

**SAAB**

**90**

**SERVICE  
MANUAL**

**4** Transmission

M 1985-

[www.saab-90.nl](http://www.saab-90.nl)



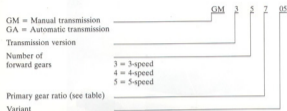
## Specifications



*Gearbox No., manual transmission*

## Model designation, manual transmission

The model designation is stamped beside the gearbox number and designates the following:



### Gear ratio code

Primary gear	Manual		6	7
	4	5		
Number of teeth, input/output gear	31/30	30/27	31/26	32/25
Gear ratio	0.97	0.90	0.84	0.78

## Clutch

Make	4-speed: Borg & Beck; 5-speed: Fichtel & Sachs
Type	Single, dry plate with spring-loaded hub (5-speed transmission includes predamper)
Operation	Hydraulically operated
Diameter	8 in (204 mm)

## Manual transmission

Oil capacity:	4-speed approx. 2.5 l 5-speed approx. 3.0 l
Oil specification	Engine oil SAE 10 W 30 or SAE 10 W 40, or SAE EP 75 API GL 4 or API GL 5

## Weights, including oil

4-speed	approx. 55 kg
5-speed	approx. 60 kg

## Drain plugs, 4-speed and 5-speed transmissions

### Transmission oil drain plug:

Parallel M18 x 1.5 thread on a square 10 mm socket-head plug.

When the gearbox is filled with the specified quantity of oil, the level on the dipstick will be between the MIN and MAX markings.

When filling an empty 4-speed transmission (overhauled transmission), note that the level will drop when the car is driven, since the primary gear case will take approximately 3 dl of oil. Note that under corresponding conditions, a 5-speed transmission will require 0.3 l for the primary gear and 2.7 l for the gearbox. Top up with oil when the level has dropped to the minimum mark or below. Overfilling of the transmission will result in stiff gear-changing when the gearbox is cold.

## Bearing preload

### Differential bearings:

New, lightly oil bearings  
Bearings having run more than 1200 miles (2000 km)

1.8–2.8 Nm (18–28 kgf cm)

0.8–1.3 Nm (8–13 kgf cm)

### Pinion bearing:

Measured using spring balance and cord wound round bearing housing:  
New, lightly oiled bearings  
Bearings having run more than 1200 miles (2000 km)

48–71 N (4.7–7.0 kgf) (25 ± 5 kgf cm)

19–43 N (1.9–4.3 kgf) (13 ± 5 kgf cm)

## Tightening torques

All 8 mm bolts  
Transmission drain plugs  
Engine  
Slave cylinder retaining bolts  
Pinion shaft nut closest to needle bearing (4-speed)  
M 10 x 1.25 crown wheel bolts  
Pinion shaft nut in clutch hub (5-speed)  
Nut on input shaft (5-speed)  
Pinion bearing housing

20–25 Nm (2–2.5 kgf m)

39–59 Nm (4–6 kgf m)

29–39 Nm (3–4 kgf m)

6–14 Nm (0.6–1.4 kgf m)

40–60 Nm (4–6 kgf m)

90 ± 10 Nm (9.0 ± 1 kgf m)

50 ± 10 Nm (5 ± 1 kgf m)

100 ± 10 Nm (10 ± 1 kgf m)

20–25 Nm (2–2.5 kgf m)

## Gearbox, summary

Model	Gearbox designation	Wheels	Dyn. rolling radius	Primary gear	Intermediate gear	Final drive	Overall gear ratio					Road speed, km/h, per 1.000 rpm					
							1	2	3	4	5	Reverse	1	2	3	4	5
1985	GM 45505	165 SR 15	312	30:27 0.90	17:33 1.94	9:33 3.67	12.81	7.24	4.86	3.30	-	14.09	9.2	16.2	24.2	35.6	-
	GM 45605	175/70 R 15	305	31:26 0.84	15:34 2.27	9:33 3.67	13.94	7.88	5.24	3.80	3.08	15.34	8.2	14.6	21.7	30.2	37.4

## Lubricants

Lubricants Esso Nebula EP 2 or Saab Special Chassis grease should be applied to the following points:

1. Inner coupling seals and the clutch shaft seal, the space between the seal lips.
2. A small amount of lubricant should be applied to the clutch shaft splines and the clutch shaft bearing prior to fitting.

Loctite 510 (45) 30 20 468 sealing compound should be applied to the surface between the primary gear housing and the gearbox housing.

Locking fluid (Loctite art No. (45) 30 09 081) is to be applied to the following points:

1. On the 12 bolts holding the differential bearing housing.
2. On the drain plug.
3. On the chain tensioner bolts.
4. On the two upper countersunk bearing retainer bolts.
5. On the slave cylinder bolts.
6. On the three cover retaining bolts.

**Note:** The sealing compound should only be applied to dry surfaces. The locking fluid (Loctite 242 (45) 30 07 200) is to be applied to the following points:

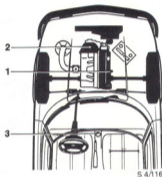
1. Reverse gear spindle stop bolt.
2. The reverse gear selector setscrew.
3. Allen screw, reverse gear and counter-shaft locking plate.
4. The four bolts in the pinion bearing housing.

Locking fluid (Loctite 242 part No. (45) 30 07 200) is to be applied to the following points:

- 12 hexagonal screws, crown wheel.  
Locking fluid (Loctite 270 part No. (45) 30 07 218) is to be applied to the thread pinion shaft nut.

The following slave cylinder components should be lightly oiled with Castrol UBCF 11:

Slave cylinder, inner and outer diameter, cylinder housing, lip seal and inner diameter of piston plus end surface against lip seal.



S 4/116

#### Lubricants general

	Lubrication point	Lubricant
1	Manual transmission	Engine oil SAE 10 W 30 or SAE 10 W 40 or SAE EP 75 API GL 4 or API GL 5
2	Clutch, release bearing	Permanently lubricated at factory, must not be washed
	Clutch, clutch shaft splines	Molybdenum paste in conjunction with fitting or Saab Special chassis grease
	Clutch, support bearing in flywheel	Permanently lubricated at factory, must not be washed
3	Gear lever housing	Soft EPI grease

## Special tools

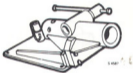
Certain tools are used in other groups in the Manual.



78 60 794 (A1) Floor stand (permanent mounting)



78 60 802 (A2) Oil pan



78 60 877 Bench stand, movable alt to 78 60 794  
78 60 885 Vise stand



83 90 460 (A2) Holder, gearbox



78 61 479 (A2) Stand  
83 90 478 (A2) Spindle for stand



83 92 409 (A1) Lifting yoke





83 93 175 (A1) *Lever for removal of clutch shaft  
(also suitable for fitting of spacer  
ring)*



83 90 023 (A1) *Spacer ring, clutch*



87 90 370 (A1) *Key, special nut, gear lever housing  
Also automatic transmission*



87 90 776 (A1) *Puller, inner drive shaft joint with  
bearing cap. Also used in automatic  
transmission*



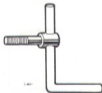
87 90 197 (A2) *Hook wrench, intermediate shaft*



83 90 049 (A2) *Puller, for fitting and removal of  
reverse gear shaft and intermediate  
shaft*



87 90 503 (A2) *Catch, reverse wheel*



87 90 511 *Puller, pinion shaft*

78 40 583 (A2) *Screw (for puller, pinion shaft)*



83 90 262 (A2) Guide pin, fitting of intermediate shaft



S 4653

87 90 552 (A2) Measuring device for pinion shaft housing position



87 90 438 (A2) Guide pin, pinion bearing housing. 2 are needed. Also in automatic transmission



83 90 148 (A2) Sleeve, installation of pinion shaft unit, inner roller bearing, primary gear housing pinion roller bearing and intermediate shaft inner ring and outer bearing. Removal of primary gear roller bearing, bearing housing outer rings, intermediate shaft inner ring and clutch shaft seal



87 90 636 (A2) Fixture for removal and fitting of bearing from pinion. Also for use on automatic transmissions



S 7452

87 90 925 (A2) Fitting ring (to be used with tool 87 90 636). For pinion shaft bearing fitting (5-speed)



S 4653

83 90 114 (A2) Sleeve for fitting of 4th gear, bearing housing outer rings, intermediate shaft inner ring and clutch shaft seal. Also used in group 1



S 4 079

87 91 097 Holder ring for pinion shaft with differential gear ratio 9:33.



S 7453

87 90 933 (A2) Puller ring (used with tool 87 90 636). Input shaft bearing removal (5-speed)



87 90 453 (A2) Spanner for pinion shaft nut



83 90 122 (A2) Drift for fitting of bearing housing outer ring (pinion) and ball bearing on 4th gear, and removal of primary gear with bearing from bearing housing



83 90 098 (A2) Dolly for fitting and removal of bearing housing outer roller bearing rings and pinion shaft



83 90 106 (A2) Drift for removal of pinion roller bearing outer ring



83 90 189 (A2) Drift for fitting of needle bearings in free wheel shaft and removal of free wheel shaft seal, free wheel shaft roller bearing input gear with ball bearing, outer bearing rings from bearing seats and steering knuckle housing outer ring and seal



S 4663

87 90 461 (A2) Sleeve, bearing ring, pinion bearing housing. Also used in automatic transmission



S 4664

83 90 064 Holder for pinion shaft



S 4668

87 90 487 (A2) Sleeve bearing differential housing. Also used in automatic transmission.



S 4611

83 90 130 (A2) Spring balance. Also in group 2



S 4666

87 90 677 (A2) Puller for sealing ring gear shaft



S 4672

87 90 685 (A1) Fitting tool for sealing ring, gear shift shaft



83 90 155 (A2) Measuring tool cpl. pinion



S 4670

83 90 288 (A2) Dial indicator retaining tool, backlash, differential



89 96 084 (A1) Puller for removal of front and rear axle hubs, gearbox differential housing bearing ring, and engine chain sprocket. Also in group 5 and 7



S 4674

87 90 768 (A2) Puller for removal of bearing ring, differential housing, gearbox, chain wheel, engine



89 95 177 (A2) Dolly for removal of bearing ring, differential housing



87 90 800 (A2) Drift for pressing in sealing ring, differential bearing cap



78 41 141 (A2) Sleeve for pressing in ball bearing, differential bearing cap. Also used in automatic transmission and Saab V4



78 41 067 (A2) Sleeve for removal of ball bearing, differential bearing cap. Fitting of bearing cap with ball bearing on inner driver. Also used in automatic transmission and Saab V4



87 90 818 (A2) Driver for measuring differential bearing torque. Also used in automatic transmission



83 91 997 (A2) Drift for clutch shaft seal (transmissions with chain-drive primary gear), needle bearing in primary gear housing



87 90 867 (A2) Ring for fitting of roller bearing on input shaft to transmission (5-speed transmission)



83 90 270 (A2) Tapping-out hammer. Also in group 5 and automatic transmission



87 90 909 (A2) 4 spacing bolts (for tool 87 90 511). Extraction of pinion shaft (5-speed)



83 90 312 (A2) *Drift for fitting of bearing races, input shaft*



78 41 075 (A2) *Sleeve for fitting of input shaft bearing*



87 90 891 (A2) *Puller for sprocket, primary drive. Used together with tapping out hammer 83 90 270*



87 90 917 (A2) *Adaptor (for hammer) Removal/fitting of input shaft (5-speed)*



87 90 859 *Sleeve for fitting of bearing, upper sprocket*

## Clutch

### General

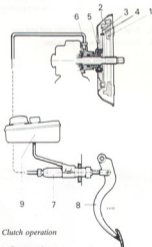
The car is fitted with a single dry plate clutch of diaphragm spring type. The principal clutch components are the disc, pressure plate assembly and release bearing. The clutch disc consists of a resilient steel plate attached to a hub which slides on splines on the clutch shaft. The clutch linings are riveted to both sides of the disc. 5-speed cars incorporate a hub equipped with a pre-damper.

The pressure plate assembly consists of the pressure plate, pressure spring (diaphragm spring) and housing. The spring acts as a lever and as pressure spring. The pressure plate assembly is an integral unit and should therefore not be dismantled.

The release bearing consists of a ball bearing with a specially designed elongated outer ring which presses directly against the diaphragm spring when the clutch is operated. Operation of the clutch is hydraulic. The clutch pedal acts on a master cylinder which is connected by a hose to a slave cylinder mounted on the transmission case. The slave cylinder is annular, and is mounted inside the clutch cover round the clutch shaft. The slave cylinder acts directly on the release bearing and adjustment of the clutch is automatic.



*Pressure plate*



*Clutch operation*

1. Pressure plate
2. Housing
3. Diaphragm spring
4. Pressure bearing rings
5. Release bearing
6. Slave cylinder
7. Master cylinder
8. Clutch pedal
9. Clutch fluid reservoir

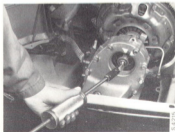
## Removal

1. Drain off the coolant through the radiator drain cock.
2. Remove the engine hood (see Group 2).
3. Disconnect the battery earth cable.
4. Disconnect the cable harness from the fan housing and the cables to the ignition coil, headlamp wiper motor and the fan thermal switch on the radiator.
5. Disconnect the hoses from the radiator.
6. Remove the grille.
7. Remove the front panel and radiator.
8. Remove the clutch cover bolts and remove the cover.
9. Mount spacer 83 90 023 between the clutch cover and the diaphragm spring. On fitting the spacer, have an assistant depress the clutch pedal.

If it is not possible to activate the slave cylinder in the normal manner, the clutch can be compressed using lever 83 93 175

10. Remove the retaining clip and seal cap.
11. Remove the plastic propeller.

12. Withdraw the clutch shaft by means of tool 83 90 270 and joint 83 90 015.

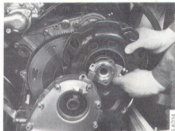




13. Remove the three bolts by which the slave cylinder (guide sleeve) is secured to the primary gear casing.
14. Remove the clutch retaining bolts and remove together the clutch, clutch disc and slave cylinder and release bearing. It is not necessary to disconnect the hydraulic hose on the slave cylinder.

**Caution**

Take care that the diaphragm spring does not damage the slave cylinder sleeve when the clutch is withdrawn.

**Assembly**

Before installing the clutch, check the clutch shaft seal and flywheel bearing:

- The seal is located inside the slave cylinder in the primary gear casing and forms a direct seal with the sealing surface of the clutch shaft.

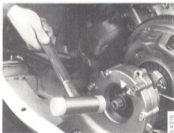
Refer to section 471 for changing of the clutch shaft seal.

1. Install together the clutch, clutch disc and slave cylinder (with release bearing) in the clutch cover and loosely fit two of the clutch bolts.

**Caution**

Take care that the diaphragm spring does not damage the slave cylinder sleeve during installation. Damage to the sleeve can result in the piston seizing. Ensure that the hardened side of the release bearing is turned towards the diaphragm spring.

2. Bolt the slave cylinder to the primary gear casing. Apply sealing compound to the bolts.
3. Grease the splines for the primary gear lightly with "Molycote G paste" and install the clutch shaft.



4. Fit the plastic propeller to the clutch shaft.
5. Fit the sealing cap and O-ring at the clutch shaft.
6. Bolt the clutch assembly to the flywheel.
7. Have an assistant depress the clutch pedal while you remove spacer 83 90 023.

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**Caution**

Do not depress the pedal further than is necessary to release the tool. There is otherwise a danger of the lip seal being pressed out too far, with the result that hydraulic fluid will escape and the seal will be damaged.

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8. Slide the dust seal and lock ring fully home against the release bearing.
9. Fit the clutch cover.
10. Fit the front panel and radiator.
11. Fit the grille.
12. Connect the water hoses and electric cables. Fill the radiator with coolant and bleed the cooling system.
13. Fit the engine hood and connect the battery.
14. Check the headlight alignment.

### Checking the clutch wear

Wear on the clutch disc can be checked through an inspection hole in the clutch cover. The inspection hole is equipped with a rectangular cover plate.



If the distance between the plastic sleeve front edge and the front edge of the turned surface is less than 2 mm, the clutch disc should be replaced.

#### Removing and fitting the clutch

##### Removal

1. Disconnect the battery and remove the ignition coil. Remove the main engine cover (see page 411-1).

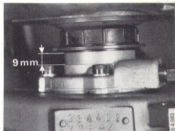
2. Disconnect the clutch master cylinder.

3. Disconnect the slave both end bearings.

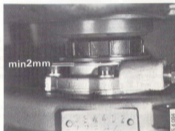
4. Disconnect the pressure of connecting.

5. Push down the pedal (loading with about 20 kg) and remove the connecting.

6. Push down the pressure roller.



*New clutch disc*



*Worn disc*

#### Master cylinder, R.H.D. car

##### Removal

1. Disconnect the battery and remove the main engine cover (see page 411-1). The main engine cover is a push rod, pusher, pusher and pusher spring (see illustration). The end of the pusher is sealed by a rubber sleeve.

##### Warning

1. Disconnect the brake fluid from the slave cylinder and push the fluid into a clean container.

2. Disconnect the push rod from the clutch master cylinder. Tighten the push rod and slack bolt.

3. Remove the retaining screws and remove the master cylinder.

##### Fitting

1. Mount the master cylinder.

2. Connect the push rod to the clutch master cylinder by inserting the shaft into the hole in the end of the push rod and the hole in the master cylinder. Tighten the push rod and slack with the 1000 gm.

3. Connect the hose.

4. Check the system.

## Linings

### Inspection of dismantled clutch and linings

1. Inspect the surface of the flywheel where the clutch disc makes contact. Blueing or small cracks on the surface are of no particular importance, but if there is any deep scoring, the flywheel should be machined down or replaced.
2. Check the pressure plate in the pressure plate assembly for scratches and distortion and also for wear to the contact surface between the diaphragm spring and the release bearing. If there are any irregularities, cracks or excessive wear the plate should be exchanged.
3. Check the release bearing for noise, wear, etc.
4. Check the disc for wear and fit new linings if necessary.

#### Check values for clutch disc:

- Under a compressive force of 4230 N, 948 lb (430 kg) applied between two parallel surfaces, the thickness of the clutch disc should be 0.28–0.30 in (7.11–7.62 mm). The clutch disc should be completely free after the surfaces have been withdrawn 0.05 in (1.27 mm) from the loaded position.

#### Note

In cars with clutches of Fichtel und Sachs make (5-speed cars), the flywheel retaining bolts have flatter heads to accommodate the clutch pre-damper. When fitting new bolts, make sure that they are of the correct type.

## Removal

1. Remove the clutch disc from the flywheel.
2. Unbolt the pressure plate from the flywheel.
3. Remove the pressure plate from the flywheel.
4. Remove the release bearing from the pressure plate.
5. Lubricate the release bearing with grease.

Reassemble

## Master

### General

The master cylinder is mounted on the right hand side of the engine compartment. The master cylinder is connected to the slave cylinder by a push rod.

## Removal

1. Disconnect the push rod from the slave cylinder.
2. Remove the master cylinder from the engine compartment.
3. Unbolt the master cylinder from the engine compartment.

## Installation

1. Mount the master cylinder on the engine compartment.
2. Connect the push rod to the slave cylinder.
3. Connect the master cylinder to the slave cylinder.
4. Bleed the clutch system.

## Clutch control

### Removing and fitting the clutch pedal

1. Remove the split pin and washer and pull out the clevis pin in the master cylinder push-rod.
2. Unhook the clutch pedal return spring.
3. Remove the pivot bolt and the pedal.
4. Remove the spring if necessary.
5. Lubricate the pedal bearing with chassis grease before reassembling.

Reassemble in the reverse order.



1. Spring
2. Bolt
3. Pivot bolt
4. Push rod
5. Clevis pin

### Master cylinder, R.H.D. cars

#### General

The master cylinder consists of a cast housing surrounded by a sheet metal fluid container. The operating elements consist of a push rod, piston, piston seal and return spring (see illustration). The end of the push rod is sealed by a rubber bellows.

#### Removing

1. Disconnect the hose from the slave cylinder and pump out the fluid into a clean container.
2. Disconnect the push rod from the clutch pedal by removing the split pin and shaft bolt.
3. Undo the retaining screws and remove the master cylinder.

#### Installing

1. Mount the master cylinder.
2. Connect the push rod to the clutch pedal by inserting the shaft bolt through the holes in the fork of the push rod and the hole in the clutch pedal. Locate the push rod and secure with the split pin.
3. Connect the hose.
4. Bleed the system.



Clutch master cylinder

1. Housing
2. Spring
3. Spring seat
4. Seal
5. Washer
6. Piston
7. Seal
8. Lock ring
9. Rubber cover
10. Push rod
11. Clevis pin

S 1800

## Master cylinder L.H.D cars

### General

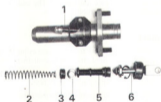
The master cylinder is placed under the servo unit and is actuated by a push rod from the clutch pedal. In the cylinder is besides the push rod, piston, piston seals and return spring. The clutch fluid container is incorporated in the brake fluid container completely separated from the brake fluid. From the container a hose leads to the clutch cylinder.

### Removal

1. Detach the clamp holding the pipe from the clutch cylinder at the body and remove the pipe at the cylinder.
2. Remove the left hand screen under the instrument panel.
3. Remove the pin holding the push rod to the clutch pedal.
4. Remove the nuts inside the dash panel and remove the clutch cylinder from the engine compartment. Pull off the hose from the fluid container and hang it up so that the fluid is not coming out.

### Dismantling (R.H.D. and L.H.D. versions)

Pull back the sealing bellows and remove the lock ring with a pair of pliers. Take out the push rod with the washer. The piston and its seal is now visible. Remove the piston, washer, piston seal and spring. Take the seal carefully off the piston. Examine the cylinder walls; if they are smooth and unscratched, new seals can be fitted, but if the surface of the cylinder bore is rough, a complete new cylinder should be installed. If the old seals on the piston are enlarged or swollen, they are probably contaminated with mineral oil; this is the most common cause of cylinder malfunction. Seals made of natural rubber are very sensitive to mineral oil, and even small quantities of oil can cause them to swell with time. If this is suspected, change all the seals and flush the system with clean hydraulic brake fluid.



Clutch master cylinder (L.H.D. cars)

1. Housing
2. Spring with seat
3. Sealing
4. Washer
5. Piston and rear seal
6. Push rod with stop washers, lock ring and bellows

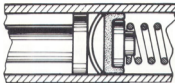
## Assembling (R.H.D. and L.H.D. versions)

Fit the return spring with its retainer. Lubricate the piston and seals thoroughly with Girling Rubber Grease 3 and fit the packing, washer and piston with seals.

### Note

The washer must be fitted with the convex side facing the piston (see illustration).

Fit the push rod into the cylinder, followed by the washer and lock ring, which are located in the cylinder housing groove. Replace the sealing bellows or fit a new bellows if the old one is damaged.

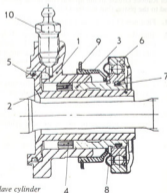


## Fitting

1. Connect the hose from the reservoir to the cylinder.
2. Position the cylinder in place and fit the nuts from inside the car.
3. Connect the push rod to the pedal.
4. Refit the safety padding under the instrument panel.
5. Connect the clutch pipe, top up with fluid and bleed the system.

## Slave cylinder

The slave cylinder is an annular hydraulic cylinder mounted inside the clutch cover and enclosing the clutch shaft. The slave cylinder consists of an outer cylinder housing and an internal sleeve, between which there is an annular piston and a lip seal. The release bearing is locked to the piston by means of an O-ring and a circlip. When the clutch pedal is depressed, the slave cylinder piston and release bearing act directly on the diaphragm spring of the clutch. When the pedal is released, the release bearing and pistons are returned by the diaphragm spring. Further return of the piston is prevented by the friction of the lip seal in the slave cylinder and by the friction between the dust seal and the piston and slave cylinder housing. This means that when the clutch pedal is in the rest position, the release bearing is in contact with the diaphragm spring. Adjustment of the clutch is thus automatic, with the dust seal advancing along the housing in pace with the wear to the clutch lining.

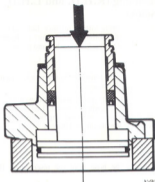


Slave cylinder

- |                           |                             |
|---------------------------|-----------------------------|
| 1. Slave cylinder housing | 6. Release bearing          |
| 2. Sleeve                 | 7. O-ring                   |
| 3. Piston                 | 8. Circlip                  |
| 4. Lip seal               | 9. Dust seal with lock ring |
| 5. O-ring                 | 10. Bleed nipple            |

### Dismantling the slave cylinder

1. Remove the release bearing from the slave cylinder.
2. Remove the dust seal.
3. Press out the slave cylinder sleeve and remove the O-ring from the flange of the sleeve.
4. Remove the piston and lip seal.

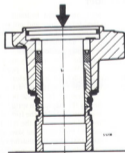


### Assembly

Thoroughly clean the slave cylinder. Wash the parts in brake fluid or a special cleaning fluid for hydraulic brake components, e.g. a mixture of cleaning spirit and acetone.

The lip seal should never be allowed to come into contact with mineral oil. Apply a thin coating of Castrol Rubber Grease to the lip seal (not in the groove) and to the piston (but not the O-ring).

1. Fit a new O-ring to the flange of the sleeve.
2. Slide the lip seal onto the sleeve. Dip the flange of the sleeve in brake fluid and insert the sleeve into the slave cylinder housing, making sure it is the right way round (see illustration). Insert the lip seal part of the way into the housing.
3. Guide the sleeve into the housing by pushing in the piston. The lock ring and O-ring should be fitted to the piston.
4. Press the sleeve into the housing (see illustration), ideally by means of a spare slave cylinder piston.
5. Fit the dust seal and the release bearing.





### Bleeding the master and slave cylinders

1. Connect a hose (about 1/4" or 6 mm ID) to the slave cylinder bleed nipple, and place the free end in a container part-filled with hydraulic brake fluid.
2. Top up the master cylinder reservoir with brake fluid as necessary.
3. Open the bleed nipple on the slave cylinder a half turn.



Master cylinder, clutch

"A" Master cylinder, clutch

"B" Clutch fluid reservoir (incorporated in the brake fluid reservoir)

4. Place the coolant system tester over the filler opening of the master cylinder.
5. Pump once or twice until all air has been expelled from the system.
6. Close the slave cylinder bleed nipple.
7. Check that all air has been expelled by depressing the clutch pedal.

## General 4-speed and 5-speed transmissions

### Manual 4-speed transmission

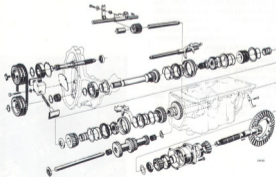
The transmission is designed for front-wheel drive in such a way that all shafts and gears, the differential and inner universal joints form an integral unit.

There is synchronization on all forward gears while reverse is engaged by a sliding gear. The shafts are journalled in the transmission case in ball and taper roller bearings. The pinion shaft gearwheels are journalled on bushes. All gearwheels except reverse are in constant mesh and have spiral-cut teeth.

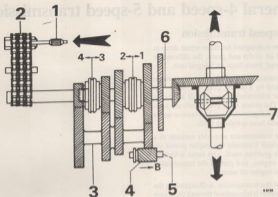
The front of the transmission assembly consists of a primary drive which transmits the engine power via the clutch to the gearbox itself. The latter is located underneath the engine, and part of the transmission case serves as an engine oil sump.

The operation of the transmission is illustrated in the diagram. Shaft power is transmitted through the clutch and primary gear to the input gear in the gearbox. When the car is being driven in 1st gear, power is transmitted by the layshaft to the pinion shaft through the No. 1 gear, which is journalled on the pinion shaft and locked to it by a sliding muff.

In 2nd or 3rd gear, power is transmitted to the pinion in the same way but with No. 2 or No. 3 locked to the pinion shaft by a coupling muff. For driving in top gear, the input shaft in the gearbox is locked to the pinion shaft direct by a coupling muff, i.e. in this case, power is not transmitted through the layshaft.



4-speed transmission, exploded view

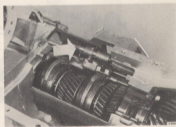


4-speed transmission, schematic diagram

- |                              |                          |
|------------------------------|--------------------------|
| 1. Clutch shaft              | 5. Reverse gear shaft    |
| 2. Primary drive             | 6. Pinion shaft          |
| 3. Layshaft                  | 7. Differential housing. |
| 4. Reverse gear (idler gear) |                          |

Reverse drive is provided by an extra reverse gear shaft. A gear journalled on this shaft is in constant mesh with 1st gear on the layshaft. The gear pinion can be engaged with a gearwheel on the pinion shaft. This gear is located behind the 1st gear on the pinion shaft. Thus when the car is being driven in reverse, power is transmitted from the layshaft to the reverse gear, and thence to the pinion shaft. This arrangement reverses the direction of rotation of the pinion shaft.

The gearbox is fitted with a braking device which provides smoother selecting of reverse. The device comprises a spring mounted on the gear selector rod. When reverse gear is selected, the spring applies a light pressure to the gear shift fork for 1st and 2nd gears, whereupon the 1st gear synchronization, applies a braking effect on the gear.



Braking device for reverse gear

## Manual 5-speed transmission

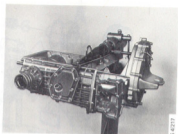
The transmission is designed for front-wheel drive in such a way that all shafts and gears, the differential and inner universal joints form an integral unit.

There is synchronization on all forward gears, while reverse is engaged by a sliding gear. The shafts are journalled in the transmission housing in ball and taper roller bearings. The pinion shaft gearwheels are journalled on bushes. All gearwheels except reverse are permanently in mesh and have helical teeth. The layshaft gears are mounted on needle bearings and the constant mesh gear is run on individual balls.

The front of the transmission assembly consists of a primary drive which transmits the engine power via the clutch to the gearbox itself. The latter is located underneath the engine, and part of the transmission case serves as an engine oil sump.

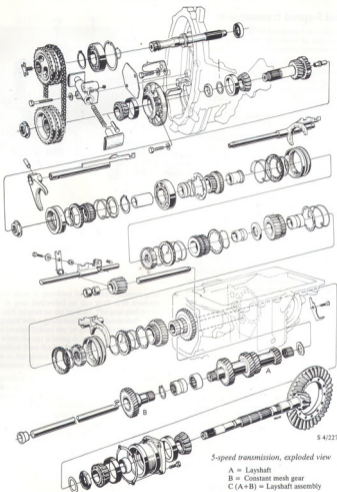
The operation of the transmission is illustrated in the diagram. Shaft power is transmitted through the clutch and primary gear to the input shaft in the gearbox. When the car is being driven in 1st gear, power is transmitted by the layshaft to the pinion shaft through the No. 1 gear, which is journalled on the pinion shaft and locked to it by a sliding muff.

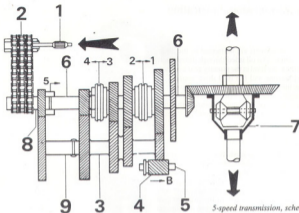
In 2nd, 3rd or 4th gear, power is transmitted to the pinion in the same way but with No. 2, No. 3 or No. 4 locked to the pinion shaft by a sleeve. For driving in top gear, the input shaft in the gearbox is locked to the pinion shaft direct by a sleeve, i.e. in this case power is not transmitted through the layshaft.



Manual transmission, 5-speed

5.4217





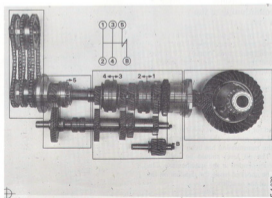
S 4 077

5-speed transmission, schematic diagram

Reverse drive is provided by an idler shaft for reverse. A gear journalled on this shaft is in constant mesh with 1st gear on the layshaft. The gear pinion can be engaged with a gearwheel on the pinion shaft. This gear is located behind the 1st gear on the pinion shaft. Thus, when the car is being driven in reverse, power is transmitted from the layshaft to the reverse gear, and thence to the pinion shaft. This arrangement reverses the direction of rotation of the pinion shaft.

1. Clutch shaft
2. Primary drive
3. Layshaft gear cluster
4. Reverse gear (idler gear)
5. Reverse gear idler shaft
6. Pinion shaft
7. Differential housing
8. Input shaft
9. Constant mesh gear

B = Reverse



S 4 078

## 5-speed transmission, lubricating system

### General

The gearbox components are lubricated by the oil in the gearbox sump. The oil is led through distribution channels to the same level in the primary gear housing, the gearbox housing and the final drive housing. A ball valve is installed in the primary gear housing to prevent changes in the level of the lubricant when the car is travelling downhill, thereby ensuring that the final drive unit will be properly lubricated.

### Lubrication

The crown wheel and the layshaft gears are partially submerged in oil. When the transmission is in motion the oil is delivered to the primary gear chain housing via an oil catcher. The oil collected here forms a sump which lubricates the chains, sprockets and input shaft bearing. Excess oil is returned to the primary gear housing and the gearbox housing via two oil catchers which lubricate the pinion shaft gear. The oil passes through drilled channels in the input and pinion shafts and via connecting pipes to 4 lubrication points on the pinion shaft for the gear bearings.

### Ventilation

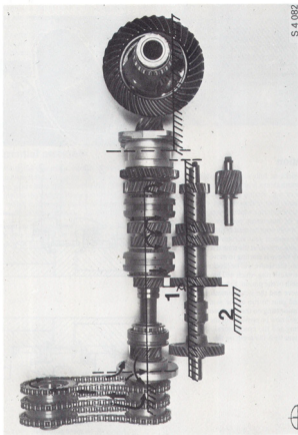
A vent in the panel on the chain housing cover compensates the pressure changes in the gearbox.

### Replenishing the transmission oil after repair or reconditioning of the transmission

Add half a pint (0,3 l) of oil through the panel in the chain housing cover and the remaining 2,7 litres of oil should be used to fill the gearbox. Approx. 2,6 litres of oil is needed before the oil will flow through the aperture into the primary gear housing. The lower periphery of the aperture is on the same level as the maximum mark on the dipstick.

### Oil

Engine oil is used for lubrication of the transmission. After the 2 000 km service, the oil need only be changed when the transmission has been repaired or reconditioned. The oil level should be topped-up using the oil recommended in the specification. The oil level should be checked using the dipstick on the right-hand side of the gearbox.



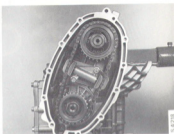
Lubricating system

1. Ball valve
2. Oil level



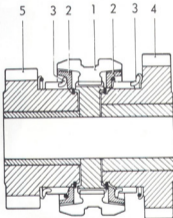
## Primary drive

The primary drive consists of a chain transmission comprising three simple chains. Located between the chains is a chain tensioner comprising two spring-loaded tensioner pads with hydraulic damping. Oil flows continuously from the primary drive case to the oil trap of the chain tensioner housing. Non-return valves providing an hydraulic damping function are located in the passages between the oil trap and the chain tensioner cylinders.



## Synchronization

Synchronization works as follows (see illustration). When the synchromesh sleeve is about to engage with the coupling teeth of e.g. second gear, the internal tapering of the sleeve first makes contact with the spring-loaded synchromesh ring which is engaged with the gearwheel. In its outermost position, the synchromesh ring can rotate approximately half the pitch of one tooth. If the second gear is running at a different speed to the pinion shaft at the time it is about to be engaged, and the sleeve is starting to move towards second gear position, the sleeve will be blocked by the teeth on the synchromesh ring which will have moved in relation to the teeth of the pinion. Friction between the taper in the sleeve and the synchromesh ring will cause the sleeve and gear to run at the same speed, whereupon the torque acting on the synchromesh ring will be reduced. It will now be possible for the teeth on the synchromesh ring and the synchromesh sleeve to slide into engagement with the teeth on the pinion.



Synchromesh unit

S 4545

1. Synchromesh sleeve
2. Synchromesh ring
3. Spring
4. 1st speed gearwheel
5. 2nd speed gearwheel

The gearbox is fitted with a braking device which provides smoother selecting of reverse. The device comprises a spring mounted on the gear selector rod. When reverse gear is selected, the spring applies a light pressure to the gear shift fork for 1st and 2nd gears, whereupon the 1st gear synchronization, applies a braking effect on the gear.



### Differential assembly

The differential assembly consists of two differential gears and two front axle gears, one for each front axle. All these gears have spur bevel teeth. The axle gears are splined to the ends of the inner drivers. The crown wheel, which is driven from the transmission by the pinion shaft, is screwed to the differential case.

The speedometer drive gear is secured to the differential case by a lock ring. Its rotation is transmitted by a worm gear to the speedometer cable attachment.

## Removal and installation

### Removal

For major work on the engine and transmission, the entire power unit should be lifted out. Removal of the engine by itself is not recommended.

1. Remove the hood as follows:  
Mark the position of the hood relative to the hinges.  
Remove both the hood fastening bolts. Lift off the hood. For this you need a helper to hold one side of the hood to help lift it clear.
  2. Detach the battery cables. Unclamp and lift out the battery.
  3. Drain the coolant through the radiator and engine block drain cocks.  
(Later-version engine blocks are equipped with a drain plug).
  4. Detach the vacuum hose of the servo cylinder from the inlet manifold and the fuel hose from the suction side of the fuel pump and, as from 1981 models, the fuel recirculation hose.
  5. Undo the cable connections to the ignition coil, temperature transmitter, oil pressure transmitter, radiator fan, thermostat, headlights and headlight wipers.
- 
- Caution**  
Do not detach the connections by pulling the cables. Grip the connecting pieces.
- 
6. a. Remove the air cleaner, the inlet hose and the preheater complete with hose.  
b. Detach the throttle cable from the driver and bracket.  
c. Detach the choke cable and sheath from the carburetor.
  7. Detach the hoses at the connections to the thermostat housing, radiator, inlet manifold and water pump.
  8. a. Remove the grille.  
b. Disconnect the hood lock cable from its fastenings at the bulkhead and wheel housing.  
c. Remove the two front panel retaining bolts and nuts, and the four screws through the headlight surrounds car body and front panel.  
d. Remove the front panel by lifting forwards and upwards.
  9. Disconnect the clutch hose from the slave cylinder. Plug the hose and the hole in the slave cylinder.
  10. Disconnect the exhaust pipe from the exhaust manifold.
  11. Disconnect the ground cable from the transmission.
  12. Jack up the front of the car and place blocks under the body.
  13. a. Put the gear lever in reverse.  
b. Undo the clamp between the gear selector rod joint and the rod.  
Separate the gear selector rod joint from the gear selector rod.
  14. Detach the speedometer cable from the transmission.
  15. Undo the engine brackets.
  16. Undo the large clips round the rubber bellows on the inner universal joints.
  17. Attach lifting yoke 83 92 177 to the two engine lifting lugs.
  18. Undo the lower end piece from the control arm on the right hand side and turn the steering wheel to the left. Raise the engine a little and withdraw the left universal joint.
  19. Lift the engine to a convenient height for access to the cable connections on the starter. Disconnect the cables.
  20. Lift out the engine and transmission. Fit protective caps over the inner drivers and rubber bellows.

## Installing

1. Make sure the front of the car is finally supported on blocks.
  - a. Check that the inner universal joints are packed with grease.
  - b. Check the front engine rubber. Make sure that the washer is properly tightened.
2. Lift the engine using the lifting yoke (tool 82 92 177) and lower it into the engine compartment to a convenient height for access to the starter.
3. Connect the starter cables.
4. Assemble the inner universal joints as follows: Hang the clips on the inner drivers. Lower the engine until it is 2-2 1/2 in (50-60 mm) above the engine rubbers. Assemble the right-hand universal joint, then lower the engine to about 1 in (20-30 mm) above the engine rubbers and push it over to the right. Lower the engine and position it over the mounting rubbers while guiding the left-hand universal joint into place. Connect the end piece to the lower control arm.
5.
  - a. Align the engine mountings.
  - b. Tighten the engine mounting bolts.
6. Remove the lifting yoke.
7.
  - a. Slide the rubber bellows over the inner universal joint driver and fit the clips.
  - b. Wipe any surplus grease off the rubber bellows and check that the bellows are not deformed.
8.
  - a. Connect the gear selector rod joint to the gear selector rod and carry out the adjustment described in section 432.
  - b. Connect the speedometer cable to the transmission.
9. Connect the hose to the slave cylinder and bleed the clutch system.
10. Bolt the exhaust pipe the exhaust manifold.
11. Lower the front of the car.
12. Connect the ground cable.
13. Mount the front panel complete with radiator and connect the hood lock operating cable to the attachment at the bulkhead.
14. Fit the grille.
15. Reconnect the cables to the radiator fan, thermostat, headlights, headlight wiper motor and clip the harness to the front panel.
16. Connect the coolant hoses to the radiator, thermostat housing, water pump and inlet manifold.
17. Connect the brake servo vacuum hose and fuel hose and connect the cables to the temperature transmitter, ignition coil and oil pressure transmitter.
18. Connect the throttle cable to the driver and bracket.
19.
  - a. Fit the air cleaner, preheater and associated hoses.
  - b. Connect the ventilation hose.
  - c. Connect the cables between the distributor and ignition coil.
  - d. Connect the fuel line and the fuel recirculation line.
20. Install the battery and connect the cables.
21. Close the radiator and engine block drain cocks and then fill the engine with coolant and oil. Bleed the cooling system.
22. Start the engine, checking oil pressure and coolant temperature. Check the operation of the transmission. Check the operation of the radiator fan by grounding the thermostatic switch cable to the radiator.
23.
  - a. Mount the hood and connect the windshield washer hose.
  - b. Check the fit of the hood. Close the hood, open the doors, and check that the door jamba clear the rear edge of the hood.
  - c. Check the headlight alignment.
24. Take the car out for a test run. Check the coolant level after driving.

## Separating the engine and the manual transmission

1. Clean the entire unit.
2. Drain the engine oil.
3. Take off the clutch cover.
4. Remove the starter.
5. Withdraw the clutch shaft (see instructions for dismantling the clutch).
6. Remove the three slave cylinder retaining bolts.
7. Remove all bolts in the mating flanges of the engine and the transmission.
8. Lift the engine carefully off the transmission, removing the slave cylinder at the same time.

If the engine and transmission fail to separate, never attempt to force them apart without first checking that all bolts have been removed.

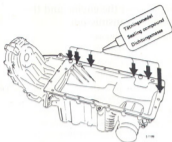
To refit, reverse the above procedure. Apply sealing compound to the three slave cylinder retaining bolts.

When assembling the engine and transmission:

- Ensure that the mating flanges between the engine and transmission are absolutely clean.
- Check that the two dowels are fitted in the transmission casing.
- Fit a new gasket on the transmission housing. Add Dirko (45) 3021243 sealing compound to the grooves in the end flanges (see illustration).



- Apply thread sealing compound to the six bolts for the holes indicated in the lower illustration.



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## Transmission control

### Manual 4-speed and 5-speed transmissions

#### General

Gear shifting is controlled by a floor-mounted lever located between the front seats.

The gear lever is fitted with a reverse gear catch which can be released by lifting the sleeve under the lever knob. The rest of the transmission control system consists of a gear lever housing recessed into the floor between the front seats and a rod that transmits gear lever movements to the gearbox.

On 5-speed transmissions, the gear lever is spring loaded such that the lever has a tendency to return to the position between third and fourth gears. Consequently, a slight resistance is felt on selecting 1st, 2nd, 5th and reverse gears.

#### Adjusting the gear positions

*Presetting (when fitting the power unit)*

##### Gearbox

1. Engage reverse gear. The gear-shift rod joint should be fitted to the gear-shift shaft of the gearbox.

##### Gear lever

2. Lock the gear lever in the reverse position by fitting a 6 mm dia. screwdriver or drift in the locking holes of the gear lever housing and gear-shift rod. The locking holes are accessible after the cover over the gear lever housing has been removed.

Remove the rear centre console.



3. Connect the gear-shift rod to the joint and tighten the clamp on the joint. Tightening torque: 17–22 Nm (1.7–2.2 kgf m).



S 4 140

#### Adjusting

1. Engage reverse gear.
2. Release the clamp on the gear-shift rod joint so that the rod can be moved in the joint.
3. Lock the gear lever as described in item 2 under "Presetting".
4. Check that reverse gear is in full engagement in the gearbox.
5. Tighten the clamp on the joint. Tightening torque: 17–22 Nm (1.7–2.2 kgf m).

#### Note. 5-speed version

After carrying out presetting and adjustment, check that, when in neutral, the gear lever is in line with the 3rd – 4th gate. If the position of the gear lever is displaced to the side, the control unit should be adjusted. See "Adjusting the spring-loading of the gear lever".

#### Dimension for the locking stud

The gear lever locking stud has the same adjustment dimension for 4-speed and 5-speed transmissions:  $22.5 \pm 0.50$  mm.



S 4 141

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#### Gear

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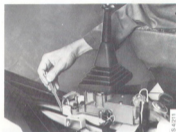
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### Adjusting the gear lever spring-loading

The adjustment is made on the control unit located in front of the gear lever housing.

1. Remove the front passenger seat and fold back sufficient of the carpeting to allow the heating duct to be removed.
2. Select 3rd gear.
3. Remove the bolts holding the control unit onto the gear lever housing.
4. Adjust the control unit so that the rollers reach the bottom of the plunger groove and the tension spring adopts its shortest length. Retighten the control unit.
5. Return the gear lever to neutral and check that the spring-loading moves the gear lever across the gate to a position opposite 3rd and 4th gears.
6. Refit the heating duct, the carpeting and the passenger seat.



### Gear lever lock

#### General

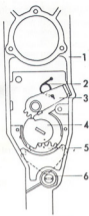
The car is equipped with a combined ignition switch and gear lever lock. When the gear lever is placed in reverse and the ignition key is withdrawn, the gear lever is locked. The ignition switch has the following positions:

- L. Locked. Reverse gear must be engaged before the key can be turned to L, and the key can only be withdrawn in this position. Parking lights and hazard warning lights can be switched on.
- G. Garage. All lights can be switched on.
- K. Drive. All electrical systems, including the ignition circuit, are live.
- S. Start. This position has a spring-loaded return to K.



Lock cylinder and key

1. Key
2. Lock cylinder



Gear lever lock

1. Housing
2. Spring
3. Locking tongue
4. Cogwheel
5. Toothed segment
6. Lock cylinder

### Ignition and starter switch

To remove the gear lever housing complete with the ignition and starter switch

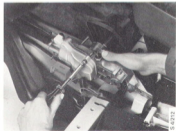
1. Disconnect the battery leads.
2. Remove the driver's seat.
3. Put the lever in the position for reverse gear and remove the ignition key.
4. Lift the rubber boot and remove the two screws from the front of the upper section of the console. Raise the console slightly and disconnect the leads from the switch for the interior lighting. Remove the circular light diffuser from the ignition switch and set it aside carefully. Remove the upper console section.



5. Insert the ignition key and move the gear lever to neutral.
6. Remove the ashtray from the back of the console. Undo the retaining screws (two at the front, two at the back and one in the centre) and remove the console.

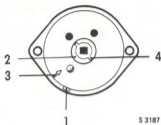


7. Fold back the carpet, remove the panel from between the heater ducts and remove the left-hand duct.
8. Disconnect the leads to the ignition switch and the reversing light switch.
9. Unhook the spring from the control unit (five-speed models only). Undo the retaining bolts for the gear lever housing using special key 87 90 370. If the entire gear lever housing is to be removed, undo the two screws securing the plastic bottom section and remove the housing.
10. Remove the two screws holding the starter contact (ignition switch) and remove the contact.



## Refitting

1. Insert a screwdriver in the slot (4) and turn the switch to bring the mark (2) opposite the arrow (3) (see illustration).
2. Check that the ignition key is in position L (locked).
3. Fit the switch with the locating stud (1) in the matching groove in the gear lever housing.
4. Turn the ignition key back and forth to make sure that the gear lever lock does not stick or jam.
5. Fit the cover plate.
6. Fit the gear lever housing and check the gear positions if necessary, adjust the positions according to the directions under "Adjusting the gear positions".
7. Connect the leads to the ignition switch and reversing light switch.
8. Fit the heater duct, the panel between the ducts and replace the carpet.
9. Fit the console, taking care that the bulb for the ignition switch illumination is in the correct position and that the console studs match with the holes in the floor. Tighten the retaining bolts and refit the ashtray.
10. Move the lever to reverse gear and remove the ignition key.
11. Fit the light diffusor.
12. Refit the upper console section, connect the electrical leads and replace the rubber boot.
13. Fit the driver's seat.
14. Reconnect the battery.



Ignition and starter switch

1. Locating stud
2. Setting mark
3. Arrow
4. Cogwheel locating slot



## Lock cylinder

### Removal

1. Take off the gear lever housing (see section on removing the gear lever housing).
2. Turn the key to a position roughly mid-way between the locking and garage positions (L and G).
3. With the key in this position, the lock cylinder dowel can be pushed in to free the cylinder with the help of a wire lockpick or similar inserted through a hole under the gear lever housing (see illustration).
4. Pull out the lock cylinder.



### Refitting

1. Turn the key in the lock cylinder to a position mid-way between the locking and garage positions (L and G).
2. Insert the lock cylinder dowel. Check that the toothed segment driver pins are correctly positioned to fit in the lock cylinder. Push in the lock cylinder and check that it is engaged in the toothed segment.
3. Refit the gear lever housing (as detailed in that section).



Pressing in the dowel

1. Hole for dowel
2. key
3. Lock cylinder

*Removing the cylinder when the key is missing*

If the key is missing, the lock cylinder can be removed from the gear lever housing as follows:

1. Remove the left front seat and the gear lever cover.
2. Remove the gear lever housing retaining nuts using tool 87 90 370.
3. Drill out the plug in the hole for the lock cylinder dowel in the gear lever housing.
4. Drive in the dowel using a drift (approx. 2 mm or 0.08 in.) and then remove the lock cylinder.

Before fitting a new cylinder, plug the hole in the gear lever housing again using a suitable screw or rivet cut to a length of approx 0,19 in (5 mm).

**Gear lever***Removal*

1. Remove the gear lever from the gear lever housing.
2. Remove the hollow dowel and remove the sleeve, spring and bearing components.
3. Unscrew the catch stud from the catch rod.
4. Remove the rubber boot from the sleeve.
5. Prise away the knob from the hollow lever.



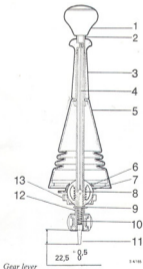
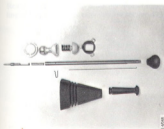
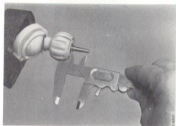
6. Remove the sleeve and the catch rod.

### Assembling

Assembly in the reverse order.

#### Note

Before the hollow dowel is fitted, the projecting length of the catch stud must be adjusted to  $22.5^{+0.5}_{-0.0}$  mm



Gear lever

- |                |                 |
|----------------|-----------------|
| 1. Knob        | 7. Bearing      |
| 2. Gear lever  | 8. Spring       |
| 3. Sleeve      | 9. Hollow dowel |
| 4. Catch rod   | 10. Spring      |
| 5. Rubber boot | 11. Catch stud  |
| 6. Cover       | 12. Carrier     |
|                | 13. Bearing     |

## Dismantling and assembly

### Manual 4-speed transmissions

For work on the transmission, it will not usually be necessary to separate it from the engine. However, the flywheel must always be dismantled first.

#### Important

Before dismantling the transmission, always measure up the positions of the pinion gear and crown wheel. This is to check whether there is any error in their locations. If the pinion and crown wheel assembly is relatively new, i.e. if it has done less than 6 000 miles (10 000 km), it can be adjusted, but if the mileage is any greater the gears will have worn themselves into a given position. In the latter case, they should be reassembled in the same measured positions which they occupied before being dismantled.

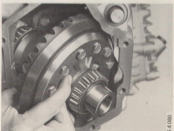
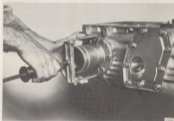
#### Dismantling

(Proceed in the following order as far as necessary in order to remove whichever component needs attention).

1. Clean off the transmission case and drain the oil.
2. Remove the differential bearing seat retaining bolts and remove the seat and inner driver using tool 83 90 270 and puller 87 90 776.

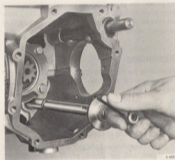
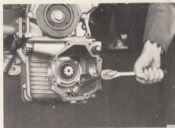
Save the spring and plunger at the shaft end of the driver, and the shims, which will be refitted, provided that the differential gear backlash has not been altered by the replacement of some components.

3. Remove the differential assembly. For dismantling of the differential assembly see section 473.

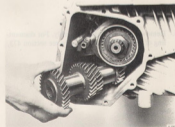




4. Remove the locking plate that holds the layshaft and reverse gear shaft in place (see illustration). Use tool 83 90 049 to withdraw the layshaft so that the layshaft gear cluster drops down.

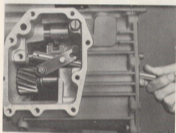
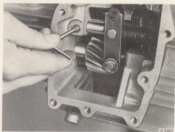


5. Separate the transmission at the joints between the gearbox and primary gear housing and lift away the primary gear housing (see illustration).
6. Remove the layshaft gear cluster (see illustration).



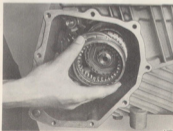
7. Unscrew the transmission side cover, take out the spring and ball catch for the gear selector rod, and put them in a safe place.
8. Undo the reverse gear-shift shaft setscrew. Turn the gear selector rod to free the driver from the reverse gear-shift and withdraw the shaft.

Make sure you use correct lubricant oil when you oil the gear selector shaft and the gear selector shaft. Make sure you use correct oil when you oil the gear selector shaft.



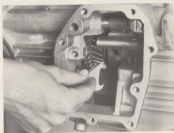
Remove the shift shaft for the 1st-2nd gear and 3rd-top gear shift forks and remove the shift fork and synchromesh sleeve for 3rd-top gear.

The reverse lever need not to de-tached from the gear shift shaft when the shaft is removed. The bolt is liable to shear because of the locking of the threads.

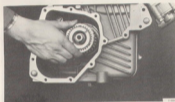


9. Pull out the reverse gear shaft. Use tool 83 90 049 to lift out the reverse gear.

10. Remove the needle bearing from the pinion shaft and use tool 87 90 503 to lock the reverse gear (see illustration), and then undo the pinion shaft nut.



11. Remove tool 87 90 503 and remove the 3rd-top gear synchromesh hub and 3rd gear.



12. Remove the four bolts in the pinion shaft bearing housing. Fit tool 87 90 511 and press out the pinion shaft. Put the gears, sleeves, washers and shims in a safe place.



### Assembly

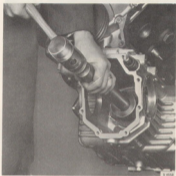
Having removed the component that needs attention, clean all fragments of old gaskets and all traces of old sealing compound off the covers and flanges. Inspect the transmission housing and all dismantled parts and wash them in kerosene or similar. Then reassemble the transmission, following the procedure described below:

1. Adjust the differential bearings to the correct compression. See section 473.
2. Screw the two locating studs (tool 87 90 438) into the transmission case. Then shim and locate the pinion shaft assembly. Tap the assembly gently into position, using a plastic headed hammer, drift 83 90 114 and sleeve 83 90 148. Then insert and tighten the four bearing housing bolts.

Any measurement or adjustment of the pinion shaft must be done before the bolts are secured with Loctite. See section 473.

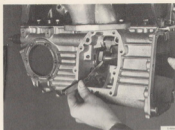
3. a. Before fitting the reverse gear on the pinion shaft, check the distance between the mating surface for the primary gear case and the pinion shaft nut. The distance must be 7.677–7.681 in (195.0–195.1 mm). If not, shims must be fitted between the nut and the reverse gear. Shims are available in thicknesses of 0.018 in (0.30 mm), 0.0157 in (0.40 mm) and 0.0197 in (0.050 mm). If the position of the pinion shaft is unchanged, the shims used earlier can be replaced.

all 200 00 70 best performance parts and  
provided in a wide range of sizes  
making it the best transmission for your

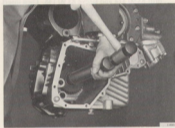


drive shaft best and available in many sizes and  
with the best quality parts and the best  
results.

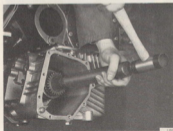
- b. When using measuring tool 87 90 552, the shimming procedure is as following:  
Install the measuring tool in the gearbox case as shown in the picture and measure the distance between the tool and the nut using a feeler gauge. Fit shims with a thickness equivalent to that of the feeler gauge.



4. Install the reverse gear using sleeve 83 90 148.



5. Fit the 1st-speed gear on the bearing sleeve of the reverse gear.  
6. Fit the 1st-2nd synchromesh hub. Fit the 1st-2nd gear shift fork into the 1st-2nd synchromesh sleeve and mount these on the synchromesh hub.  
7. Install the 2nd gear sleeve using tool 83 90 148 and mount the 2nd gear on the sleeve.



8. Fit the spacer, mount the sleeve for 3rd gear with tool 83 90 148 and mount the 3rd gear on this sleeve.

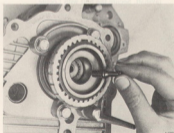
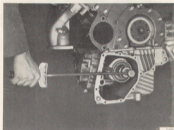
9. Fit the 3rd-4th-speed gear synchroneshub. Fit 3rd-4th gear shift fork into 3rd-4th and mount these on the synchroneshub.
10. Fit tool 87 90 503 to lock the reverse gear and tighten the pinion shaft nut to the prescribed torque of 40–60 Nm (30–45 lbf<sup>t</sup>, 4–6 kgfm) and lock the nut. Install the pinion shaft needle bearing and circlip. Remove tool 87 90 503.

11. Ease the synchroneshub sleeves onto the pinion shaft in the neutral position and fit the gear shift shaft for 1st-2nd and 3rd-4th gear shift forks.
12. Turn the gear selector rod clockwise so that there is room to mount the reverse gear shift shaft. Fit the latter. Secure the shaft by means of the set screw and apply Loctite to the screw.

**Note**

The reverse lever can be fitted to the reverse gear shaft before the shaft is fitted to the gearbox.

13. Fit the needle bearings in the layshaft gear cluster. Place the layshaft gear cluster in the bottom of the gearbox.
14. Check that the thrust washer for the layshaft gear cluster is in the right place on the primary drive housing. The washer can be glued on to facilitate the fitting of the layshaft gear cluster. Check that the connecting tube is fitted in the output shaft of the primary drive.

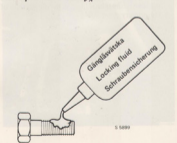
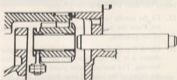
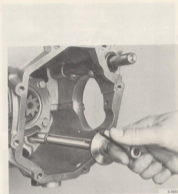
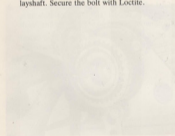


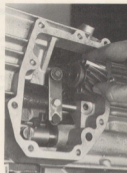
15. Coat the mating flange of the primary gear housing with Loctite 510 sealing compound and bolt the primary gear housing to the transmission case.

<sup>b</sup> Do not fully tighten the bolts, to avoid jamming the loose layshaft gear cluster in the wrong position before the layshaft is inserted.



16. Ease the layshaft gear cluster into its correct position either by turning the transmission housing or by lifting the layshaft gear cluster. Fit the rear thrust washer and slide in the layshaft, using tool 83 90 049.
17. Tighten the primary drive case bolts.
18. Fit the reverse gear and shaft, making sure that the leading edge of the reverse lever is fitted into the groove in the reverse gear. Fit the lock plate over the ends of the reverse gear shaft and layshaft. Secure the bolt with Loctite.





19. Insert the spring and ball catch for the gear selector rod and fit the transmission case cover together with its gasket.
20. Fit the differential assembly (see section 473).
21. Inspect the shaft seals in the differential bearing seats and fit new ones if necessary. Adjust the crown wheel backlash, if necessary (see section 473). Mount the two drive shafts complete with inner universal joints, taking care not to damage the shaft seals.
22. Fit the cover complete with gasket to the transmission case.
23. Fill the transmission case with oil (4,5 Imp. pints/ 2.5 litres).



## Pinion shaft, 4-speed transmission

### Dismantling

To dismantle the pinion shaft, follow the instructions for dismantling the transmission up to the point where the pinion shaft assembly is removed. Then continue as follows:

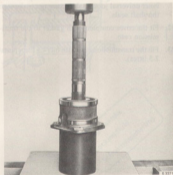
1. Secure fixture 87 90 636 and holder ring 87 91 097 in a vice. Put the pinion shaft in the fixture and loosen the nut using spanner 87 90 453.



2. Turn the input gear sleeve into its normal position by turning the transmission housing by sliding the input gear sleeve. Fit the two thrust washers and slide in the input shaft, using tool 87 90 004.

3. Tighten the primary drive cone bolts.

2. Mount the bearing assembly on sleeve 83 90 098 and press out the bearing from its housing (see illustration).



3. Press off the rear roller bearing using tools 87 90 636 and 87 91 097.



4. Press the outer rings of the taper roller bearings out of the bearing housing using tools 83 90 098, 83 90 106 and 83 90 148 (see illustration).

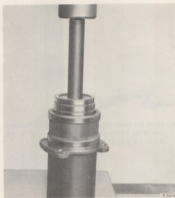


### Installing

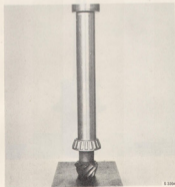
Having removed the part that needs attention, inspect all dismantled parts and wash them in kerosene or similar. Then reassemble and refit, proceeding as follows:

Lubricate the bearings before assembly.

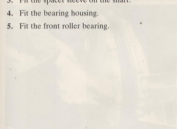
1. Press the outer races of the taper roller bearings into the bearing housing, using tools 83 90 189 and 87 90 461.



2. Press on the roller bearing adjacent to the pinion until it butts against its stop, using tool 83 90 148 (see illustration).



3. Fit the spacer sleeve on the shaft.
4. Fit the bearing housing.
5. Fit the front roller bearing.



6. Set up the shaft in a press (see illustration). Press the bearing housing slowly on, using tool 83 90 148, and rotate it at the same time until resistance is felt.

7. Smear Loctite 270 on the threads and put on the nut. Install fixture 87 90 636 with holder ring 87 91 097. Using spanner 87 90 453, tighten the nut until the correct rolling torque is obtained. To determine the rolling torque, wind a line around the bearing housing and attach the other end to a spring balance. Lightly oil the bearings and tighten to the following rolling torque:

*New bearings: 47-71 N (10-15 lb, 4.7-7.0 kg) on the spring balance, which corresponds to a torque of  $2.5 \pm 0.5$  Nm ( $2 \pm 0.5$  lb ft,  $25 \pm 5$  gf). Old bearings that have done more than 1200 miles (2000 km) 19-43 N (4.2-9.2 lb, 1.9-4.3 kg) spring balance which corresponds to a torque of  $1.3 \pm 0.5$  Nm ( $1 \pm 0.5$  lb ft,  $13 \pm 5$  kgfm).*

After the correct value has been obtained,peen over the flange of the nut, using a drift.

8. Fit two locating pins, tool 87 90 438, in the gear-box housing. Then fit on the shims and mount the pinion shaft with bearing housing. Knock the bearing housing carefully into place, using a plastic mallet or hammer, together with drift 83 90 114 and sleeve 83 90 148. Then tighten the four bolts.

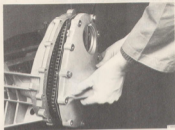
#### Note

Any measurement adjustment or adjusting of the pinion shaft must be done before the bolts are secured with Loctite 242. See section 473.

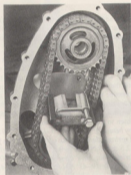


**Dismantling**

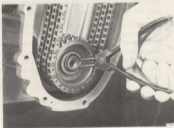
1. Undo the retaining bolts and remove the primary drive housing cover.



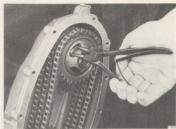
2. Remove the chain tensioner.



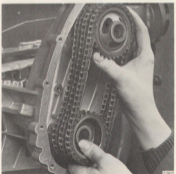
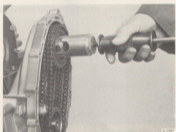
3. Remove the circlip from the lower sprocket.



Free the circlip on the upper sprocket through the opening in the sprocket.



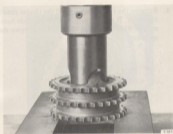
4. Remove the two sprockets and the chains simultaneously. It may be necessary to use slide hammer 83 90 270 and tool 87 90 891 to remove the sprocket.



5. Remove the bearing circlip from the upper sprocket.



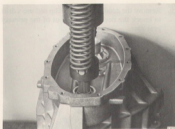
6. Press the bearing out of the upper sprocket using sleeve 87 90 842.



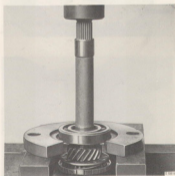
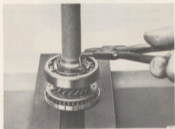
7. Remove the four countersunk socket screws and remove the bearing retainer at the input gear to the gearbox.



8. Press the input shaft to the gearbox out of the primary gear case.

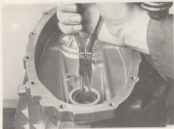


9. Remove the circlip and press the ball bearing off the input shaft.

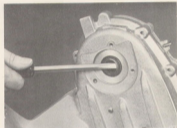




10. Remove the needle bearing circlip and use a drift to knock the needle bearing out of the primary gear case.

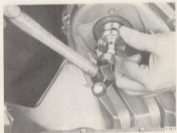


11. Remove the clutch shaft seal by means of a screwdriver.



### Assembly

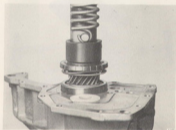
1. Fit the new clutch shaft seal using drift 83 91 997.



- Using drift 83 91 997, install the needle bearing with circlip in the primary gear case, with the mark on the needle bearing facing out.
- Press the ball bearing onto the input shaft to the gearbox and fit the circlip. Use a sleeve 83 90 148 and ring 87 90 867.



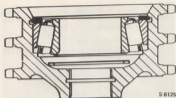
- Press the input shaft with bearing into the primary drive case.



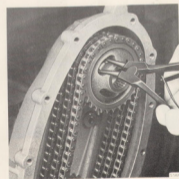
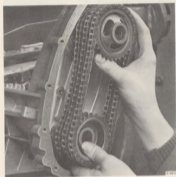
- Fit the bearing retainer to the primary drive case. Apply sealing compound to the two top screws.



6. Install the circlip in the upper sprocket and press in the bearing (see illustration) Use sleeve 87 90 859. Fit the circlip for the outer bearing ring in the sprocket, with the chamfer facing outwards.

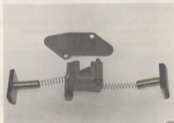
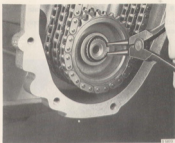


7. Mount the chains on the sprockets and mount the latter onto the splines and stud, respectively, in the primary drive case. Fit the two circlips.





8. Fit the chain tensioner. Fit the chain tensioner housing with the oil passage at the top and place the backing plate so that its top edge is in line with the top edge of the chain tensioner housing.

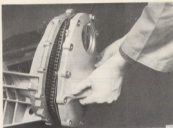


Apply thread sealant to the chain tensioner bolts.



9. Fit the gasket and the primary gear case cover.

Before fitting the clutch slave cylinder, apply thread sealant to the bolts.



### Removing the primary drive with the engine In situ

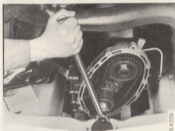
1. Mark the position of the bonnet (hood) relative to the hinges and then remove the bonnet.
2. Disconnect the negative (-) battery lead.
3. Support the front of the car on stands.
4. Drain the coolant.
5. Disconnect and remove the coolant hoses.
6. Disconnect the electrical leads from the coil, the thermostatic switch, the radiator fan and the headlamp wiper motor.
7. Disconnect the bonnet release cable at the bulkhead.
8. Unscrew and remove the front grille.
9. Remove the bolts in the radiator bracket and the upper retaining screws for the headlamps.
10. Remove the radiator bracket complete with radiator from the car.
11. Remove the taper pin and break the joint in the gear shift rod! In cars with five-speed transmission, move the gear lever to fourth gear and apply the handbrake.
12. Undo the front engine mounting from the primary gear cover.
13. Attach the lifting yoke to the front lifting lug and raise the engine approximately 40 mm.
14. Remove the front engine mounting.
15. Lower the engine approximately 50 mm.
16. Remove the cover on the primary drive - about 2 dl of oil will then drain out.
17. Raise the engine approximately 50 mm.
18. Remove the plastic propeller and knock out the clutch shaft using tapping-out hammer 82 90 270 and universal joint 83 90 015.

19. Remove the chain tensioner.
20. Remove the circlip from the upper sprocket.
21. Four-speed transmissions: Remove the circlip on the lower sprocket.
22. Five-speed transmissions: Remove the centre nut from the lower sprocket.

23. Using tapping-out hammer 83 90 270 and puller 87 90 891, remove the upper sprocket, allowing the lower sprocket to come away with it. Raise or lower the engine as necessary to allow the lower sprocket free passage.



23. Using tapping-out hammer 83 90 270 and puller 87 90 891, remove the upper sprocket, allowing the lower sprocket to come away with it. Raise or lower the engine as necessary to allow the lower sprocket free passage.



To refit, reverse the removal procedure.

Apply sealing fluid to the chain-tensioner bolts.

Tighten the centre nut on the lower sprocket to a torque of  $100 \pm 10$  Nm ( $10 \pm 1$  kgf m).

Five-speed transmissions: Lock the nut by peening.

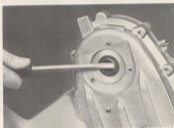
Hold the bolt for the front engine mounting on refitting.

Bleed the cooling system after refilling.

## Changing the clutch shaft seal

### Removal

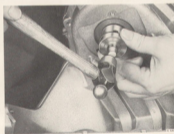
Remove the clutch shaft seal by means of a screwdriver.



### Fitting

1. Install a new clutch shaft seal using drift 83 91 997.

Refit the clutch, clutch disc, release bearing and guide sleeve as described in section 411.



17. Run the engine approximately 30 min.

18. Remove the plastic protection and spray the clutch shaft using bearing-rod grease 82 90 275 and universal grease 83 90 013.

## Gear shift mechanism

The gear shift mechanism consists of gear shift forks, shafts, a selector rod with a spring-loaded ball catch, driver, reverse gear spring, double lockout and tubular dowel.

### Dismantling

1. Dismantle the transmission as described at the beginning of this section (471-1), following the procedure outlined but stopping after item 7.
2. Remove the tubular dowel for the double lockout. The gear selector rod can now be removed from the transmission case. The driver and the dowel for the reverse brake spring can then be removed using a drift.

### Synchronisation

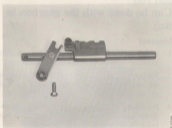
#### Synchronisation steps

When changing the synchronisation ring, follow the instructions for dismantling the gearbox. The differential lock must be removed, with the synchronisation gear shafts disconnected so that the primary gear shaft can be removed. When changing the synchronisation ring for the top gear, synchronisation is essential.

When changing the synchronisation ring for the 2nd gear, the pinion shaft must be released and the reverse bearing, so that the gear can be removed from the shaft.

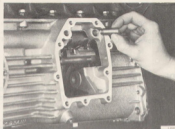
### Dismantling

Remove the shaft receiving the synchronisation ring in the gearbox.





3. If the gear shift fork for 1st-2nd gear has to be removed, the pinion shaft must be removed (see section on dismantling the transmission).



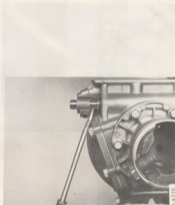
### Assembling

To reassemble the gear shift mechanism, start by fitting the selector fork to the synchromesh sleeve for third and fourth gears. Continue assembly by reversing the dismantling procedure, following the steps outlined under "Assembly of the transmission" earlier in this section, starting with item 11.

### Changing the sealing ring, gear shift rod (Can be done with the gearbox in situ)

#### Removal

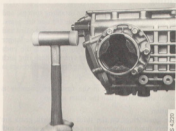
1. Knock out the front taper pin from the gear shift joint and separate the joint from the rod.
2. Put the removing tool 87 90 677 over the collar on the sealing ring and turn the screw of the tool against the shaft.
3. Pry off the sealing ring with the aid of a screwdriver held between the tool and one of the bolt heads on the rear cover.



Removing Tool 87 90 677

**Fitting**

1. Fit the new sealing ring with the aid of tool 87 90 685 and a suitable hammer.
2. Connect the gear shift rod joint and the gear shift rod and fit the taper pin.



Fitting the sealing ring: tool 87 90 685

**Synchromesh****Synchromesh rings**

When changing the synchromesh rings, follow the instructions for dismantling the gearbox. The differential unit must be removed and the layshaft gear cluster dismantled so that the primary gear housing can be removed. When changing the synchromesh ring for top gear, no further dismantling is necessary.

When changing the synchromesh ring for 1st and 2nd gear, the pinion shaft must be taken out of the transmission housing, so that the gears can be removed from the shaft.

**Dismantling**

Remove the circlip securing the synchromesh ring to the gearwheel.



### Fitting

First fit the guide rings for the retaining springs, and the circlips for the guide rings on 3rd and 4th gears. There are no circlips on the guide rings for the first and second gears. Fit the retaining spring with the longer end adjacent to the guide ring and with the ends spanning 11 teeth. Locate the synchromesh ring such that the ends of retaining spring fit into the recesses in the ring. Finally, fit the circlip.

(The retaining spring in the first-gear assembly is softer and shorter than the other springs).

### Caution

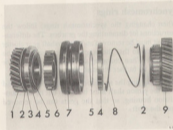
The guide rings on the third and fourth gears are factory-fitted and peened in position by a special tool after the circlip has been fitted. Guide rings supplied as spare parts should not be peened.

As a spare part guide plate 87 02 730 together with pear-shaped lock ring 87 02 722 should be used.

As an alternative a complete set consisting of gears with factory fitted synchromesh ring may be used. Part No. 87 11 632.



Location of retaining Spring



Synchromesh mechanism, 1st and 2nd gears

1. 2nd gear
2. Guide ring
3. Retaining spring, 2nd gear
4. Synchromesh ring
5. Circlip
6. Synchromesh hub
7. Synchromesh sleeve
8. Retaining spring, 1st gear
9. 1st gear

## Dismantling and assembly

## Manual 5-speed transmission

For work on the transmission, it will be usually necessary to separate the engine and transmission. However, the Swedish car frames usually allow the transmission to be dismantled first.

## Dismantling

Proceed in the following order if it is necessary to order to separate individual components (see Fig. 10.10).

1. Clean the transmission case and drain the oil.
2. a. with the transmission horizontal and  
b. with the transmission vertical. Let the oil drain out of the primary gear housing.
3. Remove the following covers:  
a. the top cover  
b. the bottom cover  
c. the oil seal  
d. the primary drive cover.

## Ventilation

Ventilation of the transmission is by means of a hole through the top cover in the primary gear housing. The hole emerges at the centre of a plastic propeller which is screwed to the clutch shaft.

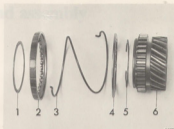
As the clutch shaft rotates, the oil is flung away from the hole by the propeller.

When the shaft is stationary, the oil level in the primary gear case is well below the hole.

See Fig. 10.11 for a diagram of the hole and of the propeller. The propeller can be removed in the same way as the oil seal. The oil seal has not been shown in the illustration of this component.

## Important

Before dismantling the transmission, always measure the position of the piston gear and mesh wheel. This is to check whether there is any wear in their positions. If the piston and crown wheel meshing is relatively new, i.e. if it has done less than 6,200 miles (10,000 km), it can be adjusted, but if the mileage is any greater the gears will have worn themselves into a given position. In the latter case, they should be re-assembly in the same unadjusted positions which they occupied before being dismantled.



Synchromesh, 3rd gear

1. Circlip
2. Synchromesh ring
3. Retaining spring, 3rd gear
4. Guide ring
5. Guide-ring circlip
6. 3rd gear



Ventilation

## Dismantling and assembly

### Manual 5-speed transmissions

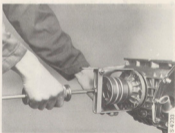
For work on the transmission, it will not usually be necessary to separate the engine and transmission. However, the flywheel and starter motor must always be dismantled first.

#### Dismantling

(Proceed in the following order as far as necessary in order to remove whichever component needs attention:)

1. Clean the transmission case and drain the oil.
  - a. with the transmission horizontal and
  - b. with the transmission vertical. Let the oil drain out of the primary gear housing.
2. Remove the following covers:
  - Front cover on the primary drive case.
  - Side cover on the primary drive case (there will still be some oil in the primary gear case).
  - Screw connection on dipstick pipe.
  - Final drive cover.
3. Measure the backlash between the pinion and crown wheel, see Section 473.
4. Remove the differential bearing seat retaining bolts and remove the seats and inner driver using tool 83 90 270 and puller 87 90 776.

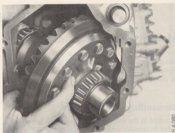
Save the spring and plunger at the shaft end of the driver, and the shims, which can be re-used on the condition that the differential gear backlash has not been altered by the exchange of some components.



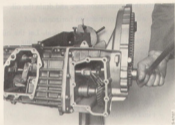
#### Important

Before dismantling the transmission, always measure the positions of the pinion gear and crown wheel. This is to check whether there is any error in their locations. If the pinion and crown wheel assembly is relatively new, i.e. if it has done less than 6,000 miles (10,000 km), it can be adjusted, but if the mileage is any greater the gears will have worn themselves into a given position. In the latter case, they should be re-assembled in the same measured positions which they occupied before being dismantled.

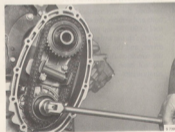
5. Remove the differential assembly. For dismantling of the differential assembly see section 473.
6. Measure the clearance between the pinion and the centre of the crown wheel. See Section 473.



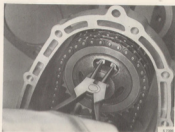
7. Remove the dowel in the gear-shift fork for 5th gear.
8. Move the gearwheel for reverse into reverse-gear position and select 5th gear.



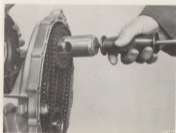
- 9 a. Free the shaft (lower sprocket) tab washer from the input shaft.
- b. Remove the nut.



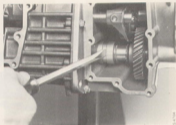
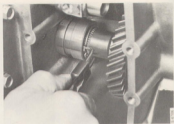
10. Remove the chain tensioner.
11. Remove the circlip from in front of the upper sprocket bearing.



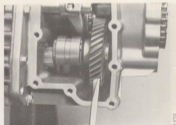
12. Remove the sprockets and the chains simultaneously. Slide hammer 83 90 270 and puller 83 90 891 may be needed to remove the sprockets.



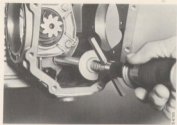
13. Separate the constant mesh gear from the layshaft gear cluster by removing the circlip from the groove and sliding the synchromesh sleeve towards the gear.



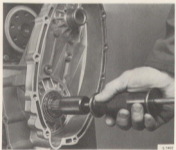
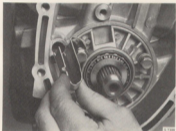
14. Remove the locking plate for the layshaft and reverse gear shaft (see illustration). Using tools 83 90 049 and 83 90 270, withdraw the layshaft gear cluster and then remove the pinion from the input layshaft, together with the synchromesh sleeve and thrust washer, through the side of the transmission case.



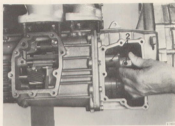




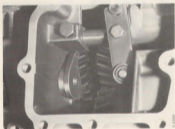
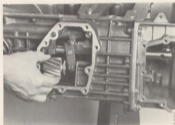
15. Remove the bolts and the oil catcher from the input shaft bearing case. Then remove the bearing case using slide hammer 83 90 270 and adapter 87 90 917.

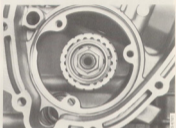
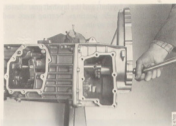


16. Slide the gear selector for fifth gear to the full extent of its travel and then remove the selector fork and the synchromesh sleeve.

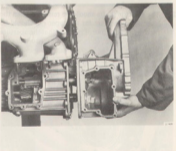
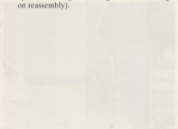


17. Remove the gearwheel and shaft for reverse gear. Fit locking tool 87 90 503 to the reverse gearwheel. Release the circlip and unscrew the nut securing the synchro hub for fifth gear. Retain the hub and spacer.

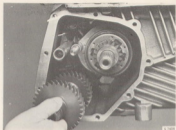




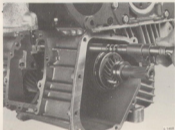
18. Remove all primary drive case retaining bolts and drift in the dowels so that the primary drive case can be separated from the gearbox housing. (The 5th speed selector will remain in the housing and can be removed later. File away any burrs there may be round the hole in the shaft, so that the aperture in the gear housing will not be damaged on reassembly).



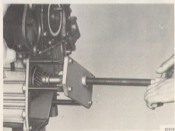
19. Remove the layshaft and the layshaft gear cluster. Retain the needle bearings, bearing track and thrust washer for re-use.



20. Remove the selector shafts and the selectors (first, second, third and fourth speeds on the inner shaft). Remove the selectors for first and second gears together with their synchromesh units. Remove the selector for reverse together with the shaft for fifth gear and reverse gear.



21. The selector shafts should be removed from the front. The aperture for the taper pin should be filed so that it is free of burrs so that the aperture is not damaged. Remove the selector, double lockout and spring later. Retain the selector ball and guide pin.
22. Remove the four bolts retaining the pinion shaft bearing housing. Install tool 87 90 909 and press out the pinion shaft. Keep the gearwheels, sleeves, washers and shims.



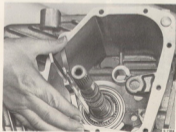
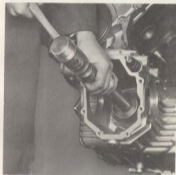
### Assembly

Having removed the component that needs attention, clean all fragments of old gaskets and all traces of old sealing compound off the covers and flanges. Inspect the transmission case and all dismantled parts and wash them in kerosene or similar. Lubricate all components as detailed in the specifications section on lubricants. Reassemble the transmission, following the procedure described below:

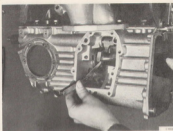
1. Adjust the differential bearings to the correct compression. See section 473.
2. Screw the two locating studs (tool 87 90 438) into the transmission case. Then shim and locate the pinion shaft assembly. Tap the assembly gently into position, using a plastic mallet, drift 83 90 114, and sleeve 83 90 148. Refit the retaining bolts for the bearing housing, tightening them to a torque of 20–25 Nm (2–2.5 kgfm; 15–18.5 lb ft). Finally, apply Loctite to the bolts.

Reassemble the case with Loctite and tighten.

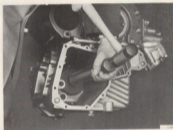
3. a. Before fitting the reverse gear on the pinion shaft, check the distance between the mating surface for the primary gear housing and the pinion shaft nut. The distance must be 7.677 in -7.681 in (195.0–195.1 mm). If it is not, shims must be placed between the nut and the reverse gear. Shims are available in thicknesses of 0.018 in (0.30 mm), 0.0157 in (0.40 mm) and 0.0197 in (0.050 mm). If the position of the pinion shaft is unchanged, the shims used earlier can be replaced.



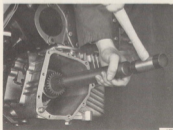
- b. When using measuring tool 87 90 552, the procedure of shimming is the following: Fit the measuring tool in the gearbox housing as illustrated, and measure the distance between tool and nut with the aid of a feeler gauge. Fit shims with a thickness equivalent to that of the feeler gauge.



4. Fit the reverse gear using sleeve 83 90 148.



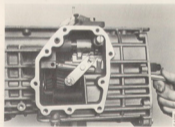
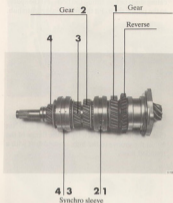
5. Fit the 1st-speed gear on the bearing sleeve of the reverse gear.
6. Fit 1st-2nd speed synchronmesh hub. Fit 1st-2nd speed gear shift fork into 1st-2nd speed synchronmesh sleeve and fit these on the synchronmesh hub. Fit 1st-2nd speed gear shift fork into 1st-2nd speed synchronmesh sleeve and fit these on the synchronmesh hub.
7. Fit the 2nd speed gear sleeve with tool 83 90 148 and fit the 2nd speed gear on the sleeve.



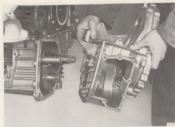
8. Fit the spacer, the sleeve for 3rd gear with tool 83 90 148 and fit the 3rd speed gear on the sleeve.
9. Fit 3rd-4th gear synchromesh hub. Fit 3rd-4th speed gear shift fork into 3rd-4th gear synchromesh sleeve and fit these on the synchromesh hub.  
Fit the bush for the 4th speed gear and fit the gear onto the bush. Fit the ball bearing bush.
10. If the selector shaft has been removed, refit it together with the double lockout guide pin.

11. Ease the synchromesh sleeves onto the pinion shaft in the neutral position and fit the gear shift shaft for 1st-2nd speed and 3rd-4th speed gear-shift forks.
12. Refit the reverse selector shaft with selector. Seal the shaft stop bolt with Loctite and tighten.

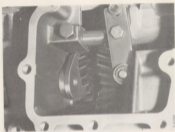
13. Fit the 5th speed selector on the reverse selector shaft.
14. Fit the needle bearing to the layshaft gear cluster and place the latter inside the gearbox housing.
15. Fit the layshaft and raise the layshaft gear cluster to line it up with the shaft. Insert the shaft far enough to hold the gears in position. Fit the thrust washer later.



16. Apply Loctite 510 sealing compound to the flange of the primary drive casing and bolt the casing to the gearbox housing. Knock in the locating studs before fitting the bolts. Fit the spacer to the pinion shaft. Fit the 5th speed synchro hub.



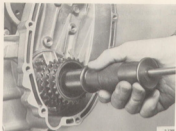
17. Fit locking tool 87 90 503 to the reverse gear-wheel. Tighten the nut to a torque of  $50 \pm 10$  Nm ( $5 \pm 1$  kgfm;  $37 \pm 7$  lbft). Upset the flange of the nut in the groove in the hub, using a drift with a rounded nose.



18. Install the 5th gear synchromesh sleeve and gear shift fork.



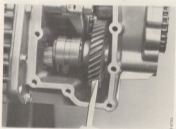
19. Fit the input shaft together with the bearing housing, oil catcher and connecting pipes. Use three guide pins 87 90 438 for alignment and the sprocket as a spacer between the adapter 87 90 917 and bearing housing. Insert the bearing housing far enough for the shaft to meet the synchro sleeve. The bearing housing should then be driven into place using slide hammer 83 90 270. See input shaft with bearing housing, section 471.



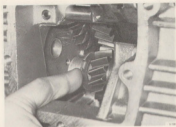
20. Fit the roller bearings and inner bearing track in the constant mesh gear.



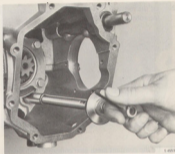
21. Fit the constant mesh gear complete with sleeve, circlip and bearing rollers. Slide the layshaft back to enable the constant mesh gear to be fitted.



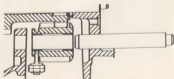
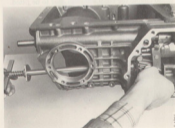
22. Push the synchro sleeve onto the layshaft and fit the circlip in the groove.



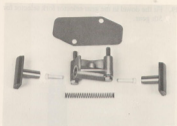
23. Fit the layshaft thrust washer. Withdraw the layshaft and slide the washer into position. Then use tool 83 90 049 to insert the shaft so that it locks in position.



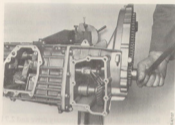
24. Fit the reverse gearwheel and shaft. Make sure that the reverse lever engages the groove in the reverse gear. Adjust the shaft using tool 83 90 049 until it locks in position.



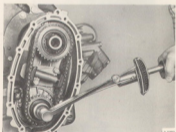
25. Fit the locking plate over the shaft ends and seal the bolt with Loctite.
26. Fit the primary gear sprockets and chains. Ensure that the hole for the tab washer on the lower sprocket is facing outwards.
27. Fit the chain tensioner. Apply locking fluid to the bolts prior to installation.



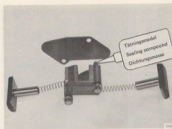
28. Fit the nut onto the input shaft. Before torque tightening select reverse and 5th speed gears at the same time so locking the input shaft. Then tighten the nut to the prescribed torque of  $100 \pm 10$  Nm and upset one of the nut tabs into the recess provided in the gearwheel, using a rounded drift.



29. Mount the bearing assembly on shaft 5/6/7/8/9/10, and press on the bearing from its housing.



29. Fit the dowel in the gear selector fork selector for 5th gear.



30. Fit the differential unit. See Section 473.
31. Check the shaft seals in the bearing retaining housings and replace if necessary. Adjust the crownwheel backlash if necessary. See Section 473. Then fit the two drive shafts and inner universal joints. Ensure that the seals are not damaged. Fit the selector ball and spring and fit the gearbox top cover assembly and gasket.
32. Fit the final drive unit, cover and gasket, the primary gear housing and the chain cover with gaskets.
33. Refill with oil: 0.3 l in the primary drive and 2.7 l in the gearbox.

## Pinion shaft, 5-speed transmission

### Dismantling

To dismantling the pinion shaft, follow the instructions for dismantling the transmission up to the point where the pinion shaft assembly is removed. Then continue as follows:

1. Secure fixture 87 90 636 and holder ring 87 91 097 in a vice. Put the pinion shaft in the fixture and loosen the nut using spanner 87 90 453.



2. Mount the bearing assembly on sleeve 83 90 098, and press out the bearing from its housing.



3. Press off the rear roller bearing with the aid of tools 87 90 636 and 87 91 097.



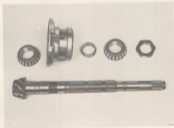
4. Press the outer rings of the taper roller bearings out of the bearing housing using tools 83 90 098, 83 90 106 and 83 90 148 (see illustration).



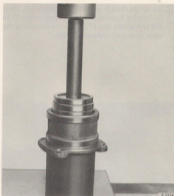
### Fitting the pinion shaft

Having removed the part that needs attention, inspect all the dismantled parts and wash them in kerosene or similar. Then reassemble and fit, proceeding as follows:

Lubricate the bearings before assembly.



1. Press the outer races of the tape roller bearings into the bearing housing, using tools 83 90 189 and 87 90 461.



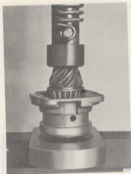
2. Press on the roller bearing adjacent to the pinion until it butts against its stop, using tools 87 90 636 and 87 90 925.
3. Fit the spacer sleeve on the shaft.
4. Fit the bearing housing.
5. Fit the front roller bearing.



411 00 28 drive shafts removed to follow up 802 00 28 axle hub



6. Set up the shaft in a press (see illustration). Press the bearing housing slowly on, using fixture 87 06 636 and holder ring 87 90 925 and rotate it at the same time until resistance is felt.



7. Smear Loctite 270 on the threads and put on the nut. Fit fixture 87 90 636 with holder ring 87 91 097 in a vice. Place the bearing housing on the fixture. Using spanner 87 90 453, tighten the nut until the correct rolling torque is obtained. To determine the rolling torque, wind a line around the bearing housing and attach the other end to a spring balance. Lightly oil the bearings and tighten to the following rolling torque: *New bearings 47-71 N (10-15 lb, 4.7-7.0 kg) on the spring balance which corresponds to a torque of  $2.5 \pm 0.5$  Nm ( $1 \pm 0.5$  lbft,  $25 \pm 5$  kgfcm).* After the correct value has been obtained, upset the flange of the nut using a drift.



8. Fit two locating pins, tool 87 90 438, in the gearbox housing. Then fit on the shims and fit the pinion shaft with bearing housing. Knock the bearing housing carefully into place using a plastic mallet or hammer with drift 83 90 114 and sleeve 83 90 148.

Apply Loctite 242 to the four bolts and then tighten them to a torque of 20-25 Nm (2.2-2.5 kgfm, 15-18.5 lb ft).



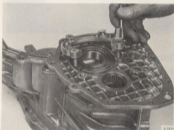


## Primary drive case

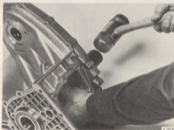
The primary drive case should be removed when dismantling the gearbox. Separate the primary drive case complete with the following components from the gearbox: A. Ball bearing, B. Needle bearing, C. Clutch shaft seal, D. Level control ball valve. Dismantle the parts as follows:

### Dismantling

1. Remove the four countersunk socket-head cap screws and remove the ball bearing retainer.



2. Drift out the ball bearing. Use drift 83 90 106 and sleeve 83 90 148.



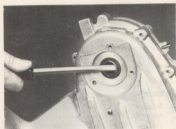
3. Remove the needle bearing sleeve in the primary drive case by means of drift 83 91 997 and 83 90 577.

Do not remove the level control ball valve. Just check that the ball moves freely and sits securely on its seat.

The ball valve acts at low speeds downhill to prevent the oil from running out of the gearbox and into the primary drive case, so ensuring proper lubrication of the differential and final drive units.



4. Remove the clutch shaft seal by means of a screwdriver.



### Fitting

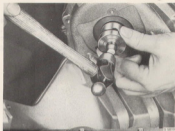
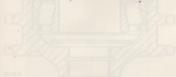
1. Fit the ball bearing with the bearing retainer. Seal the two through-screws with thread sealant. Tighten down the screws alternately until the bearing is in position.



2. Fit the needle bearing race with the numbered end pointing out towards the primary drive case. Use drift 83 91 997 and sleeve 78 41 067.



3. Fit a new clutch shaft seal, using drift 83 91 997.  
Grease the lips of the seal after it has been fitted.  
See Lubricant Specification.



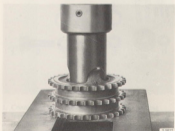
## Primary gear-chain drive

### Dismantling

1. To dismantle the primary drive separately, remove the front cover from the primary drive case. Otherwise follow the instructions under "Dismantling and assembly, manual transmission, 5-speed".
2. Remove the circlip from the upper sprocket.

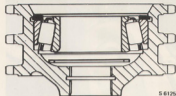


3. Use hollow drift 87 90 891 to press out the bearing from the sprocket.



### Assembly

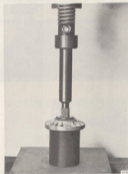
1. Fit the circlip to the upper sprocket and press the bearing into the sprocket, see illustration. Tool, hollow drift 87 90 859. Fit the circlip for the bearing's outer race with the chamfer facing outwards.
2. Fit the chains, sprockets and chain tensioner as described in the section on transmission assembly.
3. Top up with oil.



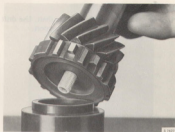
### Input shaft, bearing housing

#### Removing

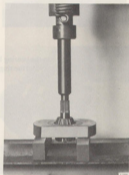
1. Remove the oil catcher from the bearing housing and press the input shaft out of the bearing housing. Retain the front bearing, the spacer and the shims. Use the ring-shaped support 83 90 098.



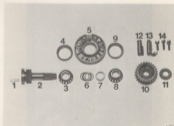
Take care that the connection pipe is not damaged when pressing out the shaft.



2. Press the rear bearing off the input (clutch) shaft. Use support 87 90 636 and ring 87 90 933.



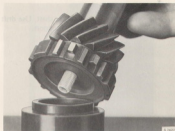
3. Remove the bearing races from the housing with a drift. Rest the housing on the ring-shaped support.



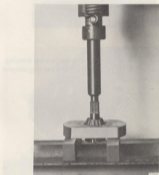
*Input shaft and bearing housing*

- |                                 |                       |
|---------------------------------|-----------------------|
| 1. Connecting pipe, lubrication | 8. Ball bearing       |
| 2. Input shaft                  | 9. Race               |
| 3. Ball bearing                 | 10. Sprocket          |
| 4. Race                         | 11. Nut               |
| 5. Bearing housing              | 12. Rear oil catcher  |
| 6. Shims                        | 13. Front oil catcher |
| 7. Spacer                       | 14. Bolts             |

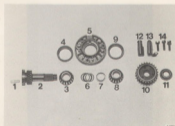
Take care that the connection pipe is not damaged when pressing out the shaft.



2. Press the rear bearing off the input (clutch) shaft. Use support 87 90 636 and ring 87 90 933.



3. Remove the bearing races from the housing with a drift. Rest the housing on the ring-shaped support.



*Input shaft and bearing housing*

- |                                 |                       |
|---------------------------------|-----------------------|
| 1. Connecting pipe, lubrication | 8. Ball bearing       |
| 2. Input shaft                  | 9. Race               |
| 3. Ball bearing                 | 10. Sprocket          |
| 4. Race                         | 11. Nut               |
| 5. Bearing housing              | 12. Rear oil catcher  |
| 6. Shims                        | 13. Front oil catcher |
| 7. Spacer                       | 14. Bolts             |

**Assembly**

1. Press the rear bearing onto the shaft. Use drift 78 41 075 and the ring-shaped support.



2. Press the bearing races into the bearing housing. Use tool 83 90 312, 83 90 189 and the ring-shaped support.



3. Fit the input shaft, shims, spacer and bearing in the bearing housing. Select shims and spacer of known size to deliberately give axial play. Place the shims between the rear bearing and the spacer.



4. Lubricate the bearings and press them together until they meet the distance stop with a 3 tonne force applied.

While the bearings are being pressed together rotate the bearing housing, against both the upper and lower bearings, 40 times in both directions so that the balls become properly positioned. Use drift 78 41 075 and the ring-shaped support to avoid damaging the connecting pipe. Maintain the 3-tonne force.



5. Fit the gauge in the bearing housing bolt hole. First put the bearing housing under load on the upper bearing and then on the lower bearing, reading off the axial play.

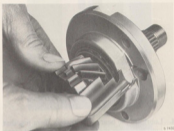
Shims of sizes 0.10, 0.15, 0.25 and 0.50 mm are available for eliminating the axial play.

When correctly shimmed, there should be no resistance to movement nor any play in the bearings. If the play cannot be eliminated by the available shims sizes, change the spacer. Spacers are available in thicknesses of 8.08, 8.09, 8.10 and 8.11 mm.





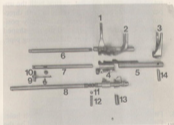
6. Press the front bearing off the input shaft and fit the estimated number of shims. Place the shims between the rear bearing and the spacer. Refit the front bearing on the input shaft in the bearing housing and press together with 3-tonne force. Rotate the bearing as described in point 4. Ensure that there is no resistance to movement or play in the bearing.
7. Fit the oil catcher in the bearing housing.



## Gear selector mechanism

Refer to the section on dismantling and refitting.

The gear selector mechanism consists of a system of selector shafts, selectors, selector forks with plungers, selector balls, ball springs and taper setscrew.

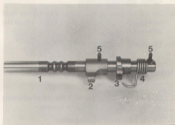


1. Selector fork, 1st and 2nd speeds
2. Selector fork, 3rd and 4th speeds
3. Selector fork, 5th gear
4. Actuator, reverse gear
5. Actuator, 5th gear
6. Shaft, 1st and 2nd speed, 3rd and 4th speed selector forks
7. Shaft, reverse actuator and 5th speed selector
8. Selector shaft
9. Reverse operating lever
10. Taper setscrew, shaft item 7
11. Ball, selector
12. Spring, ball
13. Plunger
14. Dowel

## Selector shafts

### Dismantling

Knock out the dowels with a 4 mm drift. Remove the spring, double lockout and selector.



1. Shaft
2. Actuator
3. Double lockout
4. Spring
5. Tubular dowel

### Fitting

Fit in the guide ring the two retaining springs, and the springs for the plastic rings on the end of the gear. There are also springs for the plastic rings for the gear on the shaft. Fit the pressure spring into the spring.

### Assembly

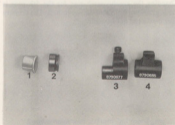
Assembly is in the reverse order. For positioning of parts see illustration. Fit new dowels.

The reverse lever need not be detached from the gear shift shaft when the shaft is removed. The bolt is liable to shear because of the locking of the threads.

## Replacing the seal and plastic bearing on the gear selector rod (Can be done with the gearbox in situ)

### Removal

1. Knock off the front taper pin from the gear shift joint and separate the joint from the rod.
2. Drain the transmission oil and remove the final drive housing cover.



1. Plastic bush
2. Sealing ring
3. Dismantling tool
4. Assembly tool

- Put the dismantling tool 87 90 677 over the collar on the sealing ring and bolt in the bolt of the tool against the shaft.
- Pry off the sealing ring using a boltdriver held between the tool and one of the bolt heads on the differential cover.
- The plastic bush can now be removed.

### Fitting

- Fit the plastic bush.
- Fit the new sealing ring with the aid of assembly tool 87 90 685 and a suitable hammer.
- Fit the final drive housing cover.
- Assemble the gear shift rod joint and the gear shift rod and fit the taper pin
- Fill the transmission with oil.

Before refitting remove any burrs or marks on the gear selector rod.

## Synchromesh

### Synchromesh rings

When changing the synchromesh rings, follow the instructions for the dismantling of the gearbox. The differential unit must be removed and the layshaft gear cluster dismantled so that the primary gear housing can be removed. When changing the synchromesh ring for top gear, no further dismantling is necessary.

When changing the synchromesh ring for 1st and 2nd speed gear, the pinion shaft must be taken out of the transmission housing, so that the gears can be removed from the shaft.

Changing the synchromesh ring for the 5th gear is made after the removal of the input shaft. The primary gear case need not be removed.

1. Dismantling tool 87 90 677

2. Boltdriver

3. Assembly tool 87 90 685



4. Plastic bush

5. Sealing ring

6. Final drive housing cover

7. Gear shift rod joint

8. Gear shift rod

9. Taper pin

10. Oil

11. Pinion shaft

12. Primary gear case

13. Input shaft

14. Layshaft gear cluster

15. Differential unit

16. Gear housing

17. Gear housing cover

18. Gear housing gasket

### Dismantling

Remove the circlip securing the synchronesh ring to the gearwheel. To remove the synchronesh ring for fifth gear, remove the circlip adjacent to the guide ring. The circlip adjacent to the synchronesh ring need not be removed.



### Fitting

First fit the guide rings for the retaining springs, and the circlips for the guide rings on 3rd and 4th gears. There are no circlips on the guide rings for first and second gears. Fit the retaining spring with the longer end adjacent to the guide ring and with the ends spanning 11 teeth.

There are no circlips on the guide rings for first and second gears. Fit the retaining spring with the longer end adjacent to the guide ring and with the ends spanning 11 teeth.

The synchronizing ring is placed so that the ends of the retaining ring fit into the spaces between the teeth, after which the lock ring is fitted.

(The 1st gear synchronesh spring is weaker and has a shorter free length than the other rings).

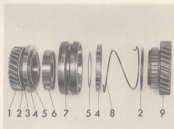
The guide rings on the third and fourth gears are factory-fitted and peened in position by a special tool after the circlip has been fitted. The guide rings supplied as spare parts should not be peened.

Guide 87 02 730, which is available as a spare part, should be used in conjunction with a pear-shaped circlip, 87 02 722.

Alternatively, a complete synchronesh unit comprising the gear and factory-fitted synchronesh is available as a spare part, No. 87 11 632.

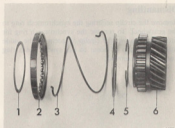
Fit the 5th speed synchro ring. The retaining spring should be positioned so that there are 5 teeth between the ends of the spring. Then fit the guide ring and the circlip.

The synchro ring for 2nd and 3rd gears has a molybdenum-coated cone; the same type may also be used for 1st and 4th gears.



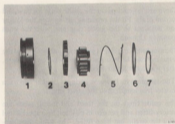
Synchronesh unit, 1st and 2nd speed gear

- |                                     |                               |
|-------------------------------------|-------------------------------|
| 1. 2nd speed gear                   | 5. Circlip                    |
| 2. Guide ring                       | 6. Synchronesh hub            |
| 3. Retaining spring, 2nd speed gear | 7. Synchronesh sleeve         |
| 4. Synchronesh ring                 | 8. Retaining spring, 1st gear |
|                                     | 9. 1st gear                   |



Synchronesh, 3rd gear

1. Lock ring
2. Synchronesh ring
3. Retaining spring, 3rd gear
4. Guide ring
5. Guide-ring circlip
6. 3rd gear



1. Synchronesh sleeve
2. Circlip
3. Synchro cup
4. Synchro hub
5. Retaining spring
6. Guide ring
7. Circlip

## Ventilation

Ventilation of the transmission is by means of a hole through the top cover in the primary gear housing. The hole emerges at the centre of a plastic propeller which is screwed to the clutch shaft.

As the clutch shaft rotates, the oil is flung away from the hole by the propeller. When the shaft is stationary, the oil level in the primary gear is well below the hole.

When the pinion is the centre of the primary wheel, and the backlash between the teeth. These measurements and the mating member are checked on both parts at the time of final setting. When the pinion and crown wheel are installed, these measurements must be accurately repeated with oil and a special measuring instrument. The pinion gear shows are placed next to the housing because of the pinion tooth bearings, and the crown wheel (differential) value are distributed between the two differential bearings.

## Adjusting the position of the pinion gear

### General

Data for adjustment the clearance between pinion gear to the centre of the bearing shaft are shown and the end face of the pinion gear should be illustrated below.

### Important

Before dismantling the transmission, always measure the position of the pinion gear to the shaft. This measurement should be repeated after the pinion gear has been set. If the pinion gear end centre which is usually too close to the shaft (2.00 mm) is not correct, the setting can be adjusted, but when a gear is changed, when the gears will have been changed in a certain position, the parts should be incorporated with the same settings as work necessary prior to dismantling.

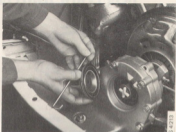


Fig. 471-63. Setting the propeller to the correct position.

When the pinion gear is set, the pinion gear should be checked (all pinion gear should be set this datum has an influence on the adjustment).



## Differential and pinion/crown wheel gear

### General

The crown wheel and pinion are a matched pair, so if one is exchanged the other must be exchanged too. The parts are tested together for noise and the optimum setting for minimum noise output is measured. The key measurements for pinion and crown wheel are the distance from the end face of the pinion to the centre of the crown wheel, and the backlash between the teeth. These measurements and the mating number are stamped on both parts at the time of noise testing. When the pinion and crown wheel are installed, these measurements must be accurately adjusted with shims and a special measuring instrument. The pinion gear shims are placed next to the bearing housing of the pinion shaft bearings, and the crown wheel (differential) shims are distributed between the two differential bearing seats.

### Adjusting the position of the pinion gear

#### General

Data for adjustment of the distance from the pinion gear to the centre of the crown wheel are stamped into the end face of the pinion (an example is illustrated below).

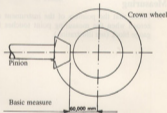
#### Important

Before dismantling the transmission, always measure the positions of the pinion and crown wheel. This provides a check on whether the setting may have been wrong. If the pinion shaft and crown wheel assembly has done less than 6,000 miles (10,000 km), the setting can be adjusted, but after greater mileage, when the gears will have worn themselves into a certain position, the parts should be reassembled with the same settings as were measured prior to dismantling.



End face of pinion

- + 3 = measurement for pinion setting
- R913 = mating number, also stamped on crown wheel
- 0 = pinion not offset - shaft centreline intersects crown wheel centerline (all pinions are marked 0 and this datum has no relevance to the adjustment)



### Before measuring

The following preparations must be made prior to measuring the pinion gear setting:

The following applies to manual transmissions: The pinion shaft bearings must be compressed until the torque required to rotate the pinion shaft in the housing is  $2.5 \pm 0.5$  Nm ( $25 \pm 5$  kgfcm), corresponding to a dynamometer reading of 47–71 N (10.4–15.4 lb, 4.7–7.0 kgf). These figures apply to new, lightly oiled bearings. The corresponding figures for older bearings (which have done more than 1,200 miles (2,000 km) are  $1.3 \pm 0.5$  Nm ( $13 \pm 5$  kgfcm), the dynamometer readings being 19–43 N (4.2–9.5 lb, 1.9–4.3 kgf).

The differential unit must be removed to permit installation of the measuring instrument (tool 83 90 155), which consists of a measuring jig with attached dial indicator. A ground gauge block is provided for calibration of the dial; the block is laid against the calibration stops of the instrument, and the distance between these stops and the centreline of the tool is exactly 2.362 in (60.000 mm), equal to the distance from the end face of the pinion shaft to the centre of the crown wheel (see illustration). The procedure for measuring the pinion gear position is as follows.

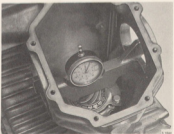
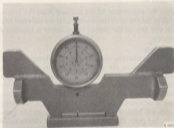
### Measuring

1. Check that the pointers of the instrument are zeroed when the measuring point touches the gauge block (see illustration).



2. Place the instrument in the differential housing with the point applied to the flat end of the pinion gear and take a reading (see illustration).

When the pinion gear is correctly positioned, the dial should show the same reading (in hundredths of a millimeter (+ or -) as that stamped on the pinion (with a permitted tolerance of  $\pm 0.05$  mm).



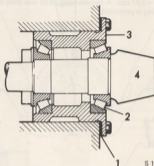


### Shimming

If the measured reading is outside the permitted tolerance, the pinion shaft must be adjusted. This is done with shims placed between the pinion shaft bearing housing and the transmission case (see illustration).

#### Shim table

Location	Shims Thickness mm	Spare part No.
Pinion shaft between bearing housing and transmission case	0.10	83 41 752
	0.15	83 41 760
	0.30	83 41 778
	0.50	83 44 723



S 1845

#### Adjusting the pinion gear

1. Shim
2. Roller bearing
3. Bearing housing
4. Pinion

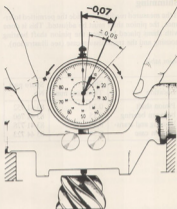
Procedure for shimming is as follows:

1. Undo the four bolts from the pinion shaft bearing housing and tap the pinion shaft gently out of the transmission case.
2. Change the shimming according to the following rules:
  - a) If the dial reading is *higher* than the correct value, *increase* the shim combination.
  - b) If the dial reading is *lower* than the correct value, *reduce* the shim combination.

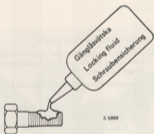
**Note!** + reads counter-clockwise and - reads clockwise on the dial.

Reduce or increase the shim combination by the difference between the measured and correct values.

If the pinion is stamped -7, the pointers should indicate  $-0.07$  mm. A deviation of  $\pm 0.05$  mm from this reading is permitted.



- Having selected the correct combination of shims, place them in the transmission case with aid of the locating pins. Mount the pinion shaft to the transmission case using sleeve 83 90 148 and arbor 83 90 114. Remove the locating pins, apply Loctite to the bolts and then tighten them to the prescribed torque.

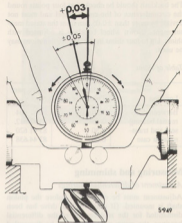


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### Rechecking

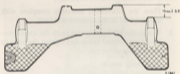
After shimming, replace the measuring jig in the differential housing and check that the dial now gives the correct reading to within  $\pm 0.05$  mm. If it does not, the shimming procedure must be gone through again.

If the pinion is stamped +3, the dial should indicate  $+0.03$  mm. A deviation of  $\pm 0.05$  mm from this reading is permitted.



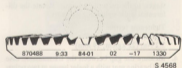
### Checking the measuring jig

The measuring jig is a precision-made tool. It should be handled with care to avoid knocks and deformation. If there is reason to suspect that the jig may have been damaged in such a way that it gives wrong readings, it can be checked. The dimension indicated in the illustration on the right should be measured for this purpose.



### Adjusting crown wheel backlash

Certain data for adjustment of crown wheel backlash are stamped on the crown wheel as illustrated.



#### Crown wheel markings

- 870488 = Item number (not part number)
- 9:33 = Ratio
- 84-01 = Date of manufacture and identification code
- 02 = Material code
- 17 = Backlash of 0.17 mm. Unless otherwise stated, this has a tolerance of 0.05 mm
- 1330 = Mating number, which is also stamped on the pinion

The backlash should be checked at four points round the circumference of the crown wheel and must not deviate by more than  $\pm 0.05$  mm from the stated measurement. Crown wheel backlash is adjusted with shims. Up to four shims in suitable combinations may be used.

Table of shims

Location	Shims Thickness mm	Spare part No.
Between differential bearing seat and transmission case	0.10	83 41 604
	0.15	83 41 612
	0.30	83 41 620
	0.50	83 44 638

## Measuring and shimming

### Adjustment of differential bearings

Adjustment must be carried out before the pinion shaft is mounted. (If only the final drive has been dismantled for the replacement of the differential bearings, the crown wheel must also be dismantled before the bearings can be adjusted.)

1. Place the differential assembly complete with crown wheel in the transmission case.
2. Mount the left bearing seat (with the speedometer drive) without shims and tighten the bolts to the prescribed torque.

#### Tightening torque,

left-hand bearing seat  
20–25 Nm (2.0–2.5 kgfm, 14–18 lbf<sub>t</sub>.)

3. Oil the differential bearings and mount the right bearing seat. Tighten the bolts, in two or three stages, to the prescribed torque. Rotate the differential while tightening the bolts.

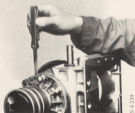
#### Tightening torque

right-hand bearing seat  
2.2 Nm (22 kgfcm; 19 lbf<sub>in</sub>)

4. Measure the gap between the transmission case and bearing seat with a feeler gauge at two points opposite each other and take an average of the two measurements. Then select shims corresponding to this result plus an increment of 0.20 mm to obtain the correct bearing compression.

The method described above applies to both new and old bearings.

The torque obtained in this way can be measured by means of a torque wrench and driver 87 90 818.



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Ensure that you adjust to the correct values. The following values apply for the rolling torque.

New, lightly oiled bearings:  
1.8–2.8 Nm (16–24 lbin, 18–28 kgfcm)

Bearings having run more than 1 200 miles (2 000 km)  
0.8–1.3 Nm (7–11 lbin, 8–13 kgfcm)

Shims of four different thicknesses can be suitably combined. The available thicknesses are shown in the table below.

Table of shims

Location	Shims Thickness mm	Spare part No.
Between differential bearing seat and transmission case	0.10	83 41 604
	0.15	83 41 612
	0.30	83 41 620
	0.50	83 44 638

The resulting set of shims should then be distributed between the right and left sides to give the correct backlash.

#### Adjusting crown wheel gear backlash

1. Place the differential assembly complete with crown wheel in the transmission case.
2. Mount the left bearing seat (with the speedometer drive) without shims and the right bearing seat with the selected set of shims, tightening the bolts to the prescribed torque.

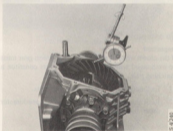
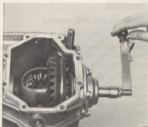
#### Tightening torque

LH and RH bearing seat:  
20–25 Nm (2.0–2.5 kgfm; 18 lbft.)

3. Mount the dial indicator, see illustration, and measure the backlash.
4. Calculate the difference between the measure backlash and the desired backlash, and then move shims of suitable thickness over to the left bearing seat. Check the measurement once again.

#### Note

The preselected set of shims must be used for adjusting the backlash. The total thickness of the set must not be altered.



## Differential

### To dismantle the differential

1. Remove the final drive cover.
2. Remove the two differential bearing seats together with the inner drivers. Save the shims and remove the differential.
3. Remove the speedometer drive and press off the journal bearing using tools 89 96 084, 87 90 768 and 89 95 177. To change the outer bearing races, refer to the section on dismantling of the inner driver.

Tool No.	89 96 084	87 90 768
Tool Name	89 95 177	89 95 177

### Mounting and adjustment

#### Advantages of differential bearings

A differential must be packed out before the pinion

4. Remove the locking pin from the differential shaft and carefully tap out the shaft. Save the gears and the wear washers.
5. Undo the crown wheel bolts and remove the crown wheel.

### To assemble

#### Important

If the crown wheel is exchanged, the pinion gear must be exchanged with it, as these two parts constitute a matching pair.

1. Exchange any worn or damaged parts.
2. Refit the journal bearings and the speedometer drive, using tool 87 90 487.

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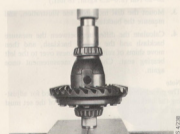
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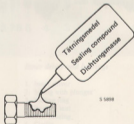
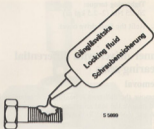
3. Mount the differential and differential bearing seats inside the transmission case. Check the bearing preload and adjust the shims as necessary (refer to "Inner driver with differential bearing seats").
4. Remove the differential and bearing seats from the transmission case.
5. Fit the crown wheel, tighten the bolts to the specified torque and apply locking fluid to them.

**Tightening torque:**

$90 \pm 10 \text{ Nm}$  ( $9 \pm 1 \text{ kgf m}$ )

6. Fit the gears and wear washers and insert the differential shaft. Fit the locking pin.

7. Mount the differential and differential bearing seats in the transmission case.
8. Check the crown wheel backlash and adjust as necessary (see the section on the inner driver with differential bearing seats).
9. When finally fitting the differential bearing seats, apply sealing compound to the 12 bolts.



**Tightening torque:**

20–25 Nm (2–2.5 kgf m)

10. Refit the final drive cover.

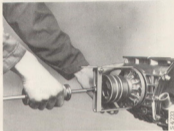
## Inner driver with differential bearing seats

### Removal

Remove the differential bearing seat retaining bolts and remove the seat and inner driver using tool 87 90 776 and tool 83 90 270. Save the shims.

1. Remove the differential and differential bearing seat from the transmission case. Check the bearing preload and adjust the shims as necessary. Refit the final drive with differential bearing seat.

2. Remove the differential and bearing seat from the transmission case.



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### Dismantling

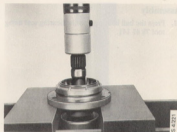
1. Remove the circlip from the driver.



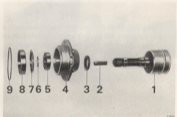
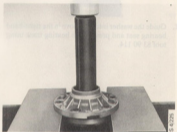
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2. Press out the driver from the differential bearing seat.
3. Using a screwdriver, remove the seal ring taking care not to damage the bearing seat.
4. Remove the speedometer drive from the left bearing seat.
5. Press out the ball bearing using tool 78 41 067.



6. Remove the bearing tracks for the differential bearings by means of a suitable drift. A washer is located inside the bearing track for the right-hand differential bearing seat (seat without speedometer drive) and the purpose of this is to improve the bearing lubrication.
7. Remove the O-ring from the groove in the bearing seat.



*Inner driver and bearings*

1. Inner driver
2. Spring with plunger
3. Sealing ring
4. Bearing seat
5. Ball bearing
6. Circlip
7. Oil level washer
8. Bearing track
9. O-ring

### Assembly

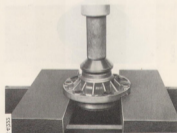
1. Press the ball bearing into the bearing seat using tool 78 41 141.



2. Guide the washer into its groove in the right-hand bearing seat and press in the bearing track using tool 83 90 114.



3. Using drift 87 90 800, press in the seals in such a way that they will project approximately 0.08 in (2 mm) above the plane of the bearing seat.



4. Fit the bearing seats in the transmission and adjust the bearing preload. (Refer to the section on adjustment of the differential bearing preload near the beginning of 473).

The crown wheel must be removed from the differential case if the pinion is in place.

5. Press the bearing seat onto the driver shaft using tool 78 41 067.
6. Fit the circlip.
7. Fit the speedometer drive.
8. Fit the O-ring in the groove in the bearing seat.

The axle of the driver is in the form of a splined shaft which has a taper. In the three-bearing universal joint of the speedometer drive, when the car is in motion, the pinion which is mounted to the axle has to rotate and slide axially on the driver shaft as well as rotate. The pinion is sealed with grease and is lubricated by the oil from the differential housing.

### Installation

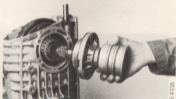
See adjustment of the differential bearing compression and adjustment of backlash.

1. Check that the O-ring is mounted on the bearing cap and place the spring and plunger in the hole in the end of the driver shaft.
2. Fit a suitable combination of shims to the two bearing caps and mount the caps, together with inner driver, to the transmission.
3. When securing the bearing cap, check that there is backlash. Tighten the retaining bolts to the prescribed torque. Use sealing compound on the threads of the 12 bolts.

**Tightening torque, differential bearing cap:**  
20–25 Nm (15–18.5 lb ft, 2.0–2.5 kgfm)

4. Check the backlash by measuring in four places.

1. Disconnect the drive shaft from the axle using tool 78 41 067.
2. Measure the backlash in four places.
3. Pull out the inner driver from the bearing cap and remove the shims.
4. See page 473 for the procedure for adjusting the inner driver from the bearing cap. The shims can be done with the inner driver removed.
5. If the vehicle has a steering column with a steering column lock, remove the steering column lock from the vehicle when you are adjusting the pinion. The steering column lock should be removed from the shaft.



## Outer universal joint

## General

## Universal joints

## Inner universal joint

The inner universal joint consists of a driver journalled on a ball bearing in the differential bearing seat and splined onto the differential gear. The driver is locked axially by means of a circlip inside the ball bearing and by a spring and plunger at the end of the driver which bears against the differential shaft.

The driver is removed from the transmission complete with the differential bearing seat.

The outside of the driver is in the form of a sleeve in which there is a recess for the three-bearing universal joint of the inner drive shaft. When the car is in motion, the joint which is journalled in needle bearings can slide axially in the driver sleeve as well as being jointed. The joint is packed with grease and is protected by a rubber bellows. Lubrication of the joint is only necessary when the joint is to be reconditioned or removed for some reason.

## Dismantling

1. Jack up the front of the car and remove the wheel.
2. Remove the brake housing and hang it up by the wheel housing to avoid strain and damage to the brake hose.
3. Release the large clip from the rubber bellows on the inner universal joint.

To separate the inner universal joint, fit cover 73 23 736 in the rubber bellows to stop the needle bearings from falling out and to keep dirt out of the joint. Fit protective cap 78 38 469 to the inner driver.

4. Disconnect the tie rod from the steering arm using tool 89 95 409 and remove the nut on the upper ball joint. Remove the bolts from the lower wishbone bracket.
5. Pull out the drive shaft through the wheel housing and remove the entire front axle assembly.
6. See page 473-10 for the removal and fitting of the inner driver from the transmission. (This cannot be done with the transmission in situ.)
7. If the rubber bellows on the inner or outer universal joint needs renewing, disconnect the shaft from the outer joint (see "Outer universal joints"). The rubber bellows can then be slipped off the shaft.



Inner universal joint and inner drive shaft



## Assembly

1. Make sure that the inner driver is washed clean, and then pack it with grease. To ensure that a sufficient quantity is used, pack grease inside the rubber bellows as well. Some 130 g of grease will be needed altogether, approximately 80 g of which can be packed in the inner driver.

### Grease

Use soft EP grease with a lithium-lead base designed to withstand wide variations in temperature and loading. Consistency in accordance with ESSO Beacon EP 2.

2. Slip the rubber bellows over the drive shaft and fit the shaft and rubber bellows to the outer universal joint (see Section 475).
3. Pack the needle bearings with grease and fit the bearings over the ends of the drive shaft. Fit cover 73 23 736 to the rubber bellows to protect the bearings and prevent them from falling off. Then insert the shaft complete with rubber bellows through the wheel housing.
4. Take the cover out of the rubber bellows and slide the drive shaft complete with needle bearings into the inner driver. Locate the rubber bellows and refit the clips.
5. Fit the steering knuckle housing and steering arm.
6. Fit the brake housing.
7. Fit the wheel and lower the front of the car.

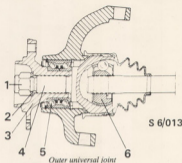
### Important

After the brake housing has been fitted the brake pads must be advanced to their correct positions close to the disc by repeated pumping of the brake pedal. Otherwise the foot brake will not work.

## Outer universal joint

### General

The outer universal joint transfers the power from the intermediate to the outer drive shaft. The outer drive shaft terminates in a bell with a spherical track in which six balls transmit the driving power from a hub. The intermediate drive shaft is splined onto the hub and is locked axially by means of a circlip accessible through a recess in the hub. The hub, balls and outer shaft are individually matched and are not interchangeable. Lubrication of the joint is only necessary when the joint is to be reconditioned or removed for some reason.



1. Lock nut
2. Washer
3. Wheel hub
4. Outer drive shaft
5. Bearing with seals
6. Outer drive shaft joint

See Group 7 (section 774) for instructions on removal and fitting of the outer universal joints.

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