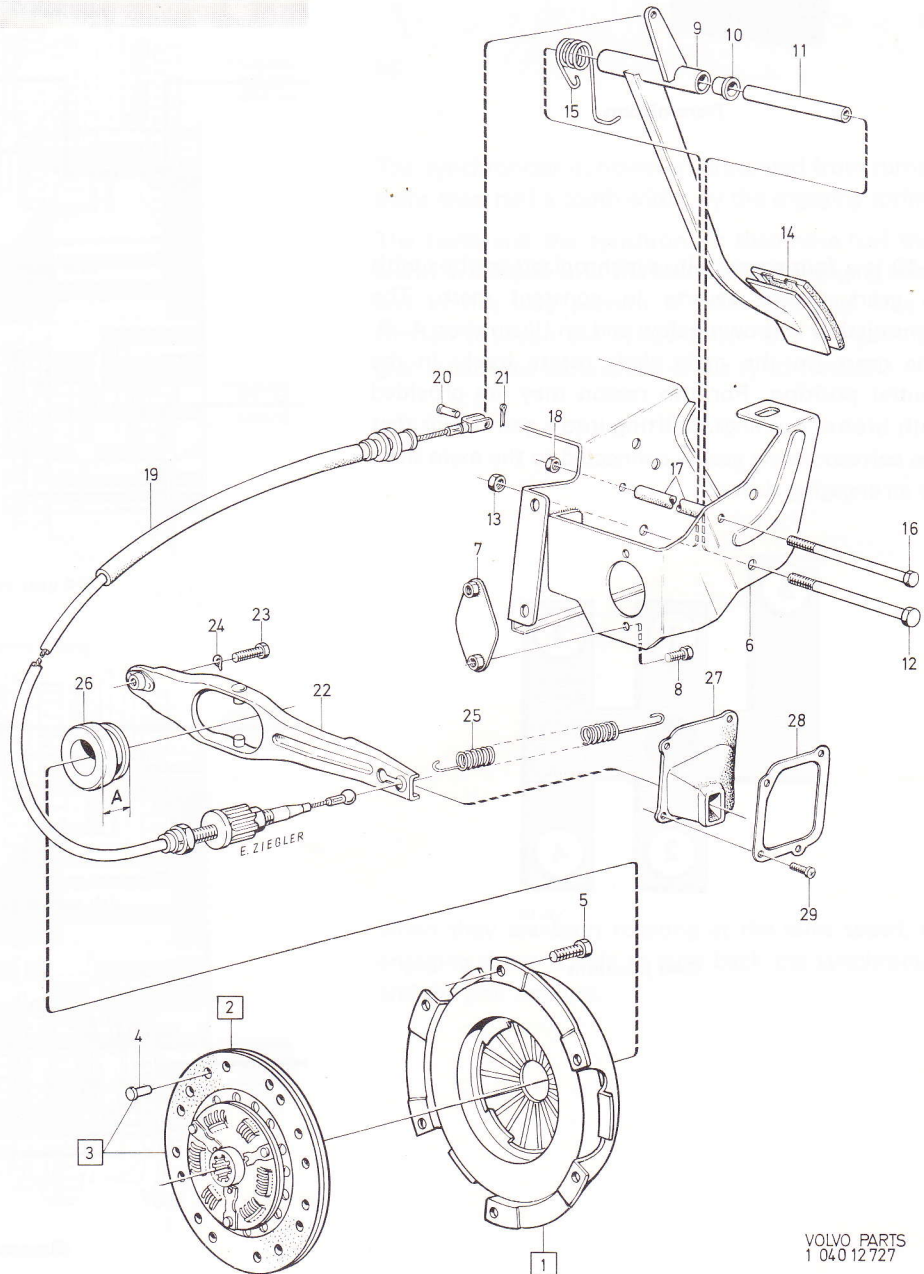
Clutch and Clutch Control

The clutch is of the diaphragm spring type. It comprises:

- a pressure plate.
- a diaphragm spring and
- a clutch cover.

The diaphragm spring has a double function: that of a clutch lever when declutching and that of a pressure spring when engaging.

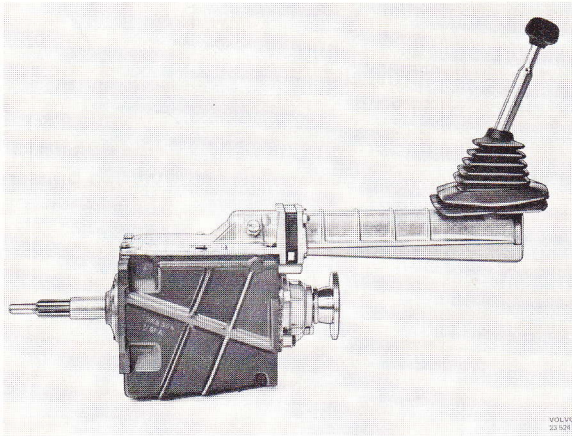
The movements of the clutch pedal are transferred to the clutch via a cable, a lever and a release bearing.



Group 43 A

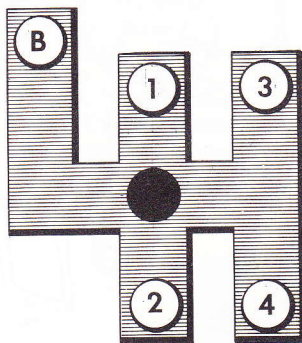
Transmission

(Transmission M 41 with overdrive, see also Group 43 B "Overdrive")



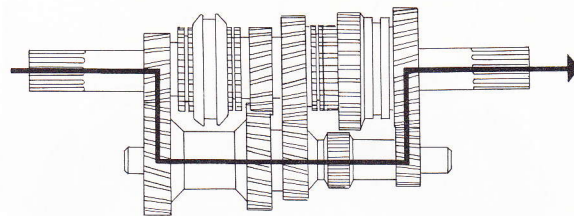
Transmission

M 40 is a four-speed fully synchronized gearbox with all gears except reverse in constant mesh. The transmission is shown below and on Illustration 4-B. The gears on the main shaft rotate freely in the neutral position. For this reason they are provided with bronze bushings. Shifting into a gear means that the corresponding gear is connected to the main shaft by an engaging sleeve.



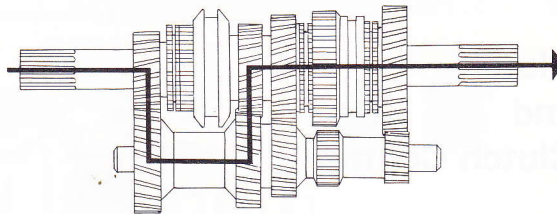
VOLVO
261 92

Gear positions



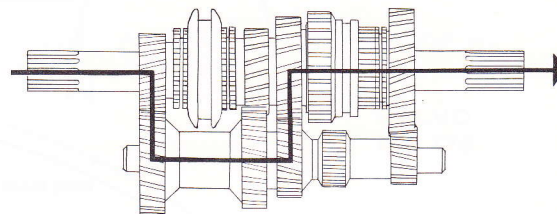
VOLVO
22 711

1st gear engaged



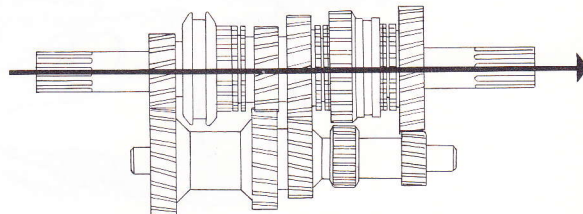
VOLVO
22 712

2nd gear engaged



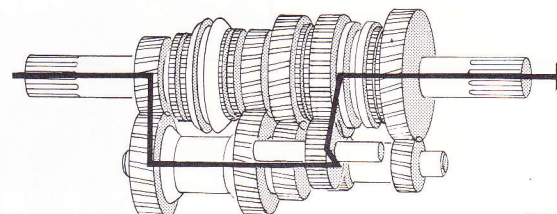
VOLVO
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3rd gear engaged



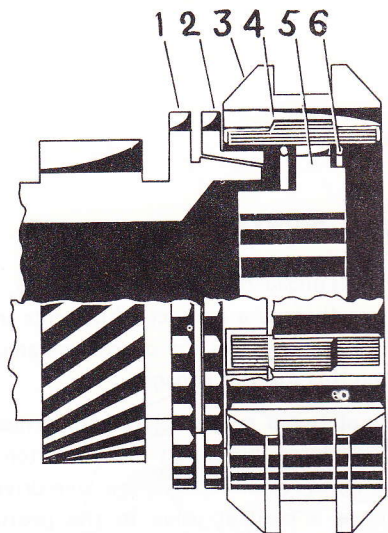
VOLVO
22 714

4th gear engaged



VOLVO
22 715

Reverse

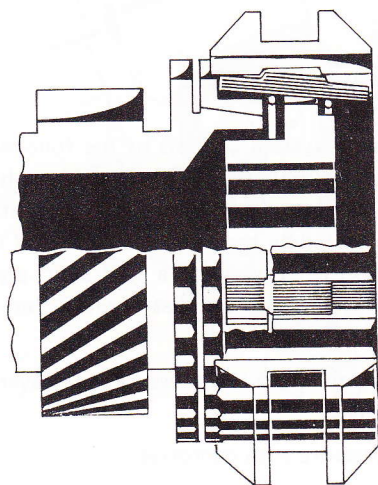


VOLVO
22 716

Neutral position

When a gear is engaged, the gear selector fork presses the engaging sleeve (3) towards the corresponding gear.

The inserts (4) then press the synchronizing cone (2) against the cone on the gear (1). If the hub and gear are rotating at different speeds, the synchronizer will turn in relation to the engaging sleeve.

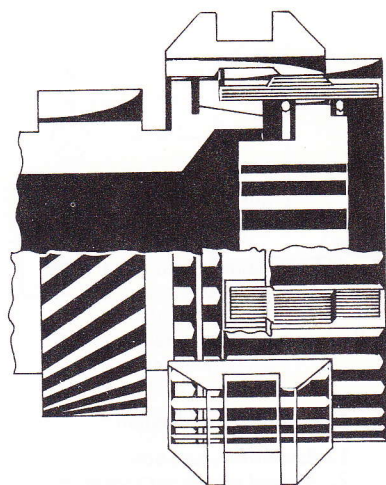


VOLVO
22 717

Synchronizing

The synchronizer is, however, prevented from turning more than half a tooth-width by the engaging springs.

The teeth and the synchronizer then have half their width in contact with the teeth on the engaging sleeve and in this way prevent it from engaging. Due to friction between the synchronizer and the gear, the gear attains the same speed as the synchronizer.



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22 718

Gear engaged

When they are both rotating at the same speed, the engaging sleeve is able to turn back the synchronizer and the gear engages.

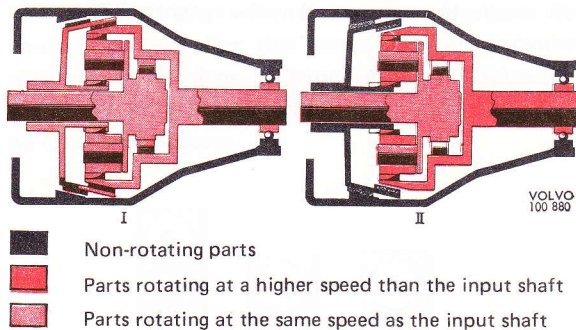
Group 43 B

Overdrive

The overdrive unit is of the epicyclic type and is attached to the rear end of the transmission. Its design is shown in Illustration 4—C. The working principle of the overdrive is as follows:

Direct Drive Position

When traveling forwards, power is transmitted from the gearbox main shaft through the one-way clutch to the output shaft of the overdrive. At the same time, the clutch sliding member (position 1), is pressed by four springs against the tapered part of the output shaft. When reversing or when the engine acts as a brake, torque is transmitted through the clutch sliding member.



Overdrive

In the overdrive position, the clutch sliding member is pressed against the brake ring (see 2, above) with the help of pistons in the hydraulic cylinders. This also locks the sun wheel. Since the planet gear retainers are linked to the main shaft through the splines, the planet gears are forced to rotate around the sun wheel. As a result of this, the output shaft will rotate at a higher speed than the main shaft.

Electrical System

The overdrive is engaged electro-hydraulically. On the gearbox cover there is a contact which cuts in when 4th speed is engaged. Thus the overdrive can only be engaged when this speed is engaged.

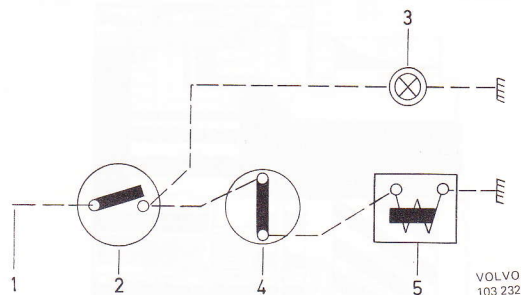
A manually operated switch placed underneath the steering wheel closes the circuit via the switch on the transmission to a solenoid on the overdrive. The solenoid moves a control valve to the position for overdrive.

Hydraulic System

The hydraulic system consists of the following main parts: pre-filter, plunger pump, fine filter, hydraulic cylinders and plungers, relief valve and a control valve which is operated by the solenoid. The relief valve has a special construction with a hydraulic piston and three different springs. It has three different functions:

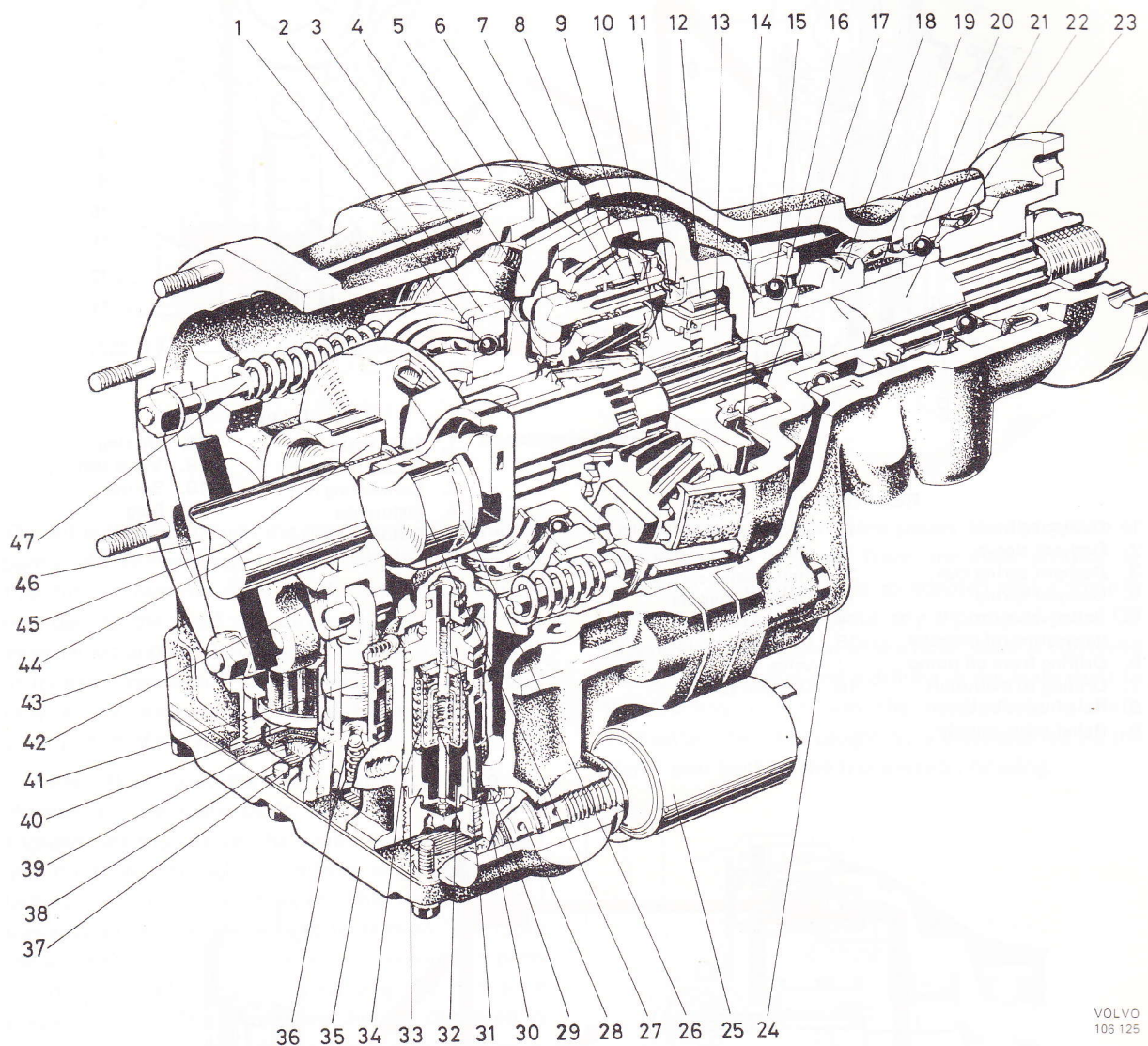
- it must maintain a low pressure in the system with direct drive
- a high pressure with overdrive
- provide smooth changing when shifting from overdrive to direct drive and vice versa

The relief valve function is described in more detail below.



Electrical circuit diagram

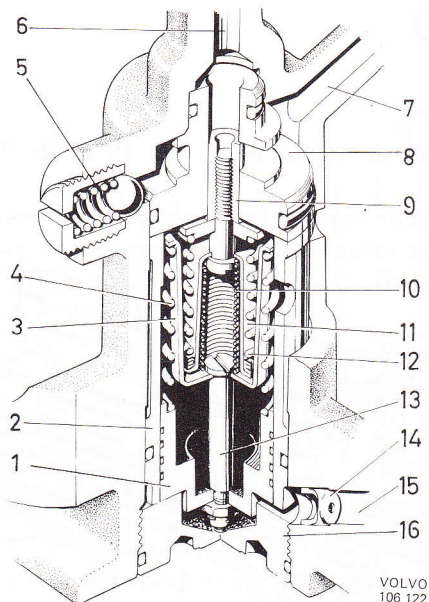
1. Lead from fuse box
2. Manual switch for overdrive
3. Overdrive warning lamp
4. Transmission switch
5. Solenoid on overdrive



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106 125

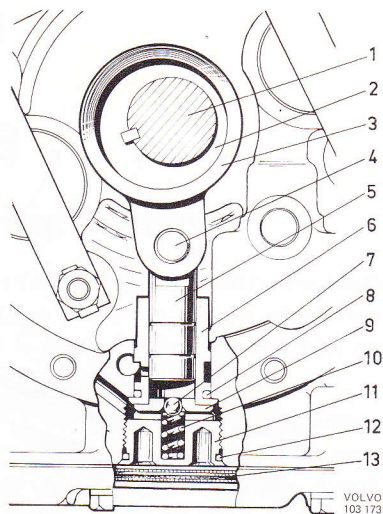
Overdrive

- | | | |
|----------------------------|------------------------------|--|
| 1. Thrust bearing | 17. Thrust washer | 34. Small piston |
| 2. Thrust bearing retainer | 18. Speedometer driving gear | 35. Base plate |
| 3. Sun wheel | 19. Spacer | 36. Check valve for oil pump |
| 4. Clutch sliding member | 20. Ball bearing | 37. Pump cylinder |
| 5. Brake ring | 21. Output shaft | 38. Magnet |
| 6. Clutch member linings | 22. Oil seal | 39. Pre-filter |
| 7. Planet gear | 23. Coupling flange | 40. Fine filter |
| 8. Needle bearing | 24. Rear casing | 41. Pump plunger |
| 9. Shaft | 25. Solenoid | 42. Connecting rod |
| 10. Planet carrier | 26. Piston seal | 43. Front casing |
| 11. Oil thrower | 27. Piston | 44. Input shaft
(transmission main shaft) |
| 12. One-way clutch rollers | 28. Operating valve | 45. Eccentric |
| 13. One-way clutch | 29. Orifice nozzle | 46. Bridge piece |
| 14. Oil trap | 31. Cylinder | 47. Spring |
| 15. Ball bearing | 32. Spring | |
| 16. Bushing | 33. Large piston | |



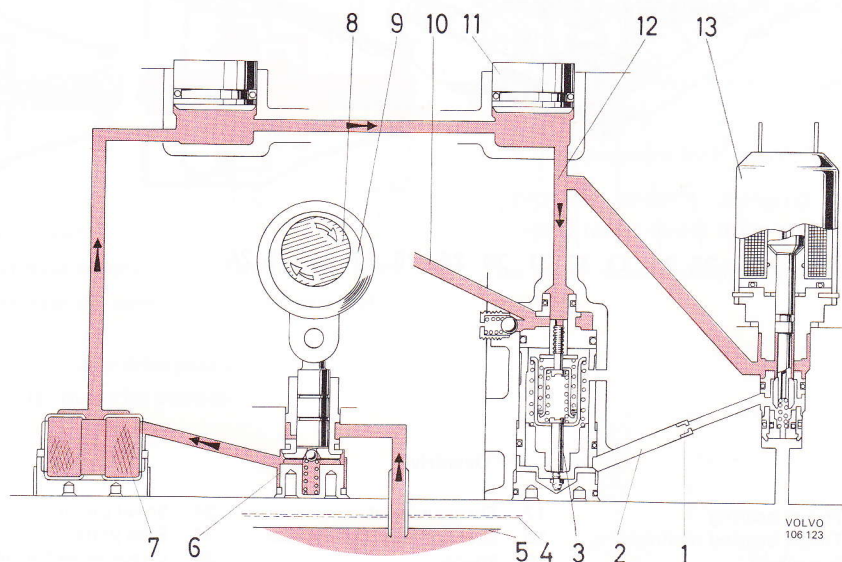
Relief valve

- | | |
|--|-----------------------------------|
| 1. Dashpot piston | 10. Residual spring |
| 2. Dashpot sleeve | 11. Relief valve spring cup |
| 3. Dashpot spring cup | 12. Relief valve spring |
| 4. Dashpot spring | 13. Dashpot spindle |
| 5. Relief valve for lubricating oil pressure | 14. Orifice nozzle |
| 6. Drilling from oil pump | 15. Drilling from operating valve |
| 7. Drilling to mainshaft | 16. Dashpot plug |
| 8. Relief valve body | |
| 9. Relief valve spindle | |



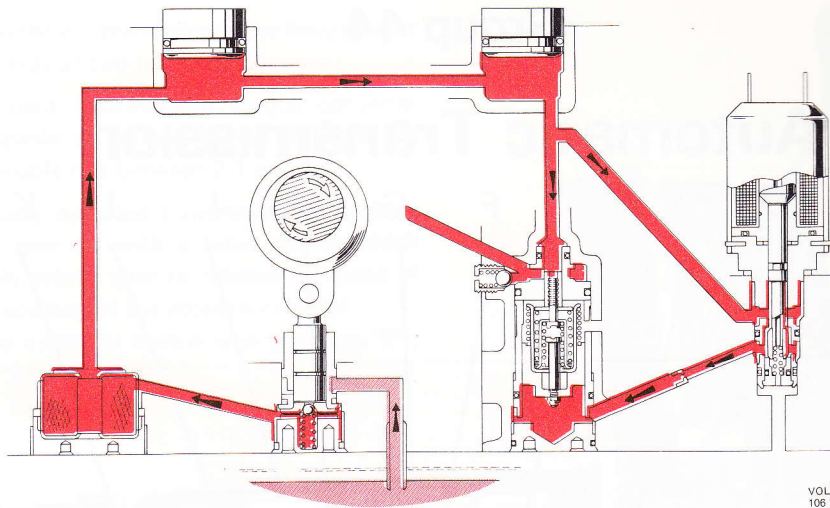
Oil pump

- | | |
|-------------------|----------------|
| 1. Main shaft | 8. Oil ring |
| 2. Eccentric | 9. Valve seat |
| 3. Connecting rod | 10. Spring |
| 4. Piston pin | 11. Plug |
| 5. Piston | 12. O-ring |
| 6. Cylinder | 13. Pre-filter |
| 7. Ball | |



Function, direct drive

- | | |
|--|---|
| 1. Nozzle | 10. Channel, relief valve — main shaft |
| 2. Channel, control valve — relief valve | 11. Piston |
| 3. Relief valve | 12. Channel, oil pump — hydraulic cylinder — control valve and solenoid |
| 4. Pre-filter | 13. Control valve and solenoid |
| 5. Oil pump | |
| 6. Oil pump | |
| 7. Fine filter | |
| 8. Transmission main shaft | |
| 9. Eccentric | |



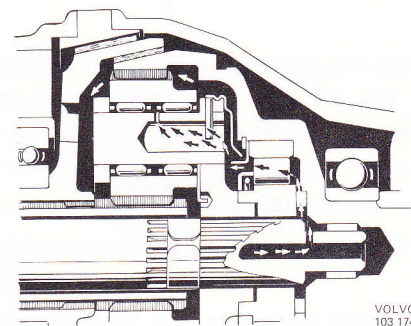
Overdrive in function

The oil is drawn through the pre-filter by the plunger pump and is conveyed under pressure through the fine filter. Then the oil flows through the hydraulic cylinders to the relief and control valves. The control valve closes and the large piston of the relief valve is in its lower position. This offloads the spring so that only a low pressure is required to press down the small piston of the relief valve.

Oil then flows past the small piston out into the channel to the main shaft. When the overdrive is engaged, see Fig. above, the control valve is displaced and oil flows through the oilway and operates the large piston of the relief valve. This is then moved upwards and causes the springs to tension. The more the springs tension the greater force is required to press down the small piston, this causing the hydraulic pressure to rise. The pistons are thereby displaced in the hydraulic cylinders, the clutch sliding member is pulled forwards and contact made with the brake ring.

With disengagement of the overdrive, the connection between channels 12 and 2 closes. The connection between channel 2 and the sump then opens. This permits oil under the large piston of the relief valve to flow out into the sump, the pressure in the system drops and direct drive is engaged. Because of the orifice nozzle in the channel and balancing of the

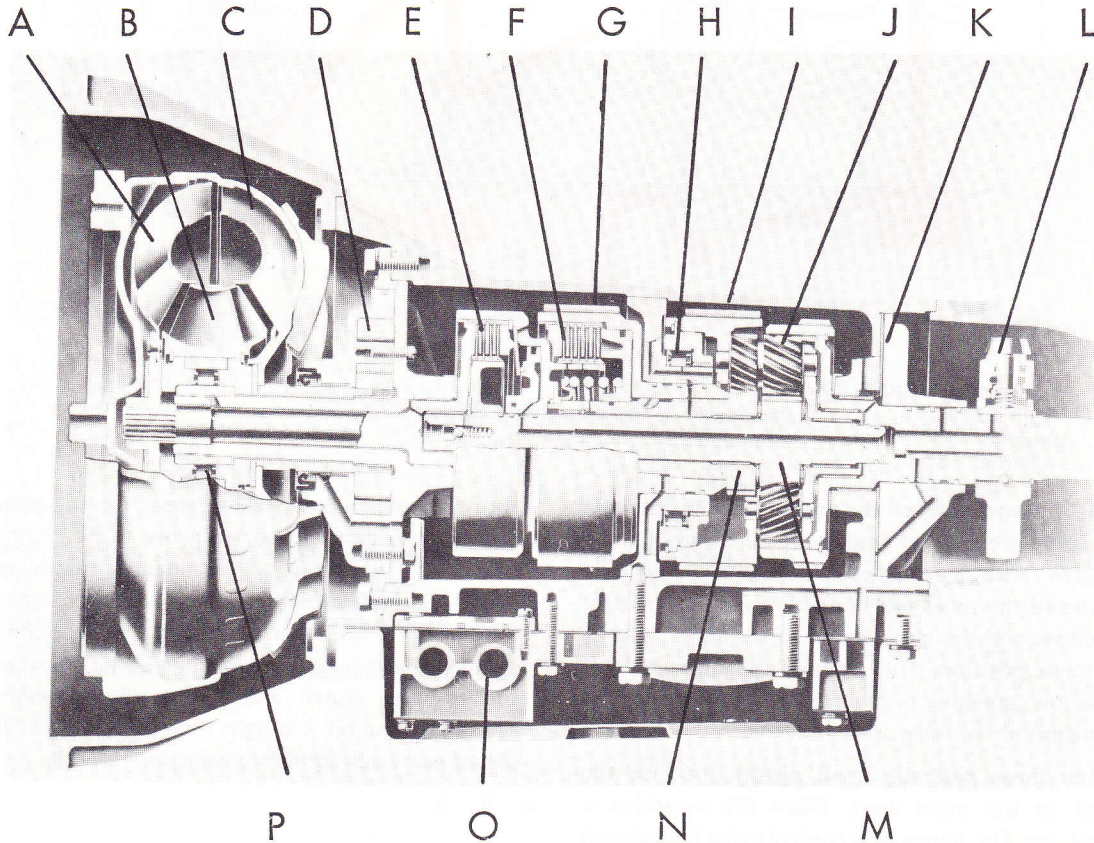
spring force, a certain time passes for the piston of the relief valve to move from one outer position to the other. This interval is so adapted that a smooth engagement occurs without any slipping of gears. Oil passing the small piston of the relief valve is conveyed through the channel and a drilling in the main shaft to the one-way clutch and the needle bearing shaft. Thereafter the oil is caught by a plate and led via the planet gear back to the transmission housing.



Lubricating system

Group 44

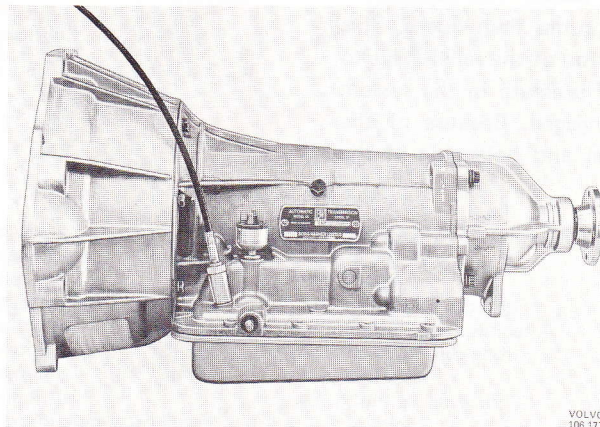
Automatic Transmission



VOLVO
106 176

Transmission sectional view

- | | | |
|-----------------------|-----------------------------------|--------------------------------|
| A. Turbine | G. Front brake band | L. Governor |
| B. Stator | H. One-way clutch in transmission | M. Reverse sun gear |
| C. Impeller and cover | I. Rear brake band | N. Forward sun gear |
| D. Pump | J. Planetary gear set | O. Control system |
| E. Front clutch | K. Oil deflector flange | P. One-way clutch in converter |
| F. Rear clutch | | |

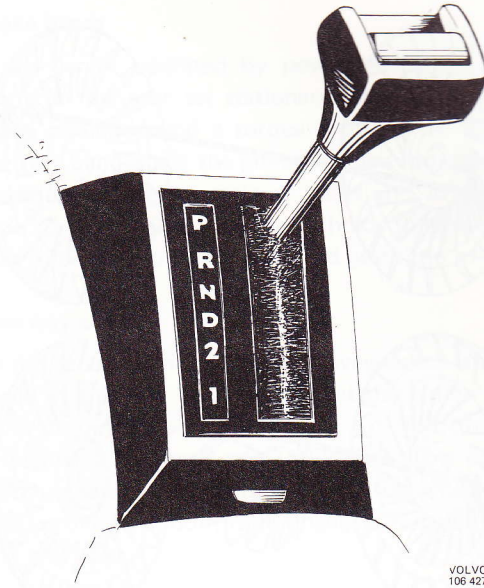


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The Borg-Warner Automatic Transmission Type 35

The Volvo automatic transmission is the Borg-Warner Type 35. It consists of two main components.

1. A three-element hydrokinetic torque converter coupling capable of torque multiplication at an infinitely variable rate between 2:1 and 1:1.
 2. A hydraulically operated transmission comprising a planetary gear set with a valve system which automatically selects gear in relation to speed of the car and position of the accelerator pedal.
- There is also a selector control with positions "P", "R", "N", "D", "2" and "1".

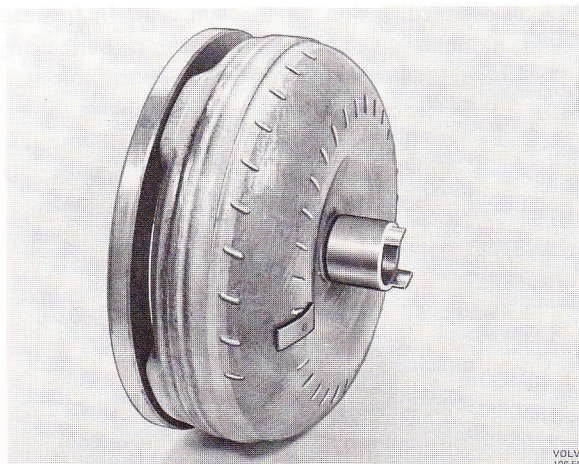


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Selector lever positions

Torque Converter

The torque converter serves as a clutch and as a hydraulic gear between engine and transmission. It provides a smooth application of engine power to the driving wheels and additional engine torque multiplication to 1st and 2nd gears.



VOLVO
106 504

Converter

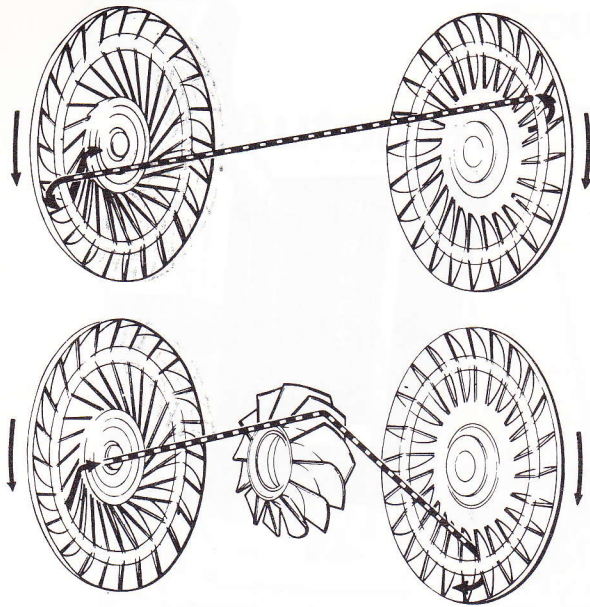
The converter also provides extreme low-speed flexibility when the transmission is in 3rd gear since it can multiply engine torque, it gives good acceleration from very low road speed.

The converter consists of three main components:

- a turbine connected to the input shaft of the transmission
- a stator mounted on a sprag-type one-way clutch supported on
- a fixed hub, projecting from the transmission case

The converter functions as follows:

The impeller is rotated by the engine and converts the engine power into hydrokinetic energy. The fluid flows from the impeller vanes to the turbine vanes and returns to the impeller vanes through the stator vanes.



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Converter function

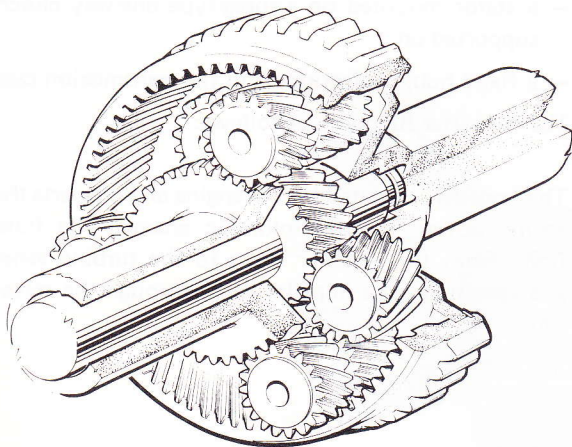
Mechanical power transmission system

Planetary gear

When a speed difference exists between impeller and turbine, the angle of the fluid flow from the turbine is changed by the stator vanes in such a way that the discharge of fluid from the stator assists in driving the impeller. Under such conditions, torque multiplication occurs and varies from 2:1 when the turbine is stalled (i.e. when, with any of the driving ranges selected, the vehicle is held stationary and the engine is operating at maximum throttle opening) to 1:1 when the turbine reaches a speed approximately 90 % of that of the impeller. When this speed differential between the impeller and turbine is achieved, the fluid angle from the turbine is such that the stator is driven in the same direction as the turbine and the impeller. Under these circumstances the converter becomes a fluid flywheel or coupling and there is no torque multiplication.

Transmission

The transmission consists of a mechanical power transmission system (planetary gear, two clutches, two brake bands and a one-way clutch) and a hydraulic system (an oil pump, centrifugal governor and a control valve system which regulates the fluid pressure and directs the fluid to the various gearbox components).



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27 670

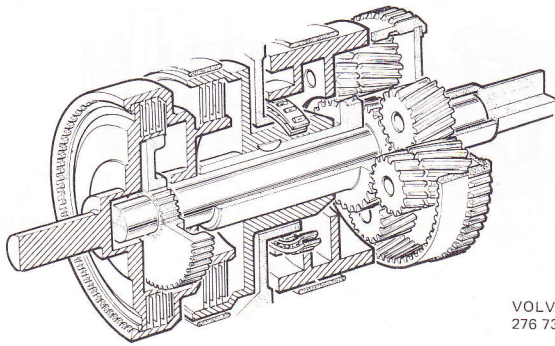
Planetary gear

The planetary gear set consists of two sun gears, two sets of pinions, a pinion carrier and a ring gear, see Fig. left.

Helical involute tooth forms are used throughout. In all forwards gears, power enters through the forward sun gear, in reverse, power enters through the reverse sun gear. Power leaves the gear assembly by the ring gear. The pinions are used to transmit power from the sun gears to the ring gear. In reverse, a single set of pinions is used which causes the ring gear to rotate in the opposite direction to the sun gear. In forward gears, a double set of pinions is used to cause the ring gear to rotate in the same direction as the sun gear. The carrier locates the pinions in their correct positions relative to the two sun gears and the ring gear (and also forms a reaction member under certain conditions). The various mechanical ratios of the gear set are obtained by the engagement of hydraulically operated multi-disc clutches and brake bands.

Clutches

The clutches consist of multi-disc units operated by hydraulic pistons. In all forward gears, the front clutch connects the converter to the forward sun gear, for reverse, the rear clutch connects the converter to the reverse sun gear.



Planetary gear, clutches and brake band

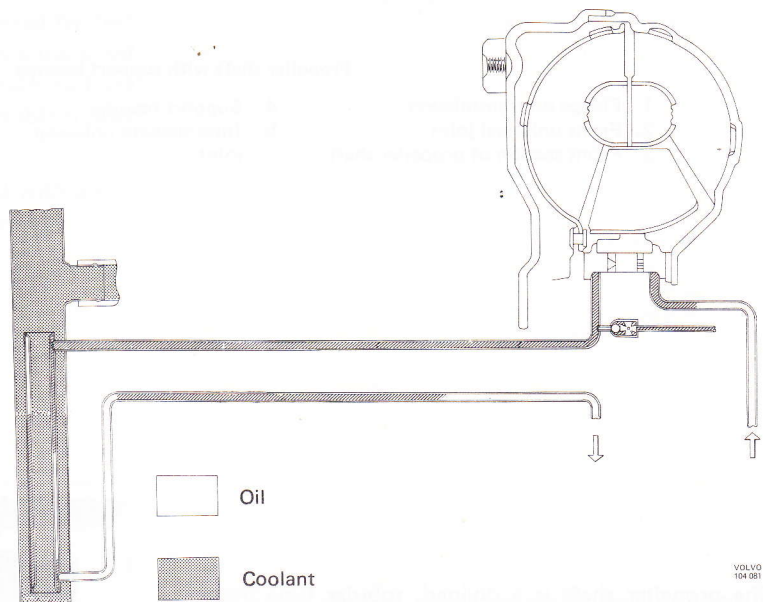
Brake bands

Brake bands, operated by power pistons, hold elements in the gear set stationary to effect an output speed reduction and a torque increase. In "lockup" the rear band holds the pinion carriers stationary and provides the 1st gear ratio of 2:39:1 and, in reverse, a ratio of 2.09:1. The front band holds the reverse sun gear stationary to provide the 2nd gear ratio of 2.45:1.

One-way clutch

In the drive position "D", a one-way clutch is used in place of the rear band to prevent the pinion carrier from turning opposite to engine rotation, thus also providing a 1st gear ratio of 2.39:1. This one-way clutch, allowing the transmission to free-wheel in 1st gear, provides smooth ratio changes from 1st to 2nd and vice versa.

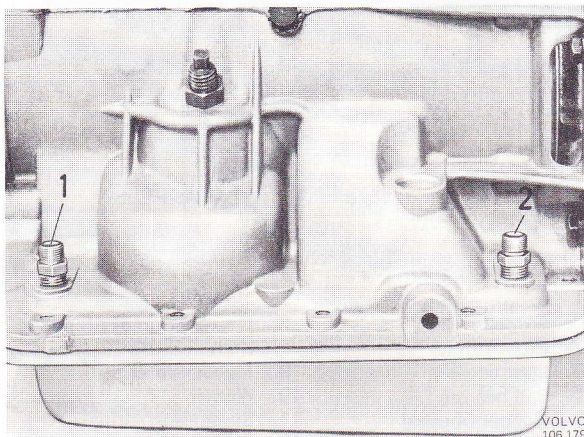
Oil Cooler



Oil cooler operation

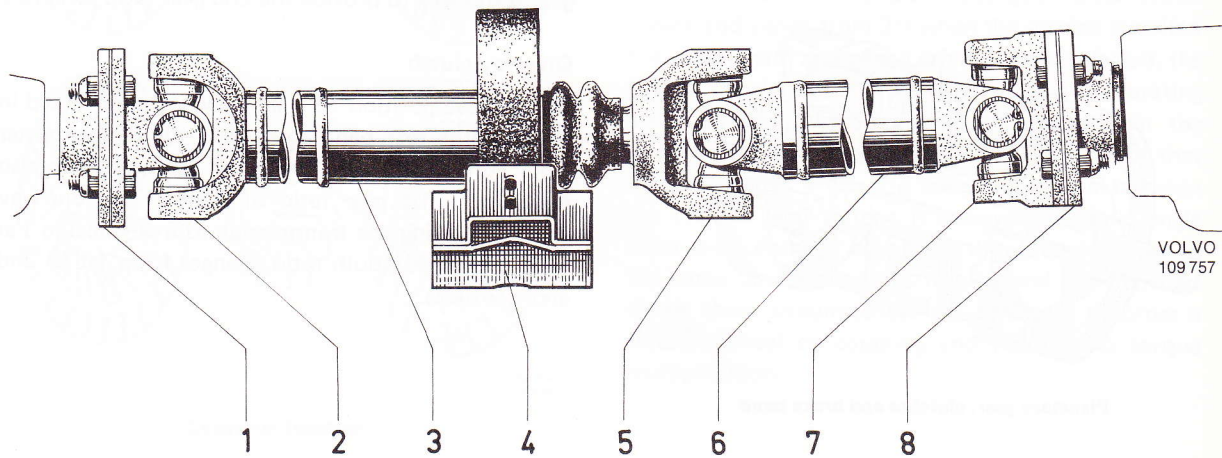
The automatic transmission is connected to an oil cooler. This is housed in the bottom tank of the engine radiator.

The oil cooler is connected to the nipples 1, 2, on the right side of the transmission.



Group 45

Propeller Shaft



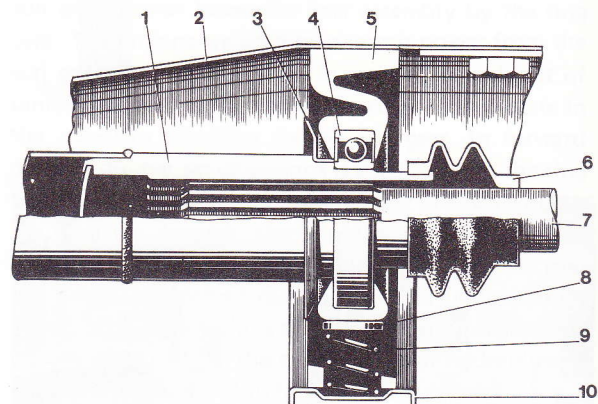
VOLVO
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Propeller shaft with support bearing

- | | | |
|-------------------------------------|---------------------------------|-------------------------|
| 1. Flange on transmission | 4. Support bearing | 6. Rear propeller shaft |
| 2. Front universal joint | 5. Intermediate universal joint | 7. Rear universal joint |
| 3. Front section of propeller shaft | | 8. Flange on rear axle |

The propeller shaft is a divided, tubular type shaft, see Fig. above. The front section rear end is formed as a splined sleeve. The corresponding splined shaft carries one of the intermediate universal joint yokes. The front section rear end is supported by a ball bearing. The ball bearing is in turn installed in a rubber bearing housing, which is attached to the propeller shaft tunnel with a cover, see Fig., right. The propeller shaft has three universal joints. Each joint consists of a cross with four trunnions which are carried in flange yokes by needle bearings.

The propeller shaft are paired and balanced together. The front and rear sections are individually marked with a yellow dot and an arrow. The propeller shaft must be replaced only as a paired unit and the front and rear sections have to be installed so that the arrows (the dots) point towards each other.



Support bearing

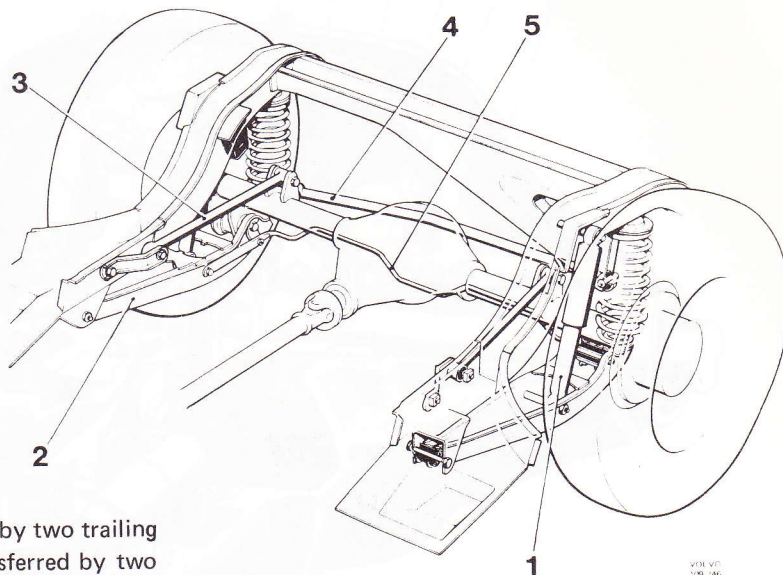
- | | |
|-------------------------------------|------------------------------------|
| 1. Front section of propeller shaft | 7. Nut |
| 2. Floor tunnel | 8. Rear section of propeller shaft |
| 3. Dust cover | 9. Rubber cover |
| 4. Ball bearing | 10. Washer |
| 5. Rubber housing | 11. Suspension spring |
| 6. Dust cover | 12. Cover |

Group 46

Rear Axle

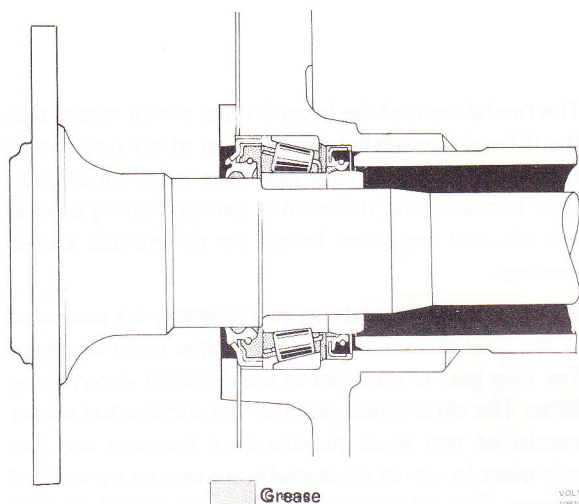
Rear suspension

1. Shock absorber
2. Trailing arm
3. Reaction rod
4. Track rod
5. Stabilizer



The rear axle is connected to the body by two trailing arms (2). Longitudinal forces are transferred by two reaction rods (3) and transversal forces by a track rod (4). Trailing arms, reaction rods and track rod are attached to body and rear axle by replaceable rubber bushings.

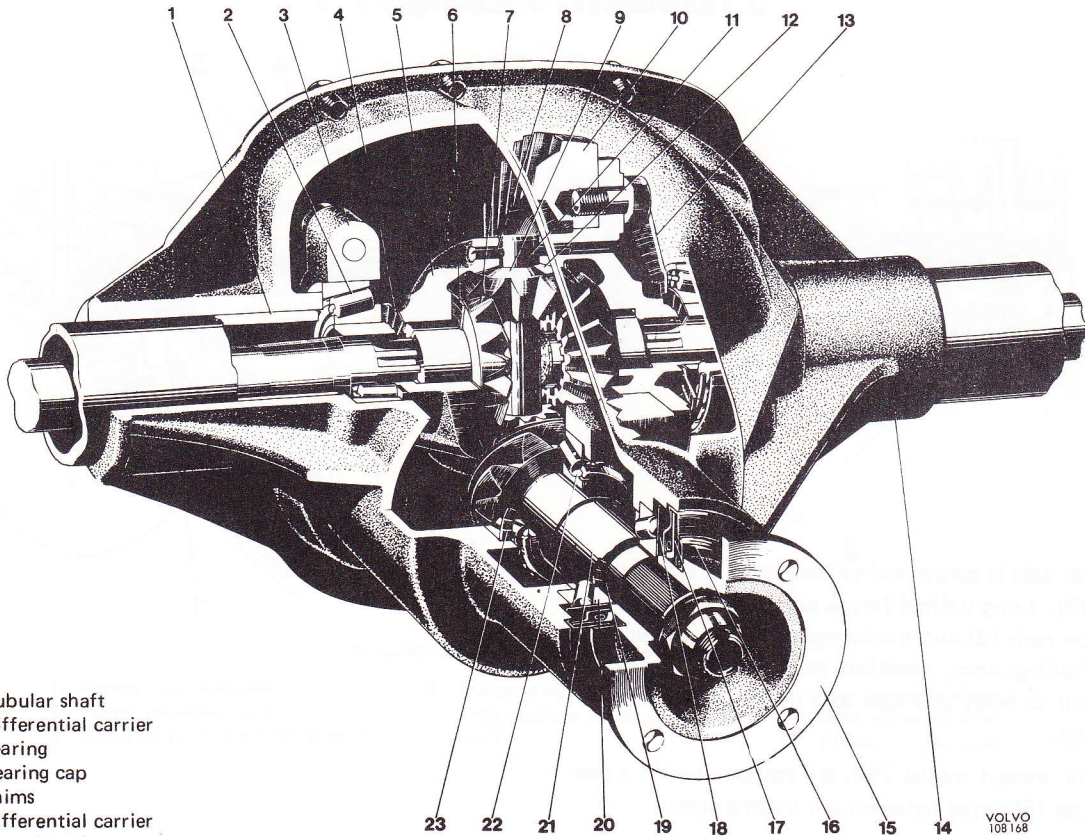
All cars, except model 245, are equipped with a rear stabilizer (5) fitted between the trailing arms.



Drive shaft journaling

The outer ends of the drive shafts are journaled in taper roller bearings. Bearing clearance is not adjustable and is determined by bearing design, see Fig. left. The drive shaft bearings are on the outside provided with oil seals.

Final Drive



1. Tubular shaft
2. Differential carrier bearing
3. Bearing cap
4. Shims
5. Differential carrier
6. Thrust washer
7. Differential side gear
8. Lock pin
9. Differential pinion
10. Crown wheel
11. Shaft
12. Thrust washer
13. Lock cover
14. Rear axle casing
15. Flange
16. Dust cover plate
17. Oil seal
18. Oil slinger
19. Shims
20. Front pinion bearing
21. Pinion
22. Rear pinion bearing
23. Shims

The final drive is of the hypoid type, which means that the drive pinion lies below the center of the ring gear. It consists of pinion, ring gear and differential gear. Gear backlash and differential carrier bearing tension are adjusted by shims inside the differential carrier bearings.

Differential carrier and ring gear assembly are journaled in the final drive housing by two taper roller bearings. The ring gear is attached to the differential carrier by bolts. The differential gears in the differential carrier consist of two bevel pinions on a trunnion and two side gears in which drive shafts are carried by internal splines. The differential gears are journaled so that they can rotate and permit the drive shafts to rotate at different speeds when the car is being driven in curves. There is a thrust washer under each of the differential gears.

The pinion bearings are taper roller bearings. The axial location of the pinion relative to the ring gear is adjusted by shims under the outer race of the rear pinion bearing.