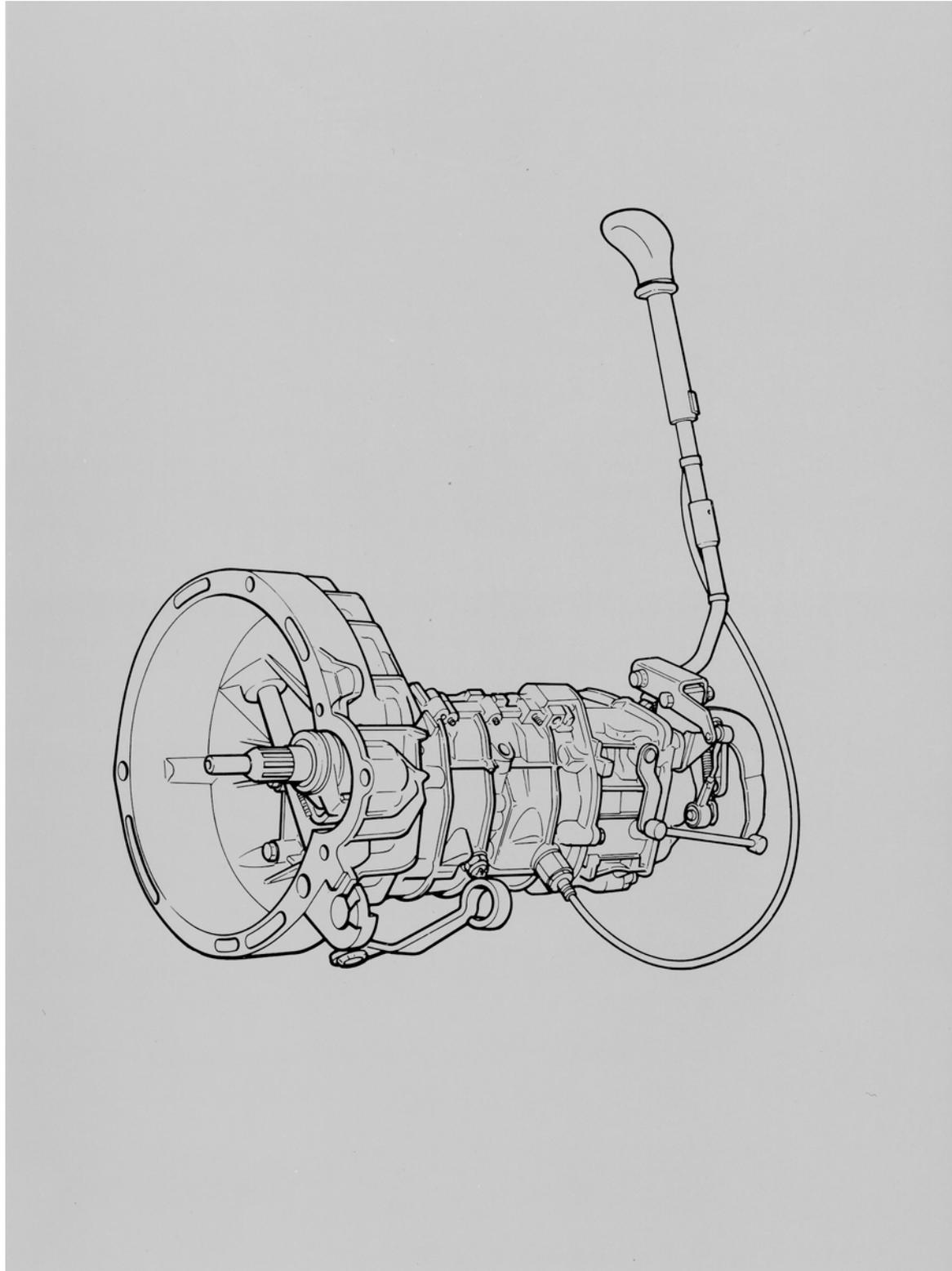


Service Workbook

Gearbox P5-100





P5-100 GEARBOX Service Workbook

This Service Workbook is primarily designed to assist skilled technicians in the efficient repair and maintenance of LDV vehicles, but can also be used as a reference workbook for training purposes.

This service workbook should always be consulted prior to servicing or repair work.

SPECIFICATION

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CONTENTS

	Page
Introduction and General Precautions	1
Technical data	2
Maintenance	
Adhesives and Sealants	
Capacities	
Lubricants	3
Special tools	4
Torque wrench settings	8
Gearchange - linkage adjustment	9
Clutch - adjustment	9
- remove and refit	12
Gearbox - remove and refit	11
- clutch housing / front oil seal overhaul	12
- rear oil seal renew	14
- overhaul:	
dismantling	17
sub-assembly overhaul	20
input shaft	20
mainshaft	23
layshaft	26
layshaft extension	27
reverse idler	28
selectors	28
intermediate casing	30
rear casing	31
reassembly	32
mainshaft preload	32
layshaft preload	33
layshaft extension end-float	35
Propeller shaft	39
- remove and refit	40
- universal joint overhaul	40
- centre bearing, remove and refit	41



INTRODUCTION

WARNINGS and **CAUTIONS** are given throughout this Service Workbook in the following form:

WARNING: Procedures which must be followed precisely to avoid the possibility of personal injury.

CAUTION: This calls attention to procedures which must be followed to avoid damage to components.

NOTE: This calls attention to methods which make a job easier to perform.

REFERENCES

References to the left and right hand side in this Service Workbook are made when viewing the vehicle from the rear.

To reduce repetition, operations covered in this Service Workbook do not always include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and, if necessary, a road test of the vehicle is carried out, particularly where safety related items are concerned.

GENERAL PRECAUTIONS

1. The gearbox is heavy; whilst removing or fitting, it is recommended that the weight of the gearbox is taken on a suitable cradle jack.
2. When removing a gearbox, if the vehicle has recently been running, the gearbox and exhaust system may be hot to the touch.
3. Whilst removing or fitting a gearbox, do not allow it to 'hang' on its input shaft as damage may be caused.
4. Do not work under the vehicle when supported only by a jack; always use safety stands.
5. When disconnecting the vehicle battery, always disconnect the earth return (negative) cable first, and then the positive cable. On twin battery installations, disconnect both earth return (negative) cables first, and then the positive cables.

REPAIRS AND REPLACEMENTS

When replacement parts are required, it is essential that only genuine LDV Parts are used.



TECHNICAL DATA

Gearbox

- Type - P5-100.
Application - All 400 models fitted with EN and ET Diesel engine.
Speeds - 5 forward, 1 reverse.
Synchronesh - All speeds
Weight - 36 Kg (dry)

		EN	ET
Ratios	- 1st	4.032	4.032
	2nd	2.393	2.393
	3rd	1.521	1.521
	4th	1.000	1.000
	5th	0.780	0.725
	Reverse	3.760	3.760

Clutch

- Type - Diaphragm, single dry plate.
Diameter - 235 mm.
Release mechanism - Mechanical by cable.

Clearances and Tolerances

Mainshaft shim and washer combined thickness	4,55mm	0.179in
Mainshaft preload	0,10mm	0.004in
Layshaft preload	0,10mm	0.004in
5th gear layshaft end float	0,05mm	0.002in



MAINTENANCE

After Sales Service

20,000 km (12,000 miles), 12 months - Main Service

1. Check/top up gearbox oil level.
2. After road test - check for leaks.
3. Check/adjust clutch

Gearbox oil capacity - 1,8 litres 3.2 pints

Recommend Lubricants

Gearbox oil - Minimum performance level to meet specifications:

- BLS 22 OL 09, API SF/CD
and CCMC PD1

Driven plate / input shaft splines

Clutch throw out fork ends

Clutch release bearing sleeve

- Molycote Long Term 2 Plus

Propeller shaft sliding splines

Universal joints

- Multipart Multipurpose L2

Adhesives and Sealants

All mating faces

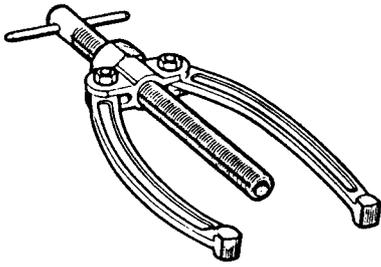
Detent Allen screws

- RTV Silicone Sealant - Black
- Loctite thread sealer



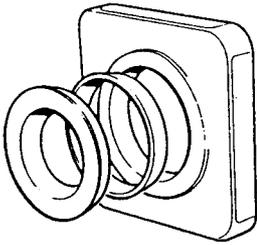
SPECIAL TOOLS

1.36/1



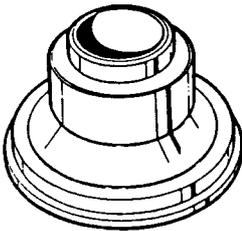
Bearing extractor

0480042
(370)



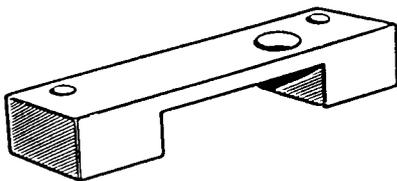
Press base plate
(see also 484820)

0480064



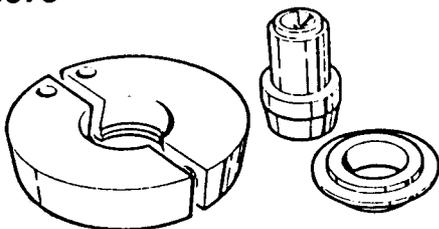
Rear oil seal replacer

0480068



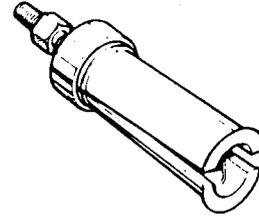
5th selector shaft support

0480070



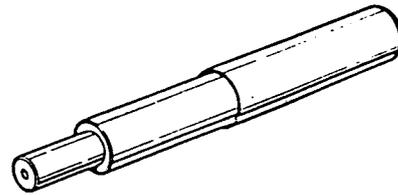
Mainshaft/pilot bearing
remover/replacer

1.30/5



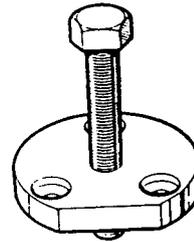
Extractor adaptor

0480057



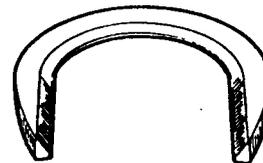
Clutch aligner

0480065



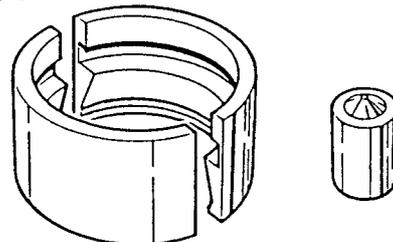
Rear casing remover

0480069



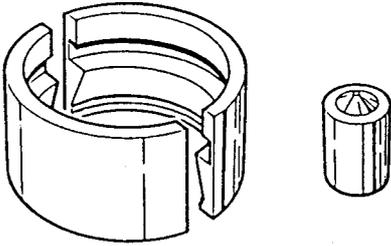
5th gear remover

0480071



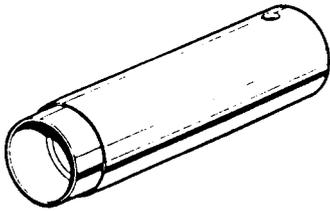
Mainshaft pilot bearing remover

0480072



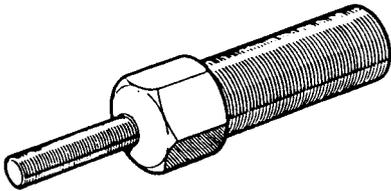
Layshaft bearing remover

0480074



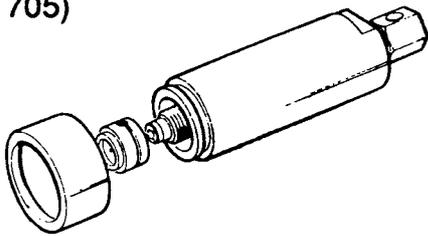
Mainshaft circlip replacer

0480076



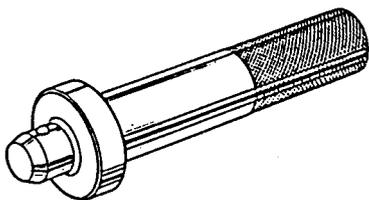
5th gear replacer adaptor

0484801
(18G 705)



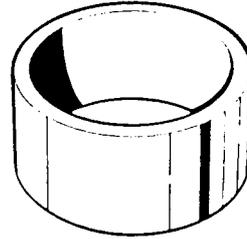
Bearing race remover

0499809
(18G 134)



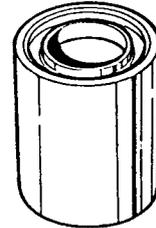
Driver handle

0480073



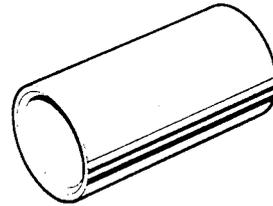
Mainshaft bearing squaring tool

0480075



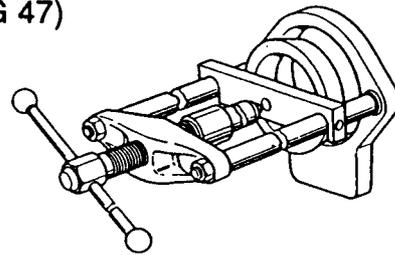
Layshaft bearing replacer

0480077



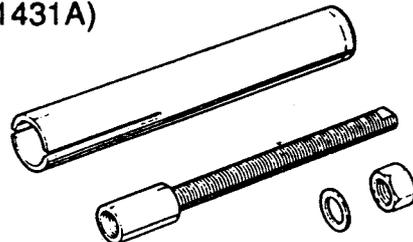
Pilot bearing cone replacer

0484820
(18G 47)



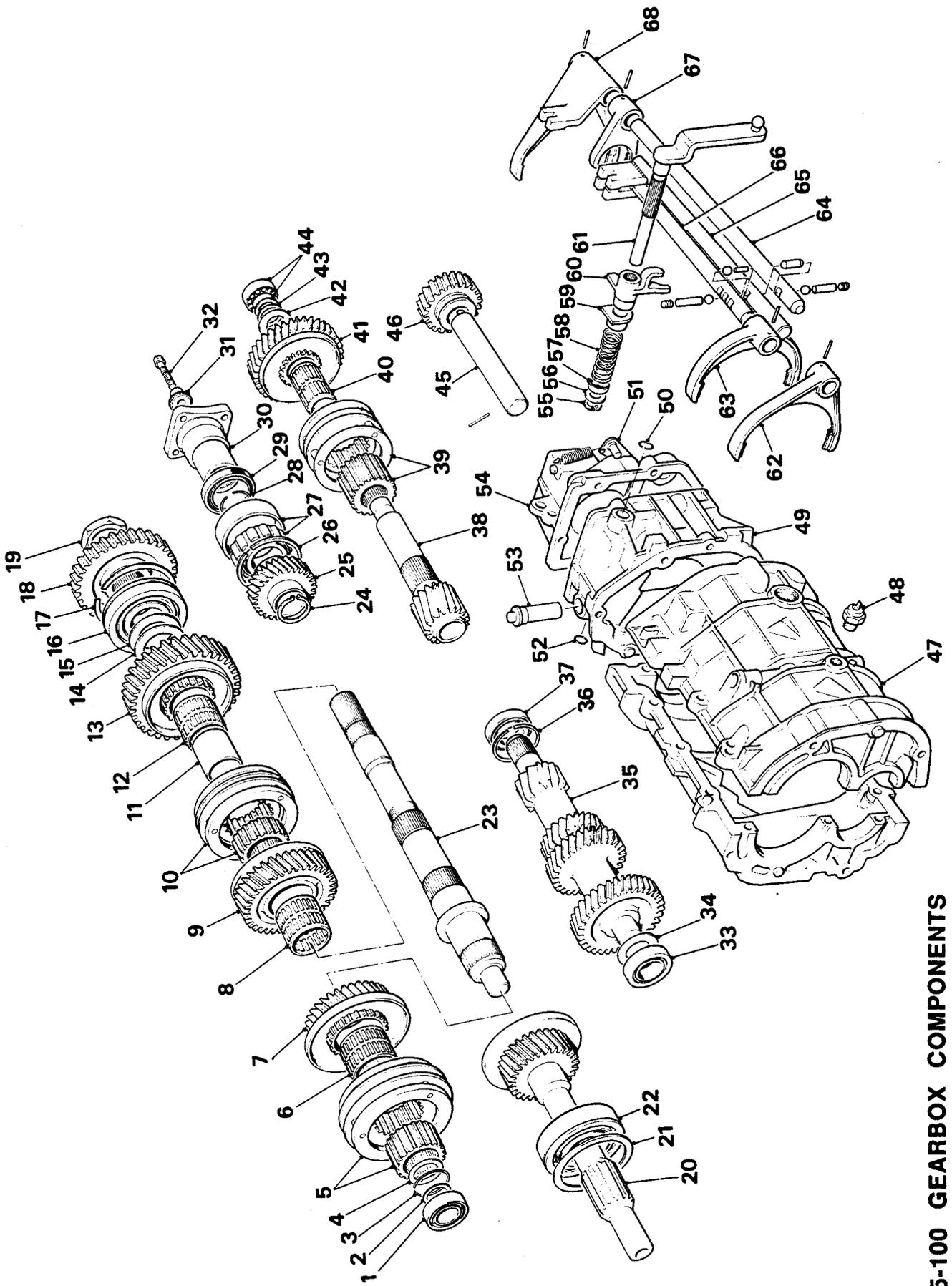
Handpress
(see also 480042)

0499915
(18G 1431A)



5th gear replacer

Also required - Two legged puller 18G 2 or similar



P5-100 GEARBOX COMPONENTS

Key to P5-100 gearbox components

- | | | |
|--------------------------------------|---|--------------------------------|
| 1. Pilot bearing | 24. Circlip | 47. Main casing |
| 2. Washer | 25. 5th gear | 48. Reverse light switch |
| 3. Snap ring | 26. Snap ring | 49. Intermediate casing |
| 4. Belleville washer | 27. Roller bearing - 5th mainshaft gear | 50. 'O' ring |
| 5. 3rd/4th synchro hub & sleeve | 28. Circlip | 51. Cross-gate selector arm |
| 6. Needle bearing - 3rd gear | 29. Oil seal | 52. 'O' ring |
| 7. 3rd gear | 30. Flange | 53. Breather |
| 8. Needle bearing - 2nd gear | 31. Crush sleeve | 54. Rear casing |
| 9. 2nd gear | 32. Allen screw | 55. Circlip |
| 10. 1st/2nd synchro hub & sleeve | 33. Front bearing - layshaft | 56. Washer |
| 11. Sleeve - 1st gear bearing | 34. Shim - layshaft bearing preload | 57. Spring cup |
| 12. Needle bearing - 1st gear | 35. Layshaft | 58. Spring |
| 13. 1st gear | 36. Snap ring | 59. Bush |
| 14. Shim | 37. Rear bearing - layshaft | 60. Selector fingers |
| 15. Washer | 38. Layshaft extension | 61. Selector shaft |
| 16. Centre bearing - mainshaft | 39. 5th gear synchro hub & sleeve | 62. 3rd/4th selector fork |
| 17. Snap ring | 40. Needle bearing - 5th layshaft gear | 63. 1st/2nd selector fork |
| 18. Reverse (mainshaft) gear | 41. 5th layshaft gear | 64. 5th/reverse selector shaft |
| 19. Nut | 42. Washer | 65. 3rd/4th selector shaft |
| 20. Input shaft | 43. Shim - layshaft extension end-float | 66. 1st/2nd selector shaft |
| 21. Shim - mainshaft bearing preload | 44. Roller bearing - layshaft extension | 67. Reverse selector fork |
| 22. Bearing - input shaft | 45. Reverse idler shaft | 68. 5th selector fork |
| 23. Mainshaft | 46. Reverse idler gear | |





TORQUE WRENCH SETTINGS

	Nm	Lbf ft
Casings - Main - long bolts	15	11
- short bolts	10	7
- intermediate	17	12.5
- rear	15	11
Clutch cover	20	15
Clutch housing to engine	80	60
Clutch housing to gearbox	27	20
Detent plugs	12	9
Drain plug	27	20
Filler/level plug	27	20
Mainshaft nut	55	40
Propellor shaft flange Allen screw	20	15
Reverse detent cable	45	33

CLUTCH CABLE ADJUSTMENT

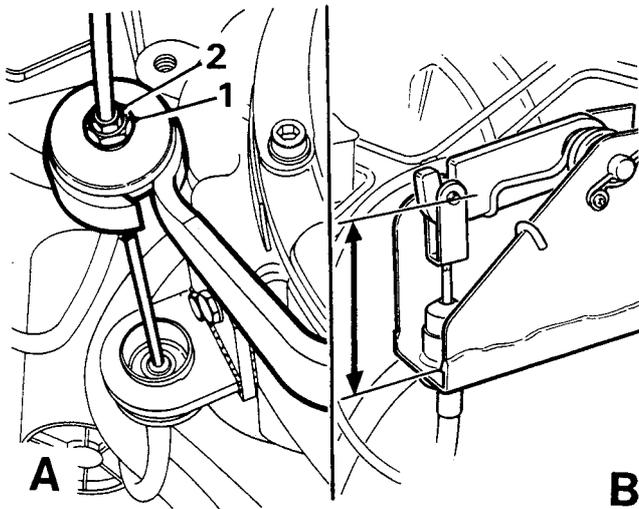


Fig.1 Cable adjustment

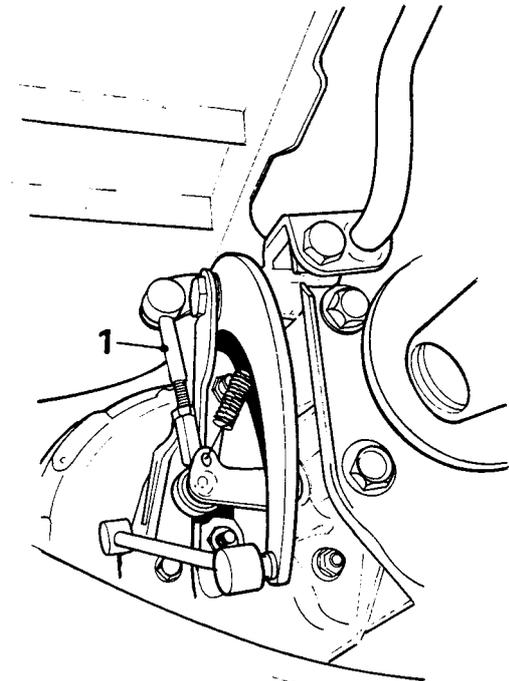
1. Adjusting nut
2. Lock nut

At actuating mechanism underbonnet, measure distance between bell crank lever pin centre and platform (see fig.1B). Measurement should be 87 to 88 mm (3.43-3.48 in).

If adjustment is required, it is made at gearbox end of clutch cable (see fig.1A):

1. Slacken lock nut and turn cable adjuster nut until measurement (fig.1B) is correct.
2. Tighten lock nut.
3. Operate clutch several times and recheck setting dimension; re-adjust if necessary.

GEARCHANGE LINKAGE



Adjustment (Early vehicles only)

Fig.1 Gearchange linkage

1. Vertical link

There is only one adjustable link on the gearchange mechanism; the vertical link (1) is adjustable to alter the transverse position of the gear lever inside the cab.

To check:

1. Select reverse gear (right hand drive) or 2nd gear (left hand drive)
2. Check for adequate clearance between gear lever and driver's seat.

To adjust:

3. Disconnect vertical link rod at lower end; adjust rod length until a satisfactory clearance is obtained. Refit the rod.

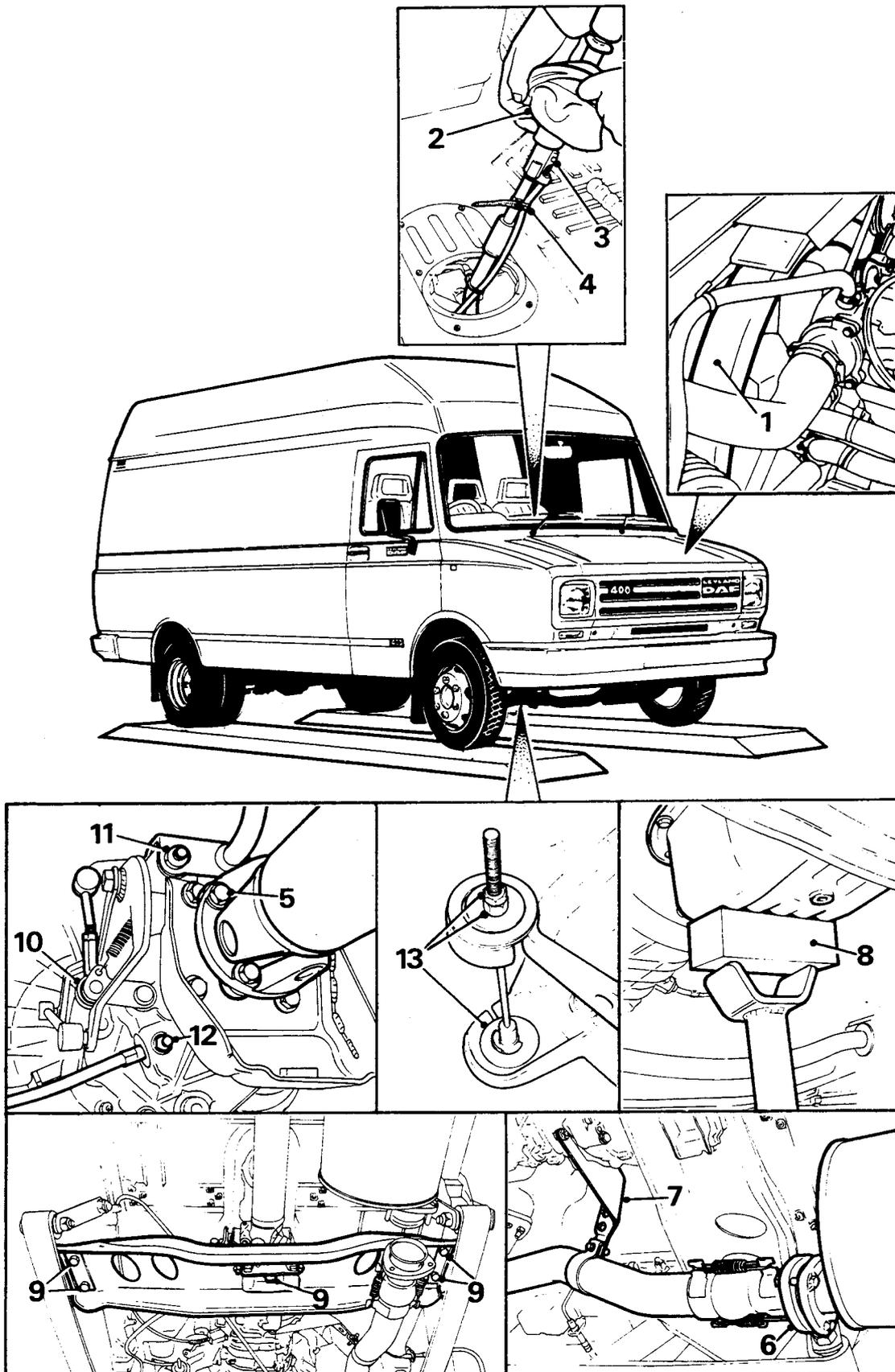


Fig.1 Gearbox removal

GEARBOX REMOVE AND REFIT

Remove

1. Drive vehicle on to lift.
2. Underbonnet:
 - Disconnect battery, negative lead first.
 - Detach fan cowl (1) from radiator. Do not remove.
3. Inside cab:
 - Release gear lever gaiter (2).
 - Detach reverse detent cable (3) from lever, and cable tie (4) to lever.
4. Under vehicle:
 - Make correlation marks and disconnect propeller shaft (5).
 - Disconnect exhaust downpipe at silencer (6), and at mounting bracket (7) to gearbox.
 - Support engine under sump using suitable wooden block (8) and axle stand.
 - Remove crossmember (9).
 - Disconnect gear lever by removing clip (10) which retains adjustable link, and bolt (11) which fastens lever to housing.
 - Disconnect :
 - Speedometer cable (12).
 - Reverse light wires.
 - Clutch cable (13).
 - Remove:
 - Two dirt shields from front of clutch housing.
 - Starter motor. Do not allow motor to hang on its cable.

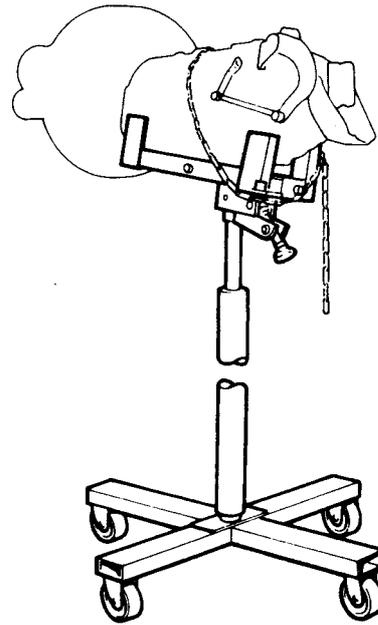


Fig.2 Gearbox on hydraulic cradle jack

- Securely support gearbox on hydraulic cradle jack.

CAUTION: Do not allow gearbox to 'hang' on clutch.

- Remove clutch housing bolts and pull gearbox clear.

Refit

5. Refitting is the reverse of the above procedure, but pay particular attention to the following points:
 - Lightly lubricate input shaft splines, clutch throw-out fork ends and release bearing sleeve with recommended lubricant.
 - Do not allow gearbox to 'hang' on clutch splines while fitting it.
 - Tighten all clutch housing bolts progressively, and to the correct torque.
 - Align correlation marks before connecting propeller shaft.
 - Adjust clutch cable after fitment.
 - Check/top-up gearbox oil level.



CLUTCH

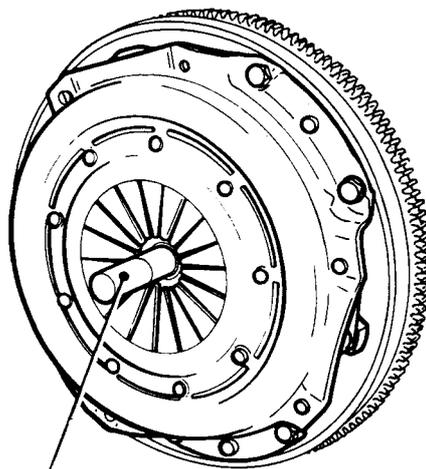
Remove

1. Remove gearbox.
2. Progressively remove 6 bolts to release clutch cover and driven plate.
3. Examine:
 - Flywheel face for wear or scoring.
 - Spigot bush and seal in crankshaft flange for wear/damage.
 - Clutch driven plate for spline wear, loose/broken springs, linings for wear or contamination.
 - Clutch cover for finger wear/ damage, spring damage/security.

Renew components as necessary.

Refit

4. Smear crankshaft bush and driven plate splines with recommended lubricant.



0480057

Fig.1 Centralising clutch driven plate.

5. Align driven plate using clutch aligner 0480057, and fit and progressively secure clutch cover.

Tighten clutch cover bolts to 20 Nm (15 lbf ft.).

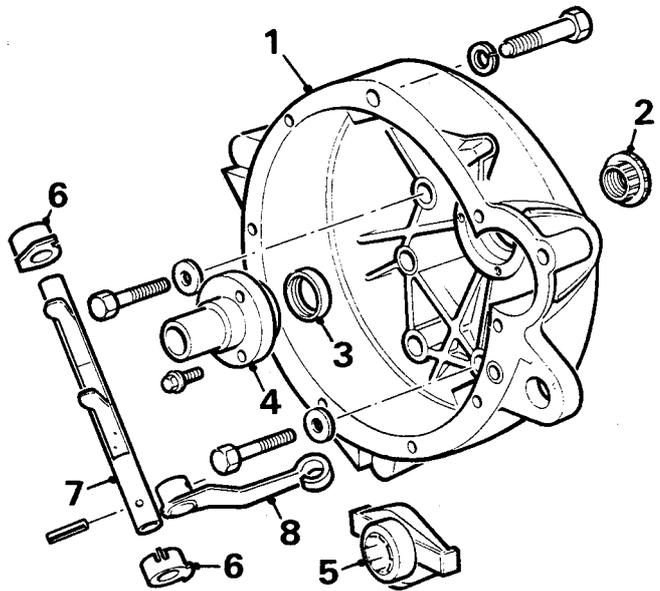


Fig.1 Clutch housing

1. Clutch housing
2. Oil scroll
3. Oil seal
4. Release bearing guide
5. Clutch release bearing
6. Clutch fork/shaft bearings
7. Clutch fork/shaft
8. Lever arm

1. Remove gearbox from vehicle.
2. To dismantle:

NOTE: If gearbox front oil seal only is to be changed, it is not necessary to carry out all the following operations. Instead, release clutch fork/shaft bearing nearest to lever arm and remove release bearing and release bearing guide.

Remove:

- release bearing,
- pin securing lever arm to clutch fork/shaft - drift out at threaded end,
- lever arm,
- lower clutch fork/shaft bush,
- clutch fork/shaft,
- upper clutch fork/shaft bush,
- release bearing guide (3 bolts).

NOTE: Clutch fork/shaft and lever arm are supplied as a matched pair.

3. Prise oil seal from bearing guide - discard.

NOTE: A plastic oil retaining scroll ring is located in rear of clutch housing. This scroll ring can only be renewed after removing clutch housing from gearbox.

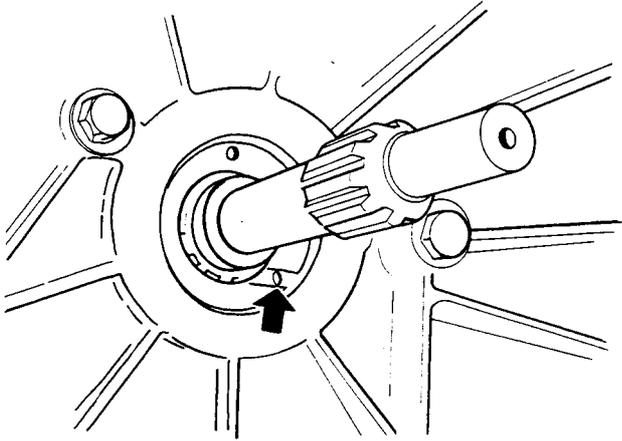


Fig.2 Drain hole

Check drain hole is clear - see fig.2.

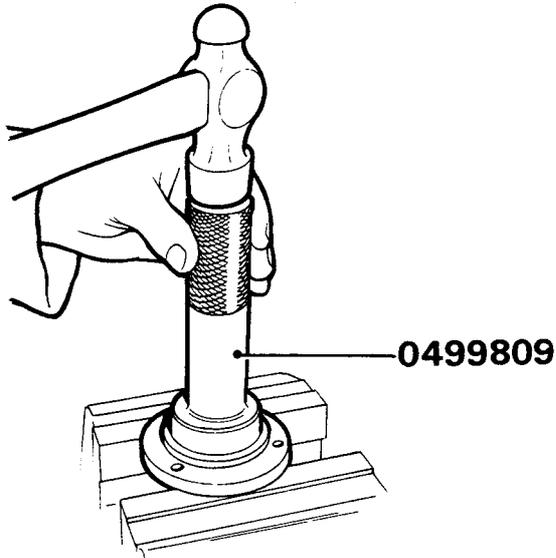


Fig.3 Fitting seal in release bearing guide

4. To assemble:

Use 0499809 (18G 134) to fit new seal, lip side out, into release bearing guide.

Lubricate seal lip in release bearing guide, apply sealant to mating faces and fit guide.

NOTE: Ensure sealant does not block drain hole (see fig.2).

5. Fit:
 - upper fork/shaft bush,
 - clutch fork/shaft,
 - lower fork/shaft bush,
 - lever arm - secure with pin,
 - release bearing.
6. Lightly lubricate input shaft splines, clutch throw-out fork ends and release bearing sleeve with recommended lubricant.
7. Refit gearbox to vehicle and check oil level.



GEARBOX REAR OIL SEAL

Remove and refit

Tool required: 0480064

Remove

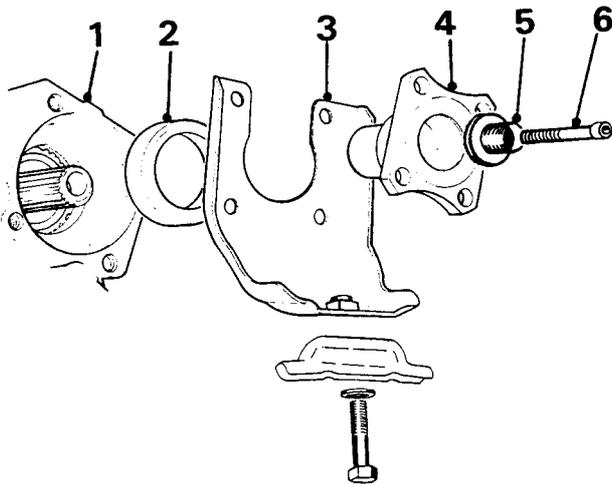


Fig.1

1. Rear casing
2. Oil seal
3. Support bracket
4. Flange
5. Crush sleeve
6. Allen screw

1. Paint correlation marks on flanges, disconnect propeller shaft.
2. Engage a gear to hold gearbox flange, use 8 mm Allen key to remove Allen screw and pull off flange. Observe crush sleeve to secure Allen screw.
3. Support gearbox, and remove support bracket between crossmember and casing.
4. Prise out oil seal.

Refit

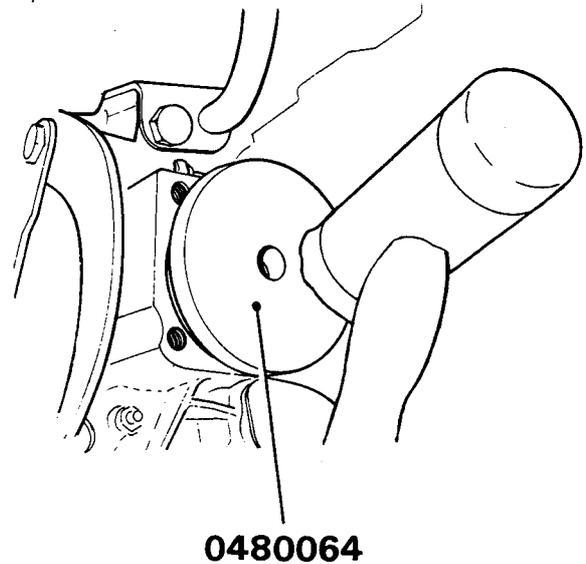


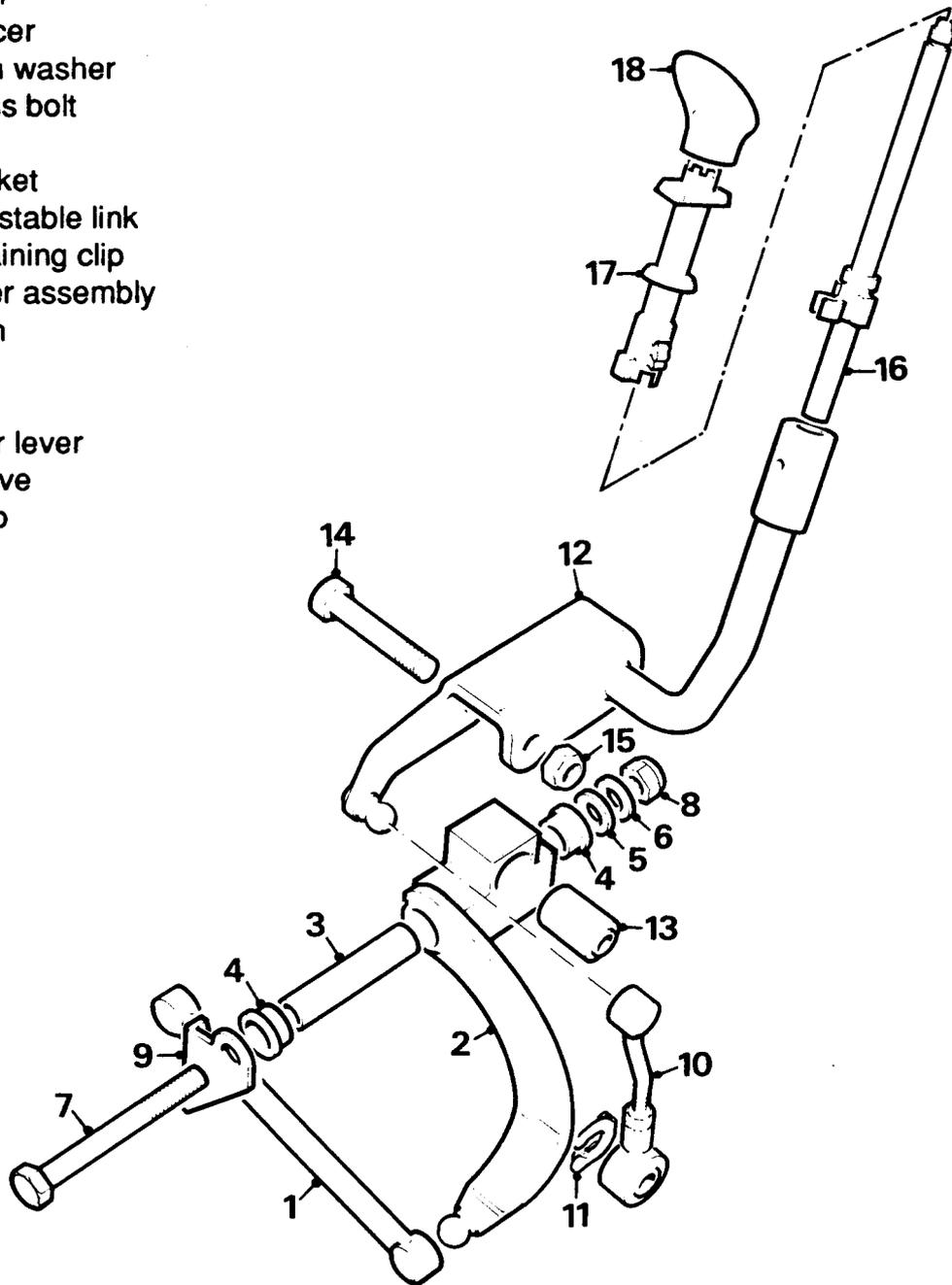
Fig.2 Fitting rear oil seal

5. Lubricate new seal and use 0480064 to fit it, lip side inwards.
6. Fit support bracket and remove gearbox support.
7. Fit flange.
Apply RTV sealant to serrated face of crush sleeve, before fitting it and Allen screw.
Tighten Allen screw to specified torque, and crimp sleeve onto flat faces on head of screw.
8. Align correlation marks, and fit propeller shaft.



Fig.1 Gearchange mechanism

- 1. Link
- 2. Lever assembly
- 3. Tube
- 4. Bush
- 5. Spacer
- 6. Plain washer
- 7. Cross bolt
- 8. Nut
- 9. bracket
- 10. Adjustable link
- 11. Retaining clip
- 12. Lever assembly
- 13. Bush
- 14. Bolt
- 15. Nut
- 16. Gear lever
- 17. Sleeve
- 18. Knob



OVERHAUL

NOTE: It is possible to remove the rear casing with the gearbox in situ; however for the purpose of the following overhaul procedure it is assumed the gearbox has been removed from the vehicle.

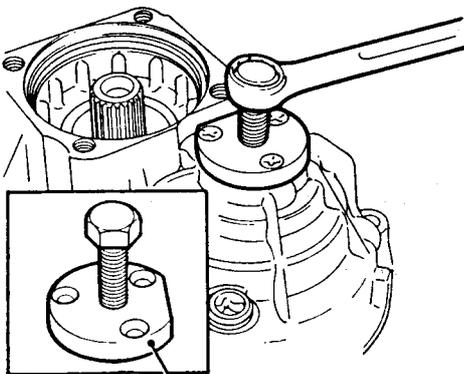
Tools required: 1.30/5, 1.36/1, 0480042 (370) or 0484820 (18G 47), 0480064, 0480065, 0480068, 0480069, 0480070, 0480071, 0480072, 0480073, 0480074, 0480075, 0480076, 0480077, 0484801 (18G 705), 0499809 (18G 134), 0499915 (18G 1431A), 18G 2.

GEARBOX DISMANTLING

1. Drain gearbox and remove rear mounting plate.
2. To remove gearchange mechanism:
 - remove cross bolt to detach lever assembly - note position of spacer,
 - release link ball socket from gear selector ball,
 - detach selector mechanism spring.

Removing Rear Casing

3. Remove propellor shaft flange. **NOTE:** Allen screw is secured from turning by a crush sleeve.
4. Remove:
 - reverse detent cable,
 - speedometer drive,
 - end plate - discard gasket,
 - bolts securing rear casing to intermediate casing.



0480065

Fig.2 Using 0480065

5. To remove rear casing:

- fit 0480065 with flat towards casing,
- turn and hold cross-gate selector arm towards speedometer drive location,
- remove casing with 0480065.

Removing 5th Gears

6. Remove snap ring which secures 5th mainshaft gear. If snap ring is difficult to reach, 5th gear can be pressed down mainshaft a short distance to ease access as follows:

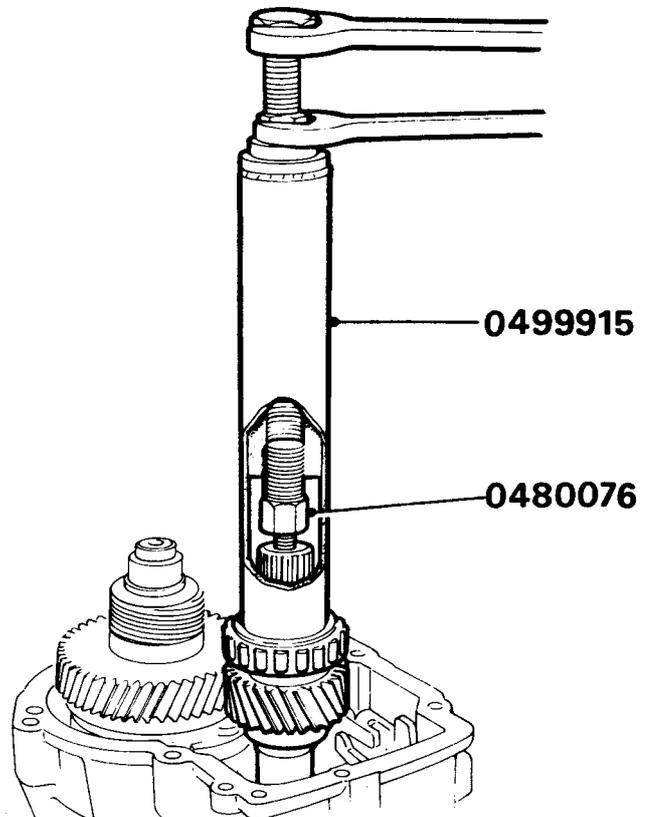


Fig.3 Pressing 5th gear down shaft

CAUTION: Do NOT press too far; a retaining circlip is fitted under gear.

Press 5th mainshaft gear down shaft using 0499915 (18G 1431A) and 0480076.

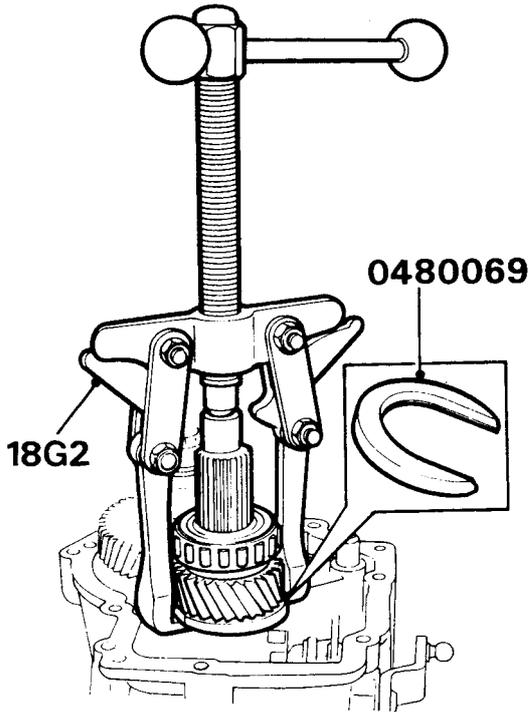


Fig.4 Removing 5th mainshaft gear

7. Position 0480069 under 5th mainshaft gear and, ensuring 0480069 cannot foul 5th layshaft gear, pull off 5th mainshaft gear and bearing assembly with 18G 2 (or similar 2-legged puller).

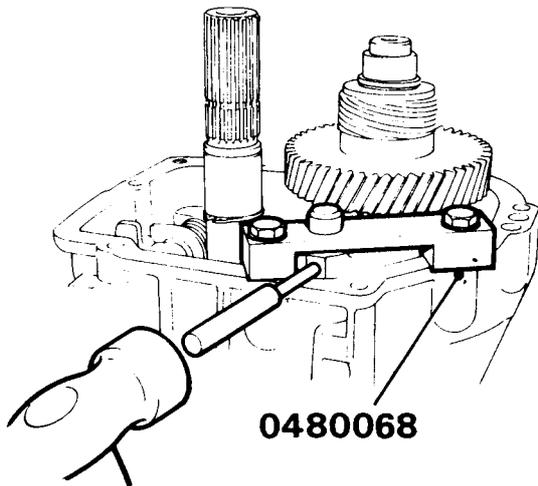


Fig.5 Removing 5th selector roll pin

8. To remove layshaft extension assembly:
 - fit 0480068,
 - move selector shaft to 5th gear position,

- drift out roll pin securing fork,
- re-engage neutral and remove 0480068.

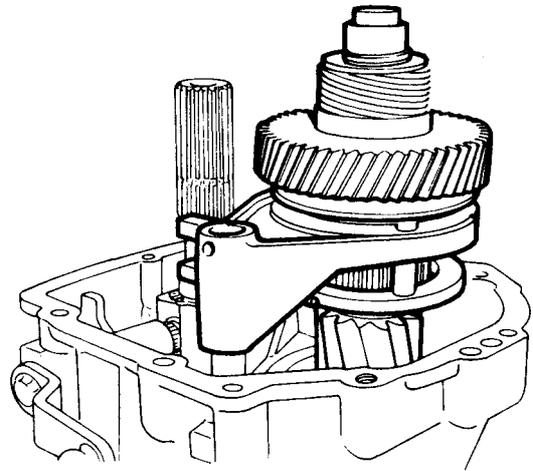


Fig.6 Removing layshaft extension assembly

- lift off layshaft extension assembly complete with fork.

Removing Intermediate Casing

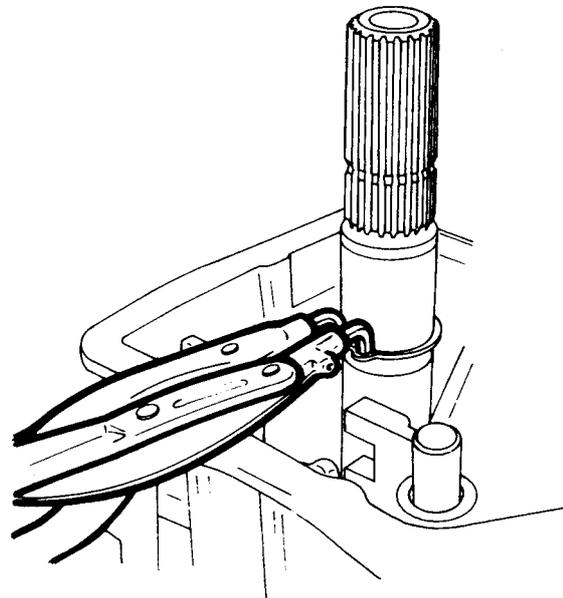


Fig.7 Removing mainshaft circlip

9. Remove mainshaft circlip.

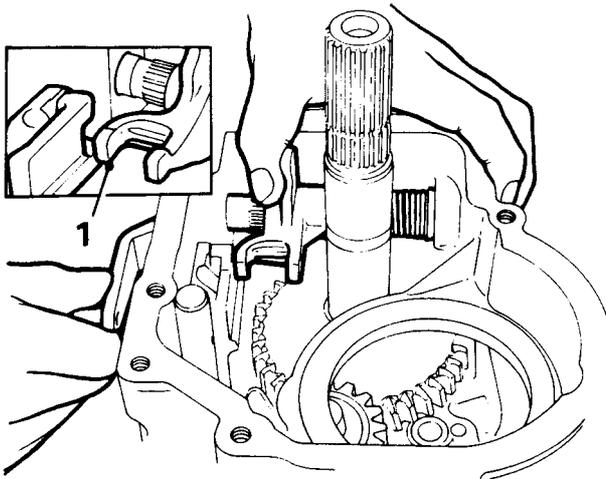


Fig.8 Removing intermediate casing
1. Selector finger

10. Remove nuts/bolts securing intermediate casing to main casing.
11. Disengage selector finger and remove intermediate casing.

Removing Clutch Housing

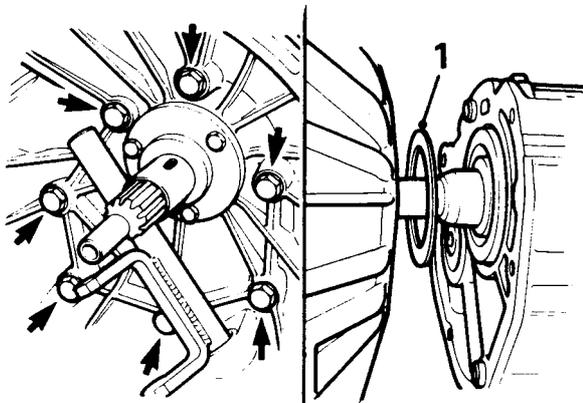


Fig.9 Removing clutch housing
1. Shim - mainshaft preload

12. Remove bolts to detach clutch housing, noting one shorter bolt. Capture mainshaft preload shim.

Dismantling Main Casing

13. Put main casing on its side and remove 12 securing bolts to separate the two halves.

Observe snap rings on rear mainshaft and layshaft bearings.

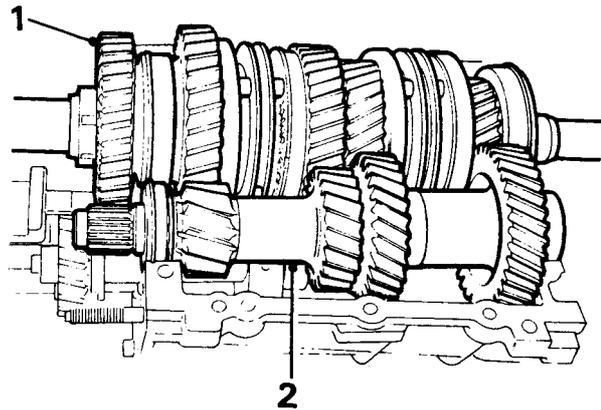


Fig.10 Mainshaft & layshaft in situ.
1. Mainshaft assembly
2. Layshaft assembly

14. Remove layshaft assembly.
15. Remove mainshaft assembly, and separate input shaft from mainshaft.

NOTE:

1. Note 3rd/4th detent ball and spring under mainshaft centre bearing (see fig.29); remove if necessary, to avoid loss.
2. If 3rd/4th selector is moved too far forward, the selector fork interlock pin can fall out.



SUB-ASSEMBLY OVERHAUL

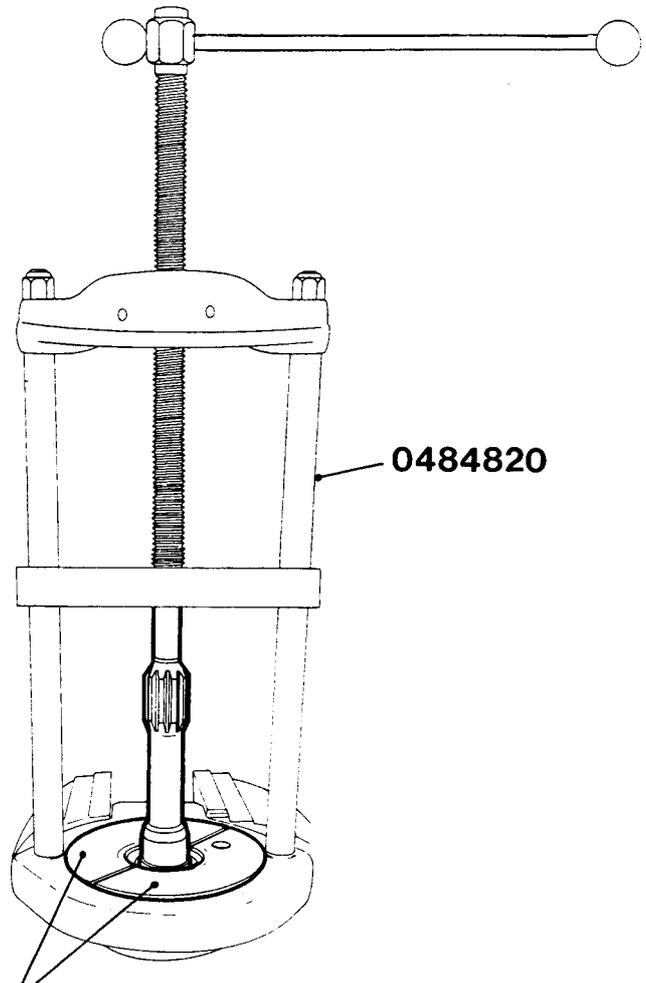
Throughout this overhaul section the following points must be checked where applicable, and renewals made as necessary:

- Paint correlation marks on each synchro hub and its sleeve before dismantling.
- Examine casings for damage, distortion, porosity, wear at bearing locations etc., and for damage to mating faces.
- Examine all gear teeth for chips and wear, and bearing surfaces for wear/damage.

In addition to above, check fit of splines between synchro sleeves and their hubs.

- Examine bearings for wear, damage, blueing etc..
- Examine selector forks for fit on shafts, and fork ends for wear.
- Lubricate all bearing surfaces during rebuild with recommended lubricant.
- Renew all snap rings.

Input Shaft



0480070

Fig.11 Removing bearing cone

16. To dismantle:

- Use collars 0480070 in handpress 0484820 (18G 47) to pull off bearing cone.

NOTE: Throughout overhaul, base plate 0480042 (370) can be used instead of 0484820 if working with hydraulic press.

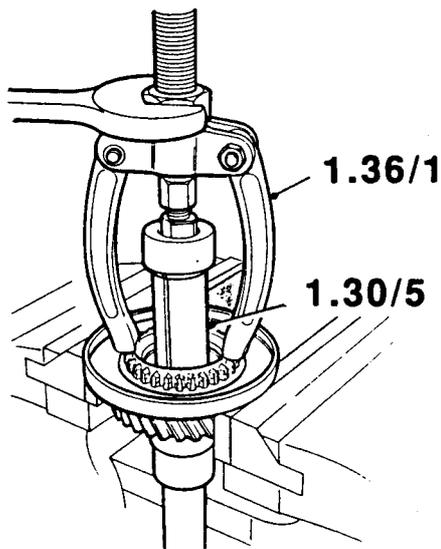


Fig.12 Removing pilot bearing cup

- Remove pilot bearing cup with 1.36/1 and 1.30/5.

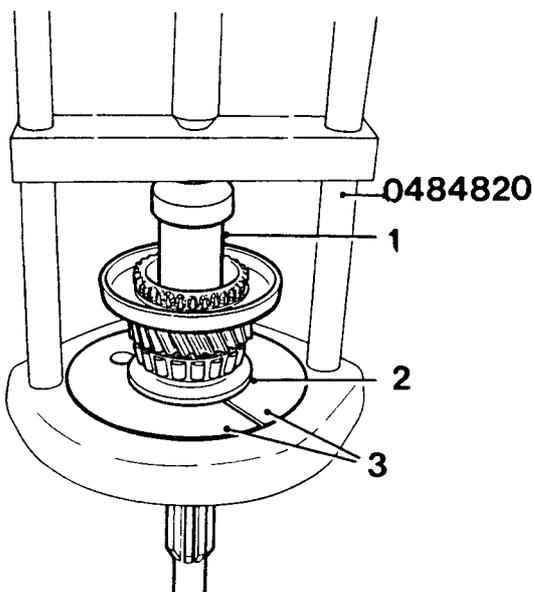
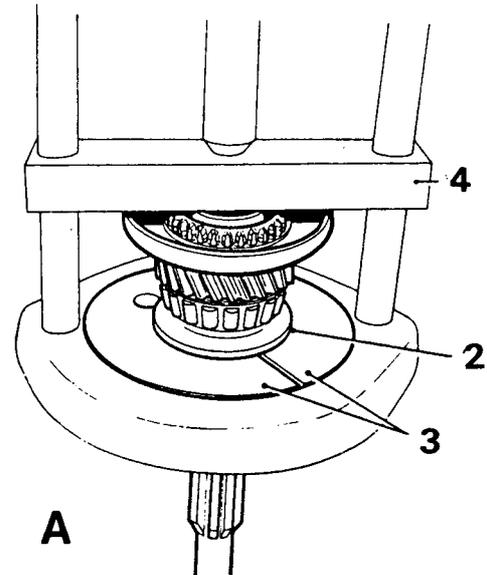


Fig.13 Fitting bearing cone

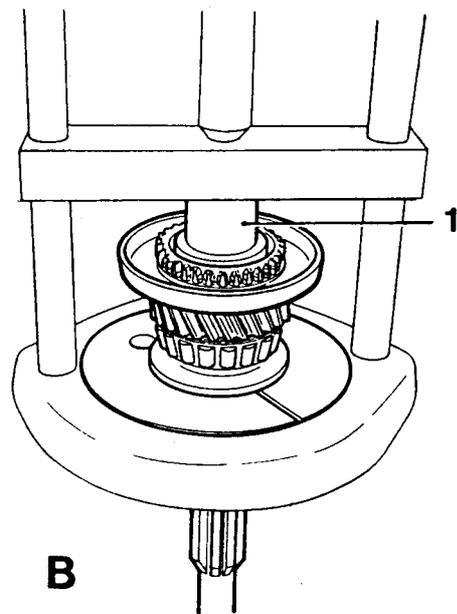
1. 0480070 - thrust button
2. 0480070 - ring
3. 0480070 - collars

17. To rebuild:

- Position square face of thrust button 0480070 inwards and fit bearing cone using ring and collars of 0480070 in press 0484820 as fig.13.
CAUTION: Ensure bearing is pressed fully home



A



B

Fig.14 Fitting pilot bearing cup

1. 0480070 - thrust button
2. 0480070 - ring
3. 0480070 - collars
4. Cross bar of press

- To fit pilot bearing cup, support shaft on ring and collars of 0480070, and use cross bar of press to press in initially (fig.14A), then use taper face of thrust button of 0480070 for final positioning of cup (fig.14B).
CAUTION: Ensure cup is pressed fully home.

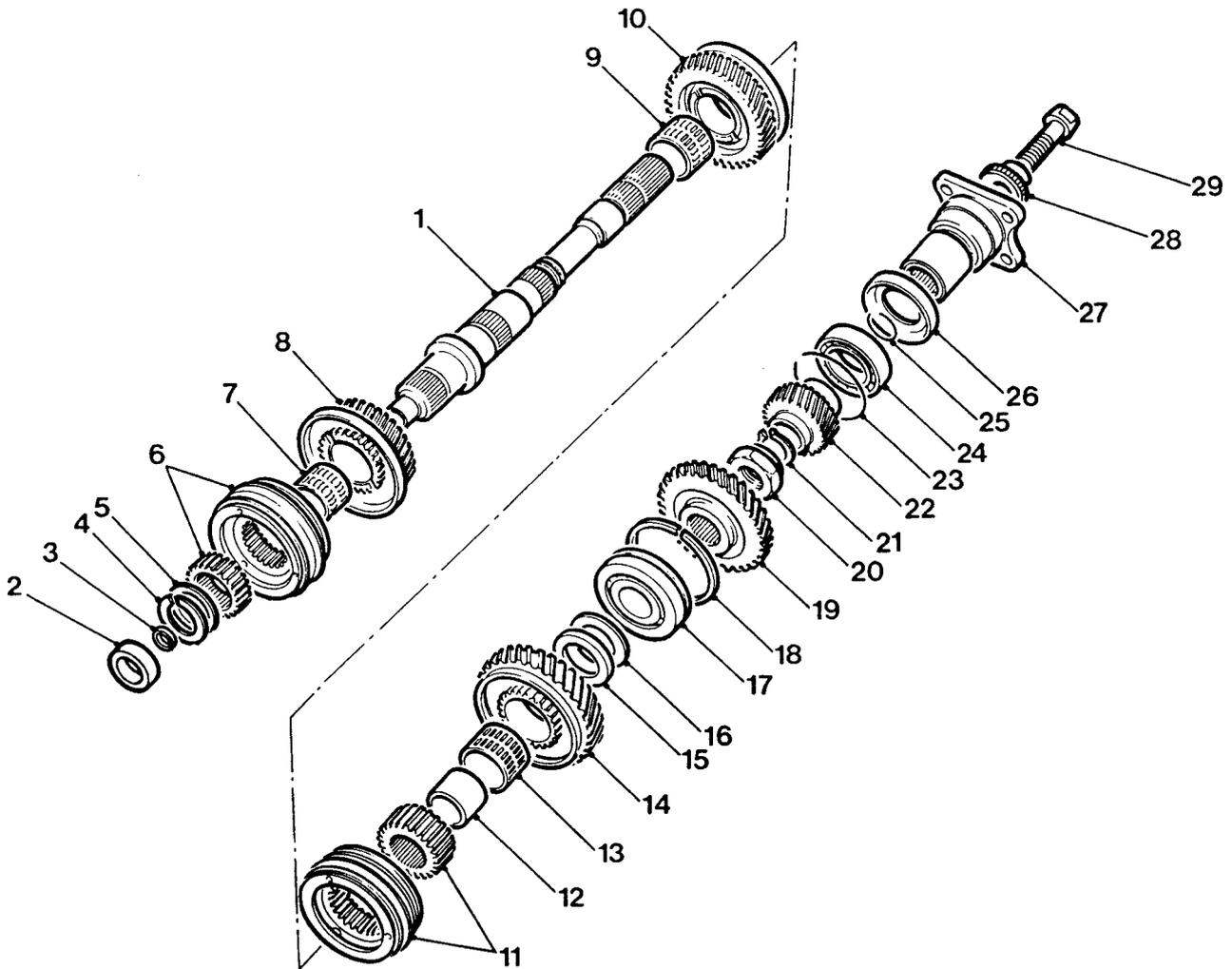


Fig.15 Mainshaft components

- | | |
|----------------------------------|------------------------------|
| 1. Mainshaft | 16. Washer |
| 2. Pilot bearing | 17. Bearing |
| 3. Washer | 18. Snap ring |
| 4. Snap ring | 19. Reverse (mainshaft) gear |
| 5. Belleville washer | 20. Nut |
| 6. 3rd/4th synchro hub & sleeve | 21. Circlip |
| 7. Needle bearing - 3rd gear | 22. 5th gear |
| 8. 3rd gear | 23. Snap ring |
| 9. Needle bearing - 2nd gear | 24. Bearing |
| 10. 2nd gear | 25. Snap ring |
| 11. 1st/2nd synchro hub & sleeve | 26. Oil seal |
| 12. Sleeve - 1st gear bearing | 27. Flange |
| 13. Needle bearing - 1st gear | 28. Crush sleeve |
| 14. 1st gear | 29. Allen screw |
| 15. Shim | |

Mainshaft

18. To dismantle:

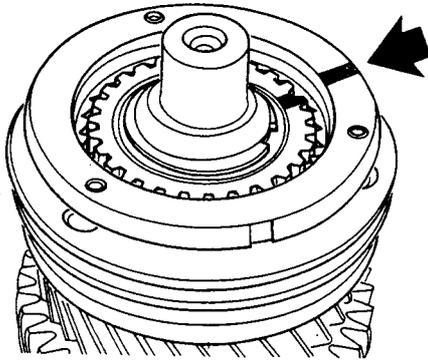


Fig.16 Correlation marks, 3rd/4th gear

- **NOTE:** correlation marks on synchro, then remove 3rd/4th synchro sleeve.
- Working at rear of shaft - de-stake nut.

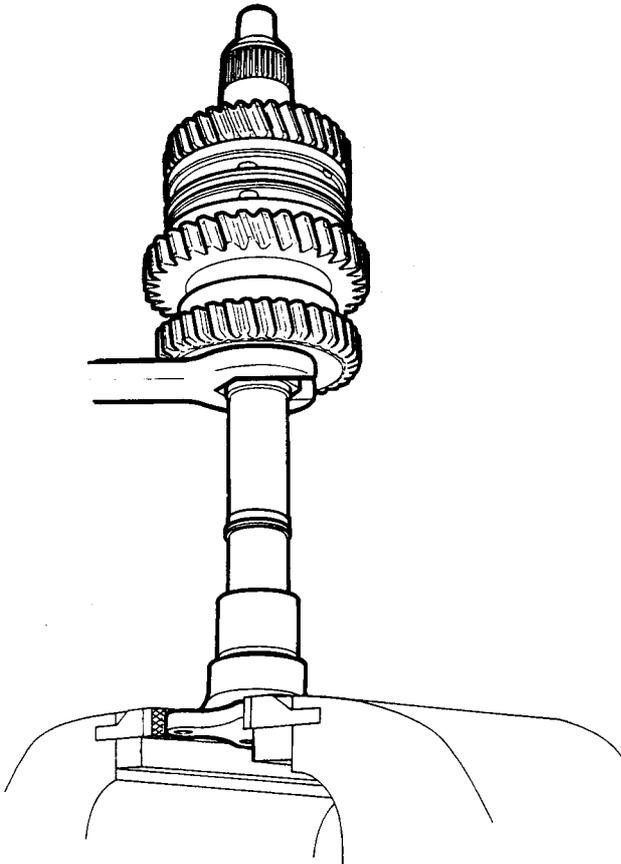


Fig.17 Removing mainshaft nut

- Using soft faced jaws, secure propeller shaft drive flange upright in vice. Fit rear of mainshaft into flange and remove:
 - nut,
 - reverse gear,
 - mainshaft bearing cup.

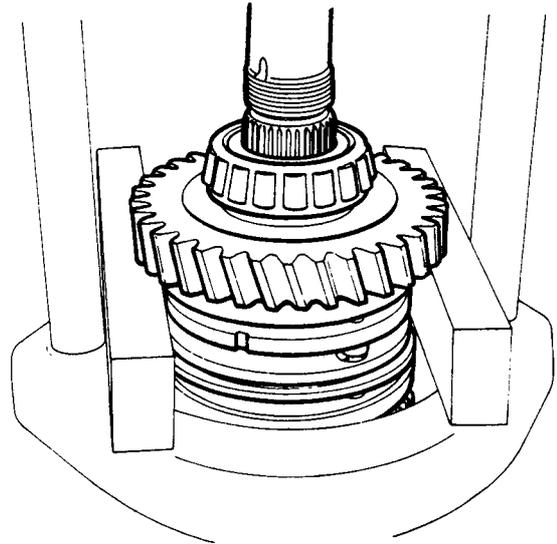


Fig.18 Removing mainshaft centre bearing cone

- Position assembly in press, with press bars beneath 1st gear; and remove:
 - centre bearing cone,
 - washer and shim,
 - 1st gear,
 - 1st gear bearing and sleeve.**NOTE:** correlation marks on synchro.
 - 1st/2nd synchro sleeve,
 - 1st/2nd synchro hub,
 - 2nd gear,
 - 2nd gear bearing.

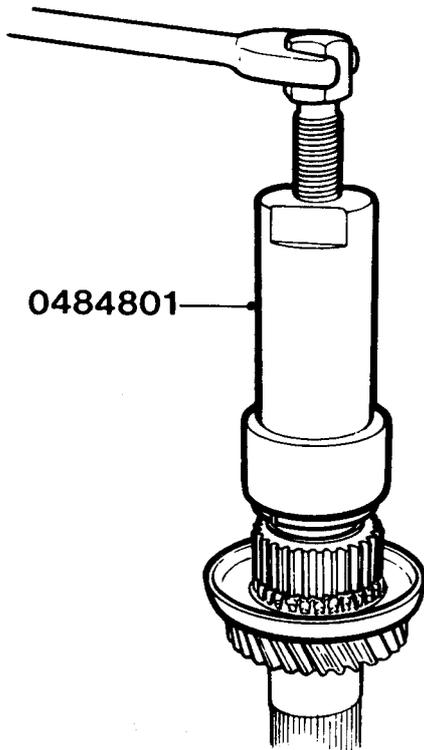


Fig.19 removing pilot bearing cone

- At front of mainshaft:
- Use 0484801 (18G 705) with thrust button and collars 0480071 to remove pilot bearing cone. Note washer under bearing has internal chamfer facing inwards.

WARNING: Snap ring is under load from below, exercise care when removing it.

- Remove:
 - snap ring,
 - belleville washer,
 - 3rd/4th synchro hub,
 - 3rd gear,
 - 3rd gear bearing.

19. To assemble the mainshaft, oil components with recommended lubricant and proceed as follows:-

Starting at the rear, fit -

- 2nd gear and bearing,
- 1st/2nd synchro hub and sleeve aligning correlation marks,
- 1st gear, bearing and sleeve,
- washer and shim.

Use original shim if original gearbox components except bearings are re-used. Use new shim if any gear, shaft, synchro unit, or main casing are being renewed. New shim and washer combined thickness should be 4,55 mm (0.179 in.).

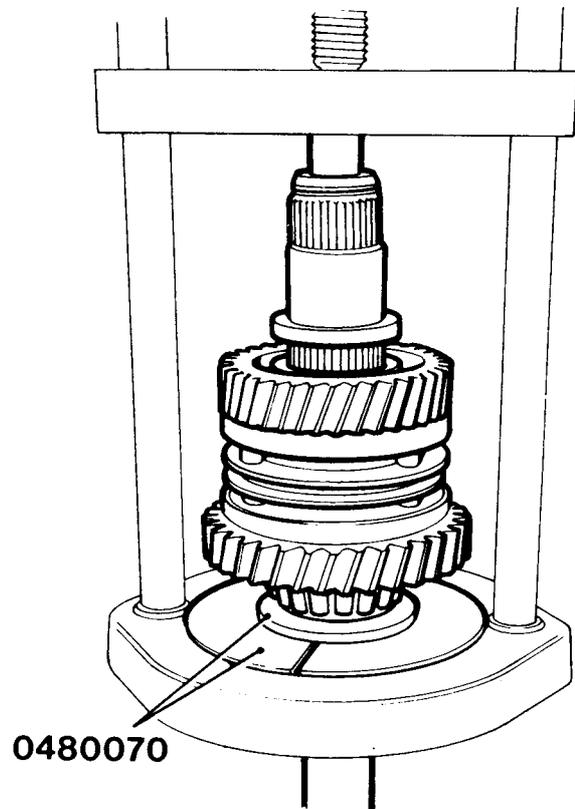


Fig.20 Fitting mainshaft centre bearing cone

Press mainshaft centre bearing cone onto shaft using 0480070.

At the front fit -

- 3rd gear and bearing,
- 3rd/4th synchro hub (correlation mark outwards),
- belleville washer (coned face upwards).

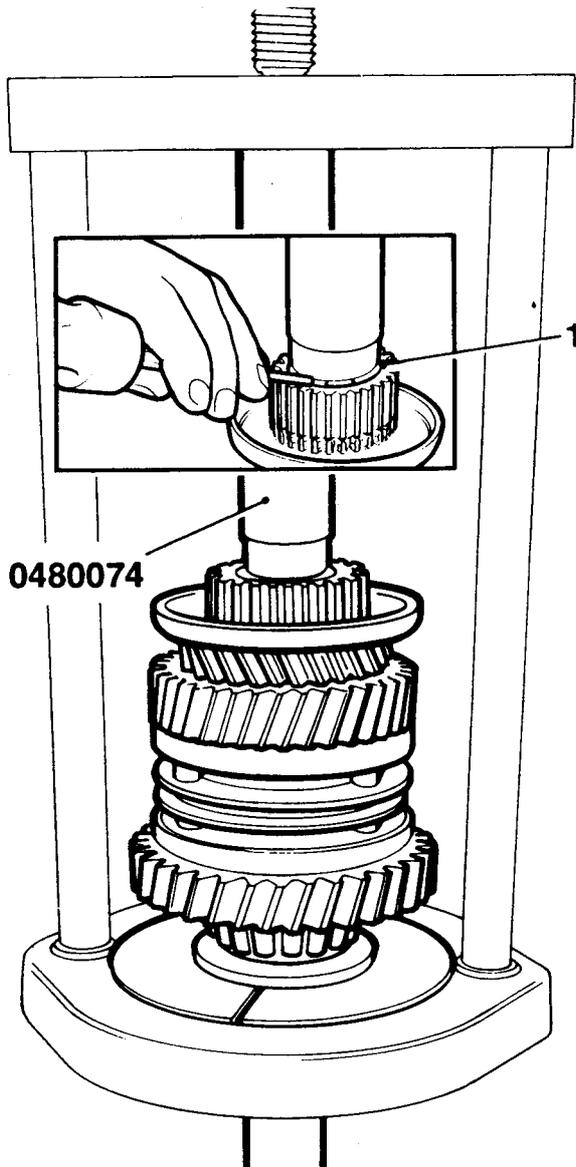


Fig.21 Fitting snap ring

1. Snap ring

WARNING: Ensure snap ring is fully home in groove before removing from press.

Fit new snap ring by pressing onto shaft with 0480074.

Ensure snap ring fully locates in groove by tapping with drift before removing from press (fig.21).

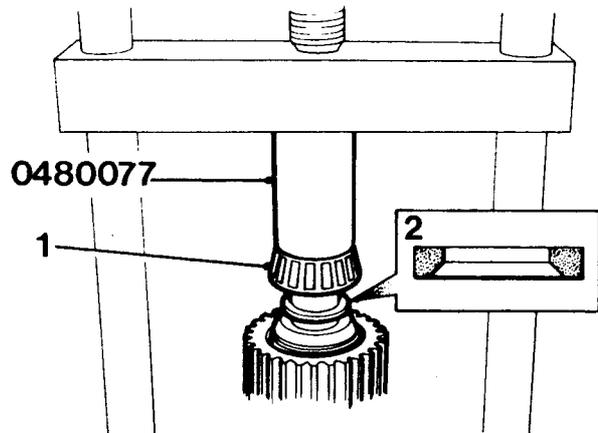


Fig.22 Fitting pilot bearing cone

1. Pilot bearing
2. Washer

Fit:

- Pilot bearing washer (internal chamfer inwards),
- pilot bearing cone with 0480077 (fig.22).

At rear of mainshaft, fit:

- centre bearing cup,
- reverse gear (boss towards bearing),
- new nut.

Stand shaft in propellor shaft drive flange (secured in vice using soft jaws).

Tighten nut to correct torque before staking it.

At front of shaft fit 3rd/4th synchro sleeve (align correlation marks).



Layshaft

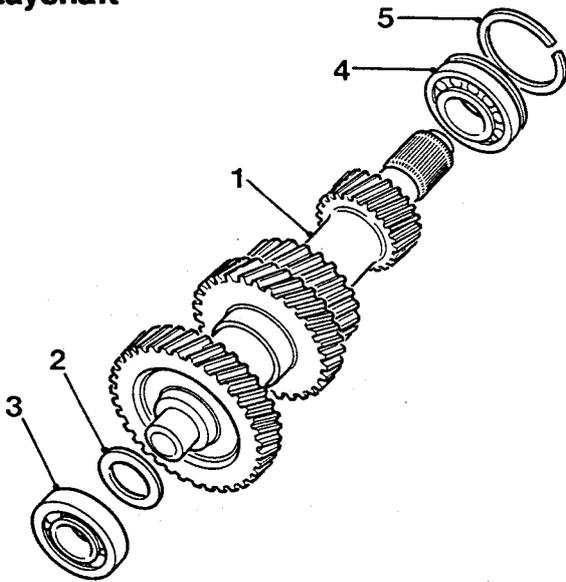


Fig.23 Layshaft assembly

1. Layshaft
2. Bearing preload shim
3. Front bearing
4. Rear bearing
5. Snap ring

20. To dismantle:

NOTE: It is not necessary to dismantle layshaft unless component parts are to be renewed, or bearing preload adjusted (after removing front bearing).

- Drift off and discard rear bearing.

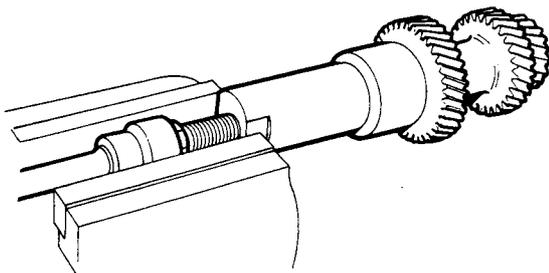
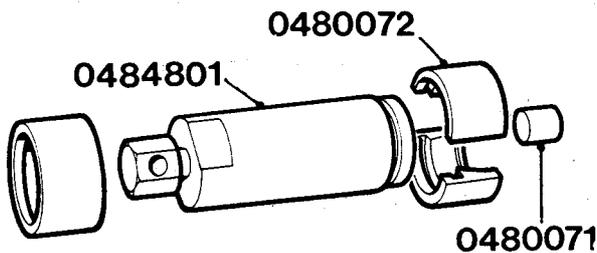


Fig.24 Removing layshaft front bearing

- Remove front bearing using 0484801 (18G 705), 0480072 and thrust button from 0480071.
- Remove preload shim only if preload is to be re-set. This is necessary if main casing or layshaft are being renewed. **NOTE:** Shim is fitted with internally tapered face inwards.

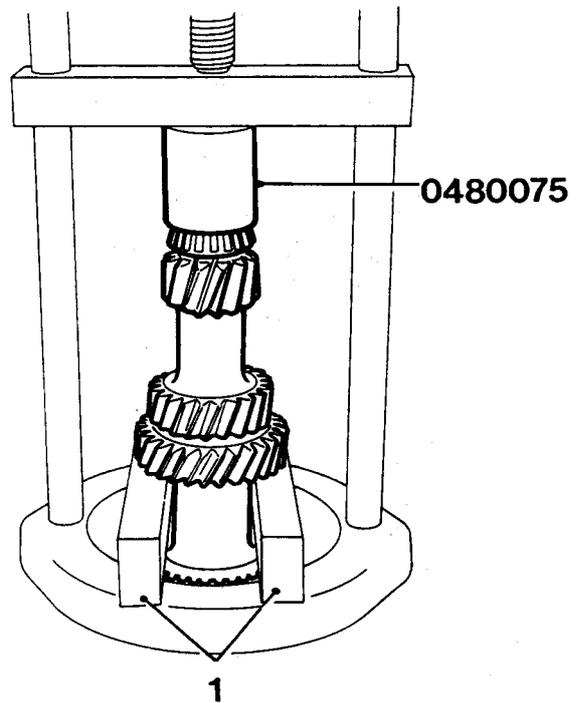


Fig.25 Fitting layshaft bearings

1. Press bars

21. To re-build:

- Fit rear bearing using press, press bars and 0480075.
- Fit front bearing in same way but leave out shim if main casing or layshaft are being renewed.

Layshaft Extension

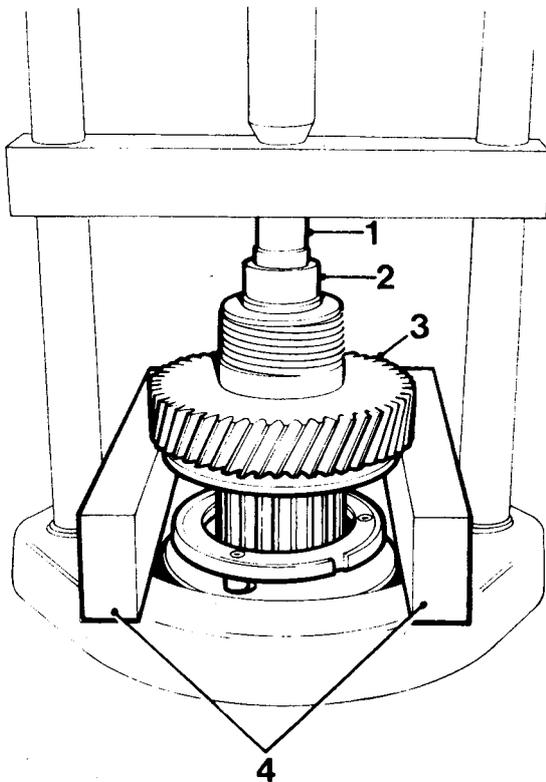


Fig. 26 Dismantling layshaft extension

1. Thrust button from 0480072
2. Bearing inner track
3. 5th layshaft gear
4. Press bars

22. To dismantle:

Support 5th layshaft gear on press bars in press, use thrust button from 0480072 and press shaft out of bearing inner track.

Remove from shaft:

- rear bearing inner track,
- shim,
- washer,
- 5th layshaft gear,
- 5th layshaft gear bearing.

Apply correlation marks to synchro hub and sleeve, then remove them.

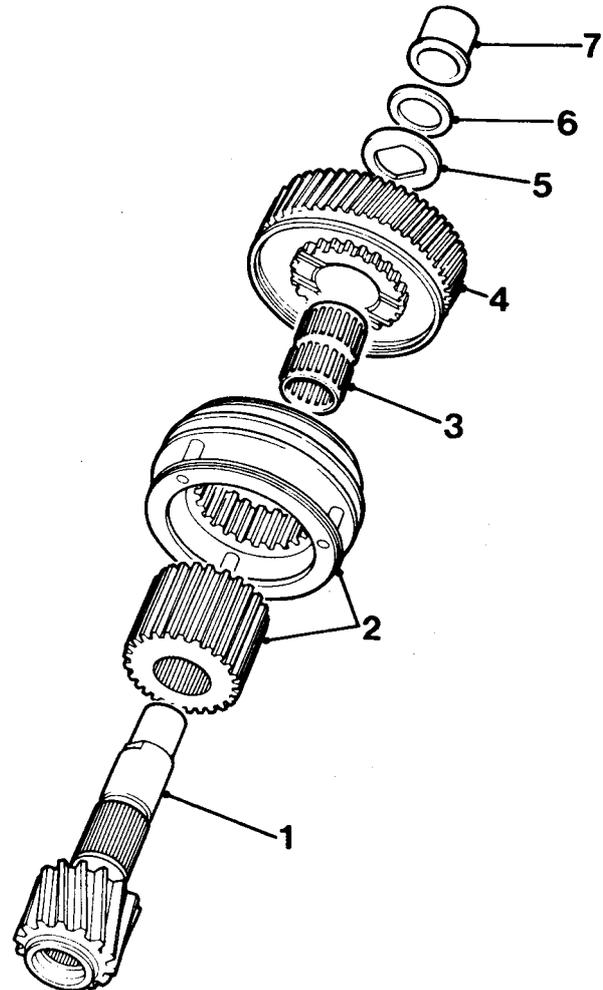


Fig. 27 Layshaft extension components

1. Layshaft extension
2. Synchro hub & sleeve
3. 5th layshaft gear bearing
4. 5th layshaft gear
5. Washer
6. Shim
7. Rear bearing inner track

23. To assemble:

Align correlation marks and fit synchro hub and sleeve, short offset side of sleeve to rear of shaft.

Lubricate and fit:

- 5th layshaft gear bearing,
- 5th layshaft gear.

Do not fit washer, shim, rear bearing inner track.



Reverse Idler

24. To remove:

Drift out roll pin from shaft.

Note position of 'D' flange on shaft end before removing shaft.

Remove reverse idler gear.

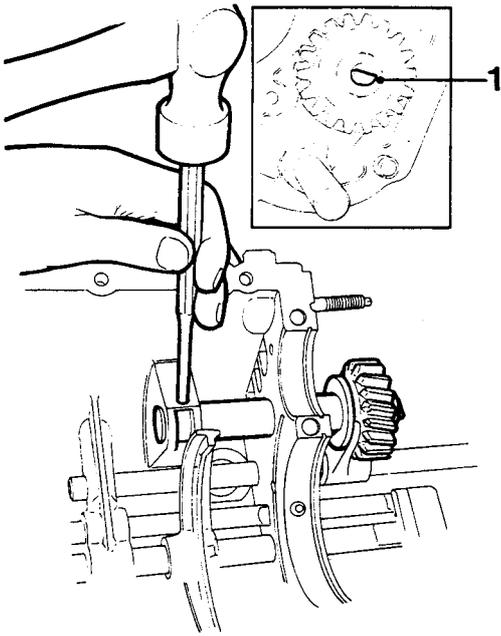


Fig.28 Removing reverse idler shaft

1. 'D' flange position

25. To refit:

Place reverse idler gear on reverse selector fork.

Fit shaft, positioning 'D' flange as in fig.28.

Drift in new roll pin.

Selectors

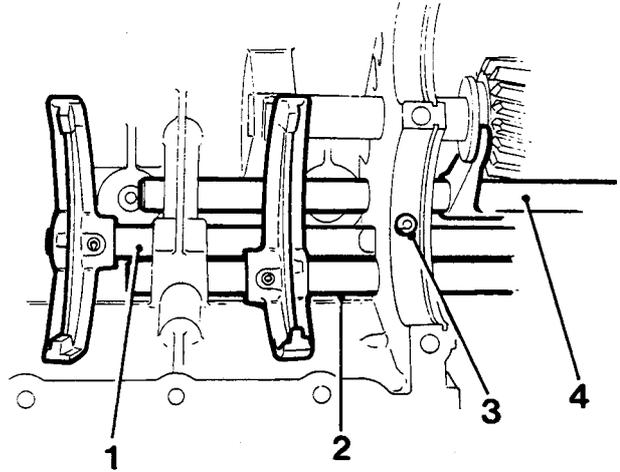


Fig.29 Selector shafts

1. 3rd/4th selector shaft and fork
2. 1st/2nd selector shaft and fork
3. 3rd/4th detent ball and spring
4. 5th/reverse selector shaft and fork

26. To dismantle:

Remove 3rd/4th detent spring and ball if not already removed (fig.29). See note 1 on page 19.

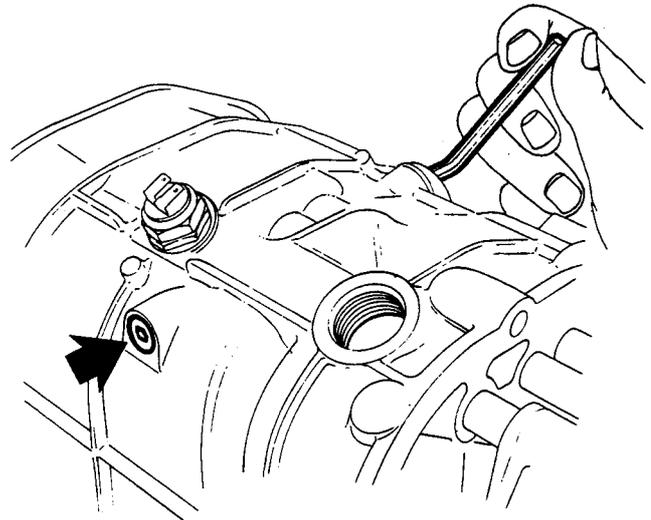


Fig.30 Removing external Allen screws

Remove both external Allen screws retaining 1st/2nd and 5th/reverse selector detent springs and balls. If balls do not drop out, they can be tapped out after removal of selector shafts.

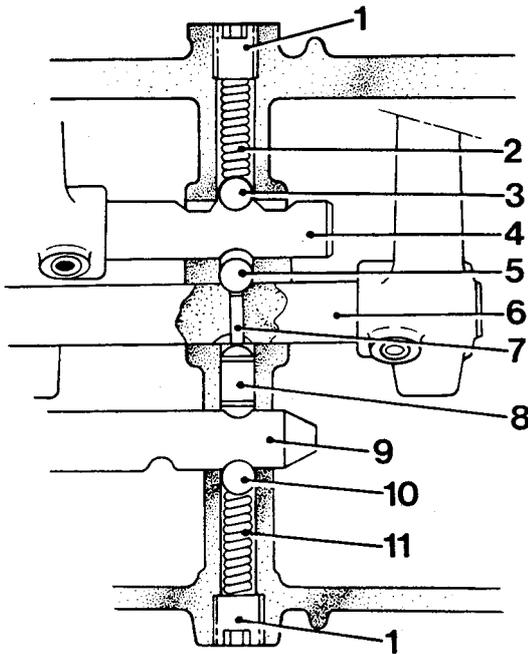


Fig.31 Detent/interlock mechanism

1. Allen screws
2. 1st/2nd detent spring
3. 1st/2nd detent ball
4. 1st/2nd selector shaft
5. Interlock ball
6. 3rd/4th selector shaft
7. Interlock pin
8. Plunger
9. 5th/reverse selector shaft
10. 5th/reverse detent ball
11. 5th/reverse detent spring

Drift out roll pins - 1st/2nd and 3rd/4th selector forks.

Remove:

- 3rd/4th fork,
- interlock pin (7),
- 3rd/4th selector shaft (6),
- ball (5),
- 1st/2nd selector shaft/fork (4),
- ball (3) if not already removed,
- 5th/reverse shaft (9) and reverse idler gear,
- ball (10) if not already removed,
- plunger (8) (tap out if necessary).

NOTE: 1st/2nd and 3rd/4th detent springs are identical, 5th/reverse spring is longer.

If required, drift out roll pin to detach reverse fork from shaft.

27. To assemble:

If removed, fit reverse fork to shaft and secure with new roll pin.

Fit:

- plunger (8),
- reverse idler gear and 5th/reverse selector shaft (9); place in neutral position.

Apply petroleum jelly and fit detent pin (7) into 3rd/4th selector shaft.

Locate 3rd/4th selector fork (see fig.29) and fit 3rd/4th selector shaft (6); place in neutral position.

Fit ball (5).

Locate 1st/2nd selector fork (see fig.29) and fit 1st/2nd selector shaft (4).

Secure 1st/2nd and 3rd/4th forks with new roll pins.

Fit detent balls (3 & 10) with their springs (2 & 11), coat securing Allen screws with Loctite thread sealer before fitting them.

Check that interlock pin (7) has not become dislodged from 3rd/4th selector shaft.



Intermediate Casing

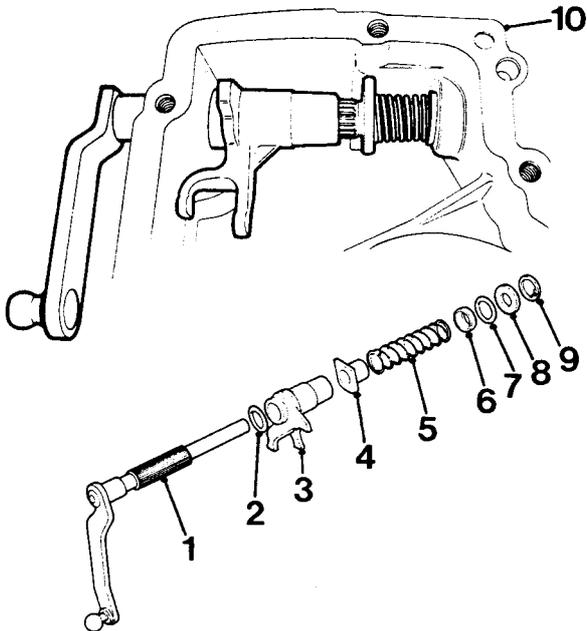


Fig.32 Selector

- 1.Selector shaft
- 2.Seal
- 3.Selector fingers
- 4.Bush
- 5.Spring
- 6.Spring cup
- 7.Seal
- 8.Washer
- 9.Circlip
- 10.Intermediate casing

28. To dismantle:

Remove circlip and washer securing selector shaft.

Pull out selector shaft and recover:

- spring cup,
- spring,
- bush,
- selector fingers.

Extract shaft 'O' rings from casing.

Check cleanliness of breather.
If it is to be replaced, prise out and fit replacement with sealant.

29. To assemble:

Fit new 'O' rings.

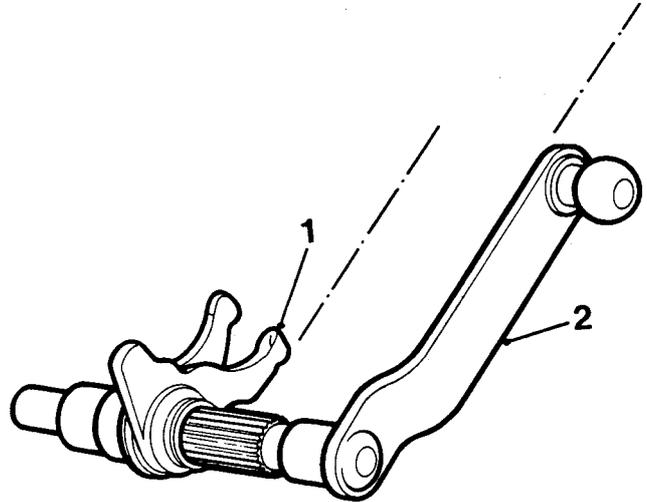


Fig.33 Alignment of selector fingers

1. Selector finger
2. Selector shaft arm

Lubricate 'O' rings, insert selector shaft and fit selector fingers so that nearest finger aligns with selector shaft arm - see fig 33.

Fit on shaft:

- bush - with flat side against casing,
- spring,
- spring cup.

Secure with washer and new circlip.

Rear Casing

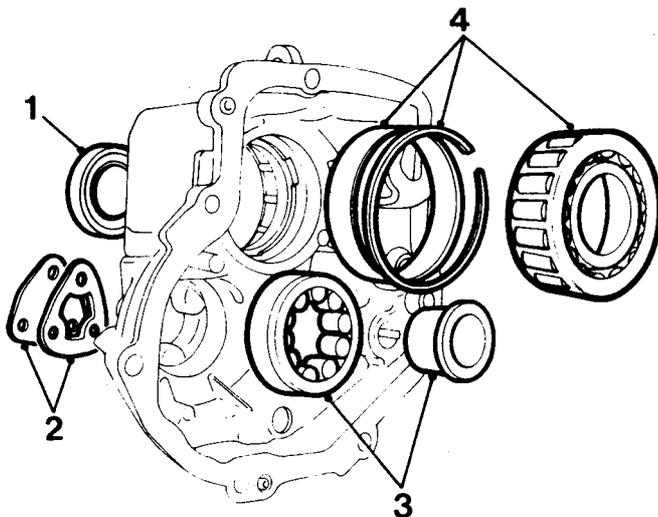


Fig.34 Rear casing

1. Mainshaft seal
2. End plate and gasket
3. Layshaft extension rear bearing
4. 5th mainshaft gear bearing and snap ring

30. To dismantle:

Remove:

- Mainshaft seal,
- Snap ring,

Drift out:

CAUTION: Do not damage casing.

- 5th mainshaft gear bearing outer track,
- Layshaft extension rear bearing.

If required, use puller and suitable thrust button to pull bearing off 5th mainshaft gear.

31. To assemble:

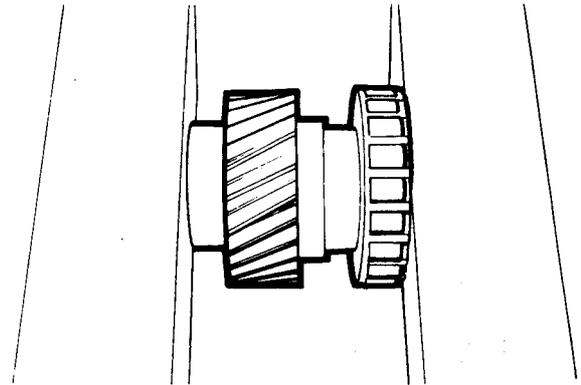


Fig.35 Fitting 5th mainshaft gear bearing

If removed, press bearing onto 5th mainshaft gear using vice fitted with soft jaws.

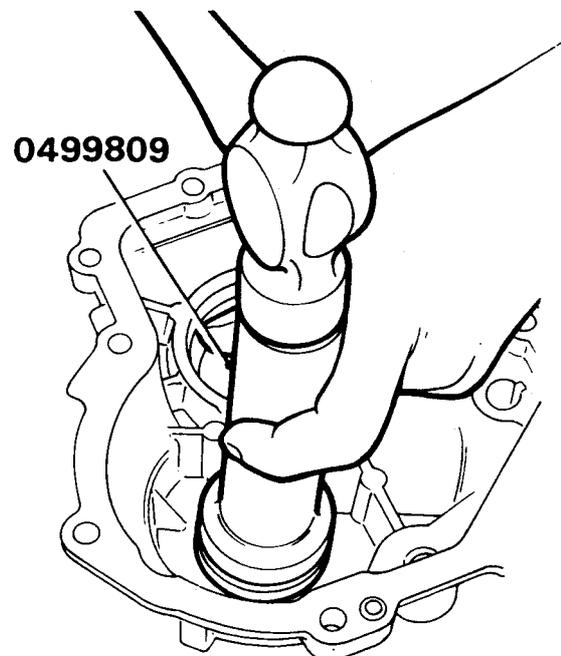


Fig.36 Fitting layshaft extension rear bearing

Fit in rear casing:

- 5th mainshaft gear bearing outer track (drift in squarely),
- snap ring,
- oil seal, using 0480064,
- Layshaft extension rear bearing using 0499809 (18G 134).

Clutch Housing

For clutch housing overhaul procedures, see separate section - 'Clutch housing / front oil seal overhaul'.



GEARBOX REASSEMBLY

Lubricate all moving components during assembly with recommended oil.

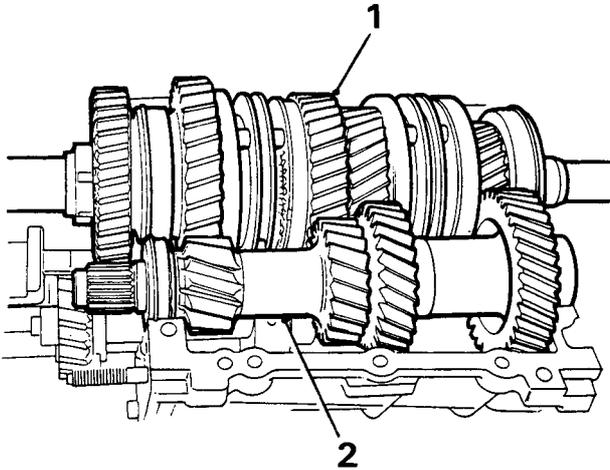


Fig.37 Fitting mainshaft & layshaft

1. Mainshaft assembly
2. Layshaft assembly

32. Fit input shaft to mainshaft, and position in main casing - ensure centre bearing snap ring locates in groove, and both selector forks locate in synchro sleeves.
33. Fit layshaft - ensure rear bearing snap ring locates in groove.

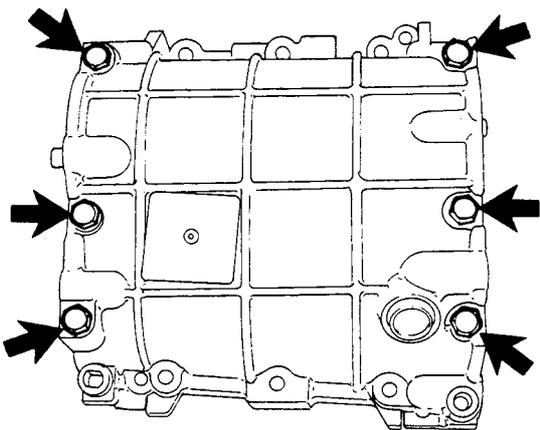
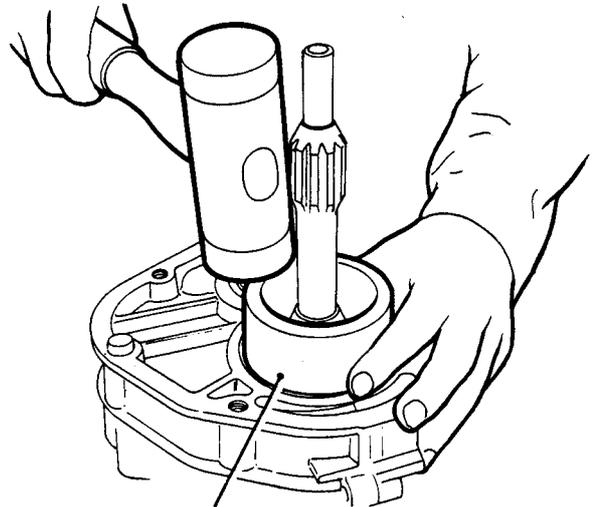


Fig.38 Casing bolts

34. Apply recommended sealant to mating faces and fit upper half casing; progressively secure with 6 larger bolts (see fig.38) torque tightened to 10 Nm (7 lbf ft).

Position main casing vertically, input shaft upwards.

CALCULATING MAINSHAFT PRELOAD SHIM



0480073

Fig.39 Squaring input shaft bearing cup

35. Use 0480073 to square input shaft bearing cup in main casing (see fig 39), at the same time turn input/ mainshaft to track bearings.

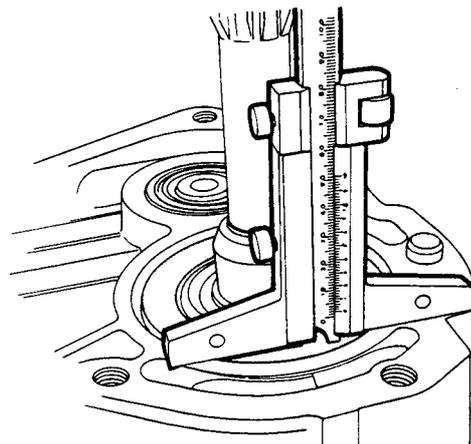


Fig.40 Using depth gauge

Use depth gauge to measure from main casing machined surface to mainshaft bearing cup.

Add 0,1 mm to recorded measurement for shim thickness required.

Example

Measurement recorded 2,1 mm

Add 0,1 mm 0,1 mm

Shim thickness required 2,2 mm

Select shim just calculated from range available - 1,8 to 2,6 mm

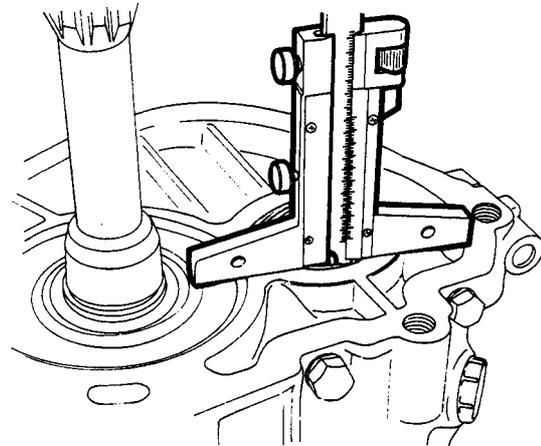


Fig.42 Using depth gauge

Use depth gauge to measure from main casing machined surface to layshaft front bearing cup.

Add 0,1 mm to recorded measurement for shim thickness required.

Example

Measurement recorded 2,25 mm

Add 0,1 mm 0.10 mm

Shim thickness required 2,35 mm

Select shim just calculated from range available - 2,25 to 2,95 mm.

To fit the shim -

Remove:

- half main casing,
- layshaft,
- front bearing, fit selected shim (internal chamfer inwards) and refit bearing - see operations 20 and 21.

CALCULATING LAYSHAFT PRELOAD SHIM

It is not necessary to carry out this procedure unless preload shim has been left out - for explanation, see layshaft dismantling procedure, operation 20.

If shim calculation is required, proceed as follows:

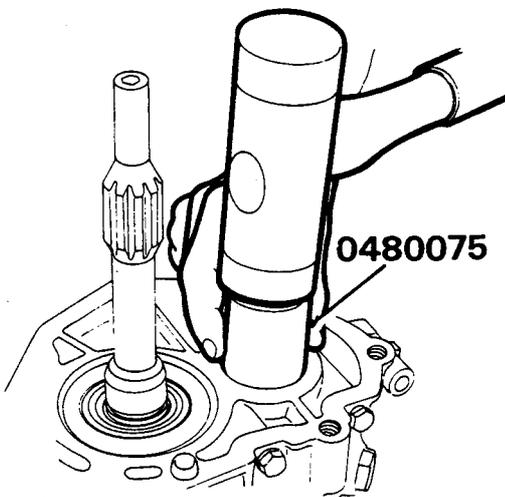


Fig.41 Squaring front layshaft bearing cup

36. Use 0480075 to square front layshaft bearing cup in main casing (see fig 41), at the same time turn input shaft to track bearings.

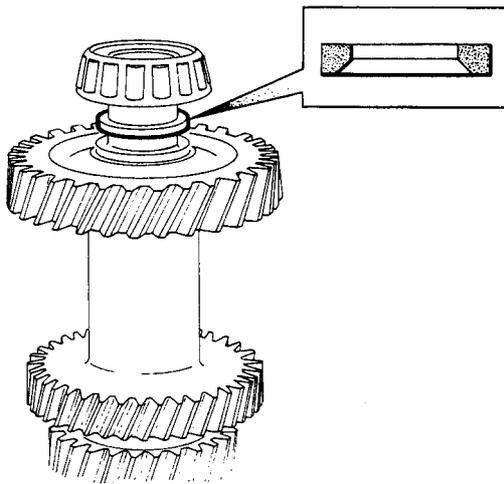


Fig.43 Layshaft preload shim

37. Refit layshaft.

38. Check two dowels in position, apply recommended sealant to joint faces and assemble main casing sections.

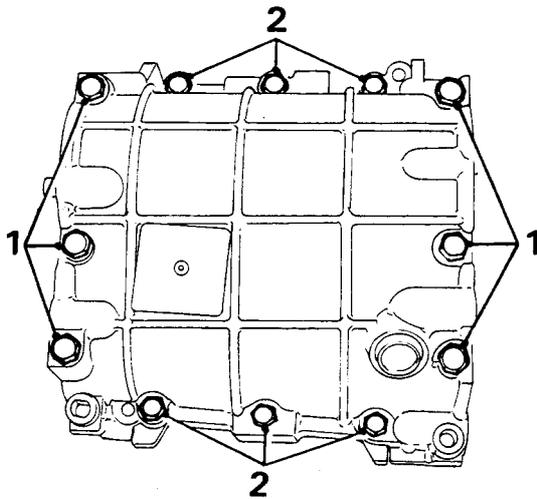


Fig.44 Tightening main casing bolts

1. Long bolts
2. Short bolts

39. Square input shaft and layshaft bearing cups as previously, and track bearings, before progressively torque tightening all 12 main casing bolts to correct final torque - longer bolts first:

CAUTION: DO NOT OVERTIGHTEN BOLTS.

6 long bolts	15 Nm (11 lbf ft)
6 short bolts	10 Nm (7 lbf ft)

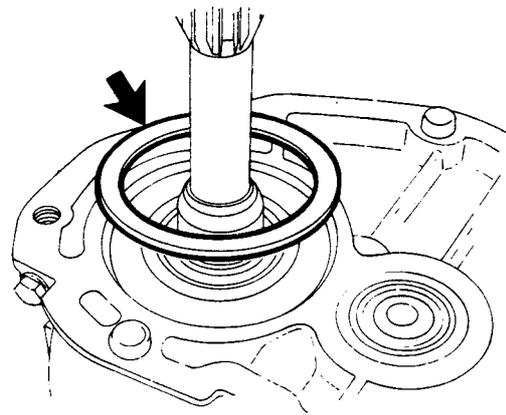


Fig.45 Mainshaft preload shim

40. Fit mainshaft preload shim selected in operation 35 (use dab of petroleum jelly to hold shim in position).

41. Tape input shaft splines, apply sealant to main casing outer machined face and fit clutch housing. Tighten bolts to correct torque -

27 Nm (20 lbf ft)

Remove protective tape.

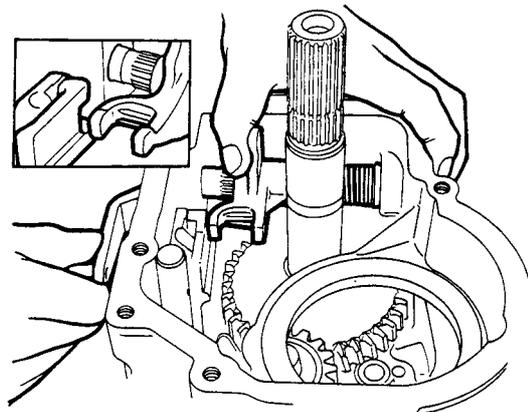


Fig.46 Fitting intermediate casing

42. **NOTE:** Ensure intermediate casing dowels are correctly positioned.

Apply recommended sealant to mating faces before fitting intermediate casing, ensuring selector finger locates in selector shaft gate - see fig.46.

Torque tighten casing nuts to 17 Nm (12.5 lbf ft).

CALCULATING LAYSHAFT EXTENSION END FLOAT SHIM

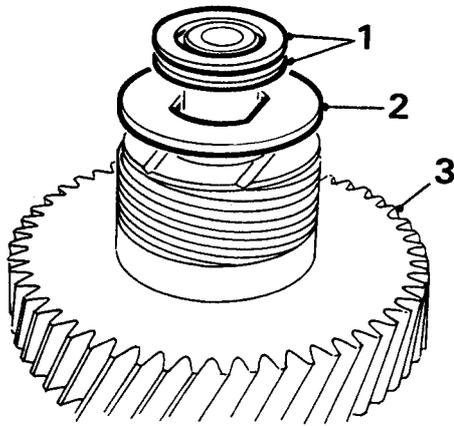


Fig.47 Temporary fitment for end float adjustment check

1. Shims
2. Washer
3. 5th layshaft gear

43. Temporarily fit layshaft extension assembly, together with washer, original shim and a second shim.

Remove rear casing dowels.

Ensure inner track of layshaft extension rear bearing is in position in bearing, then fit rear casing, ensuring cross-gate selector engages over selector finger.

CAUTION: Do not overtighten bolts or casing will be distorted. Fit 5 rear casing bolts and progressively pull down casing until layshaft extension rear bearing can be felt to 'bottom'.

Slacken bolts by 3 turns.

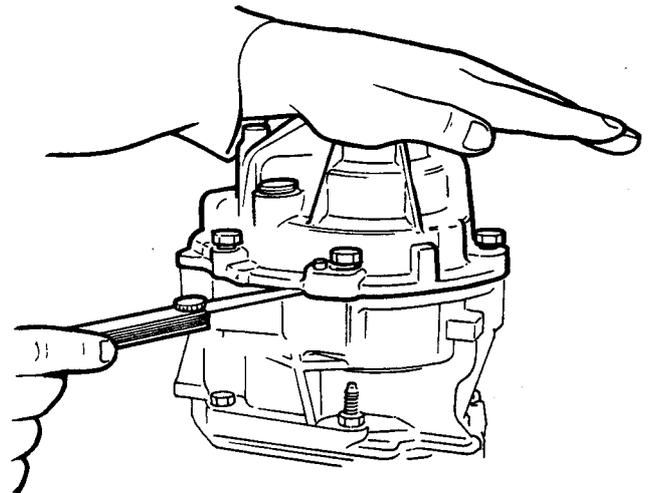


Fig.48 Measuring housing gap

Apply firm hand pressure downwards on the rear casing directly above the bearing, and use feeler gauges to:-

- a. check that gap is parallel all round mating faces of the two casings,
- b. measure and note the gap.

Remove rear casing, and lift out layshaft extension assembly.

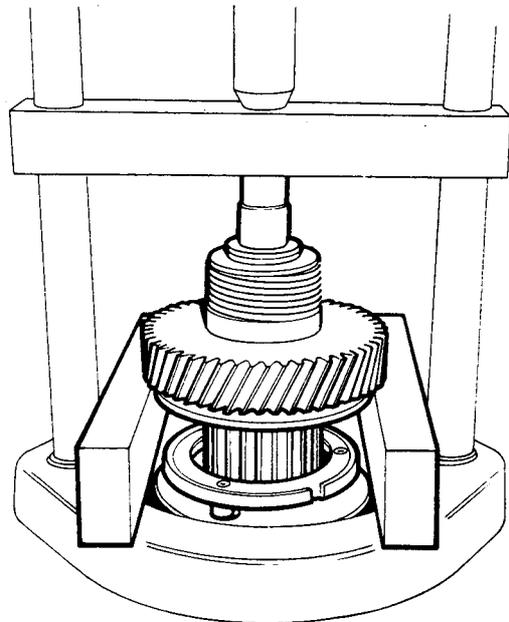


Fig.49 Removing rear bearing inner track

Remove inner track of layshaft extension rear bearing - see operation 22.

Remove the two shims and accurately measure their combined thickness. Calculate the actual shim thickness required to give 0,05 mm end float as follows:

Example

Combined shim thickness	3,02mm
Subtract housing gap	<u>1.35mm</u>
	1,67mm
Subtract required end float	<u>0.05mm</u>

Shim thickness required 1,62mm

Select shim just calculated from range available - 1,2 to 2,0 mm.

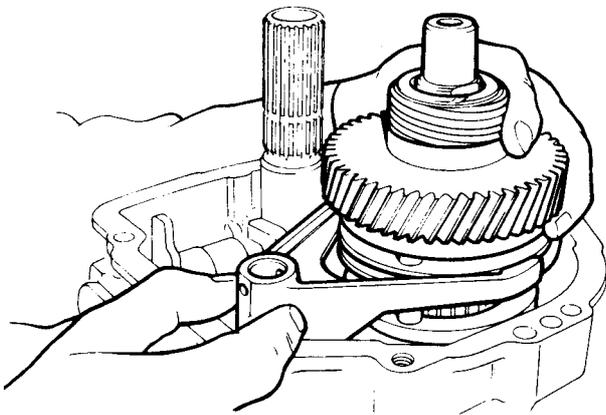


Fig. 50 Fitting layshaft extension assembly

44. Fit layshaft extension assembly together with 5th selector fork.

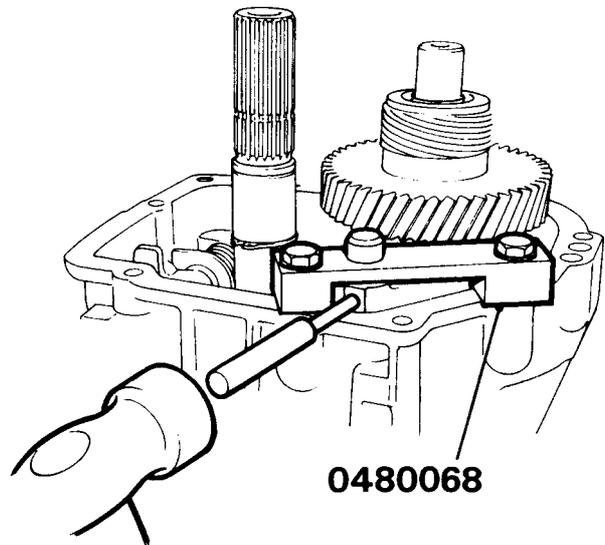


Fig.51 Securing 5th gear selector

45. Fit 0480068 (see fig 51).
Move selector to 5th gear position.
Fit roll pin, taking care not to damage case.
Return selector to neutral.
Remove 0480068.

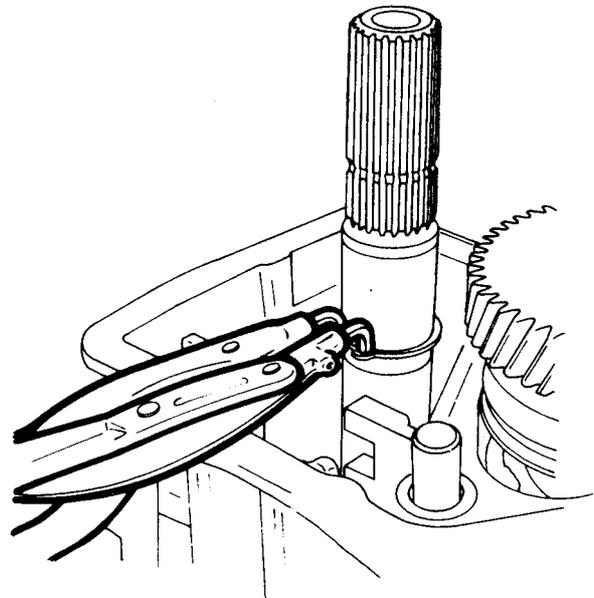


Fig.52 Fitting mainshaft circlip

46. Fit mainshaft circlip.

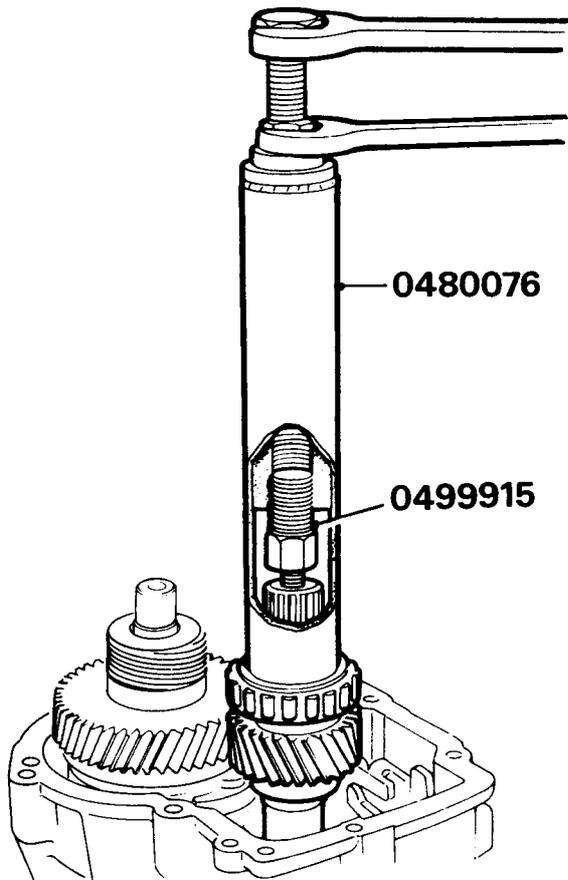


Fig.53 Fitting 5th mainshaft gear

47. **CAUTION: Mesh gears while pressing on 5th gear, to avoid chipping teeth.** Fit 5th mainshaft gear assembly on shaft, and use 0480076 and 0499915 (18G 1431A) to press gear down to circlip (see fig 53).

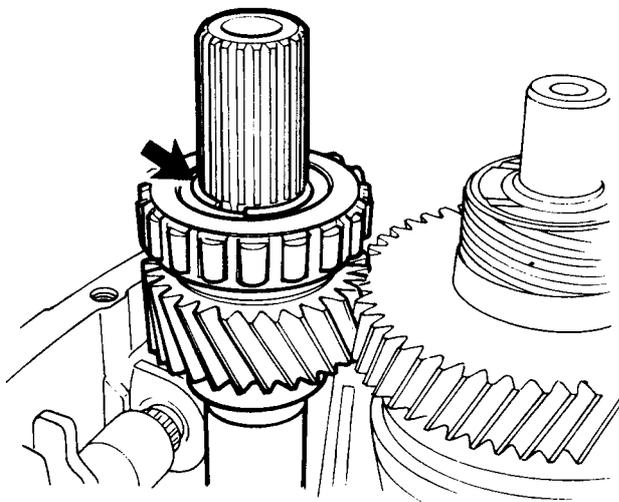


Fig.54 Fitting 5th gear securing snap ring

48. Secure with new snap ring.

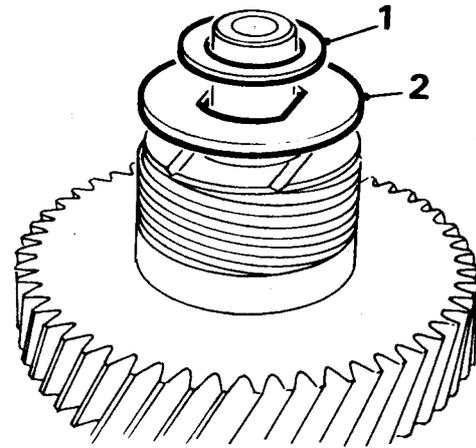


Fig.55 Layshaft extension

1. Shim
2. Washer

49. Fit to layshaft extension:

- washer,
- shim just selected,

50. Fit dowel pins in rear casing, and fit bearing inner track in layshaft extension rear bearing.

Apply sealant to mating faces and fit rear casing, ensuring cross-gate selector engages over selector finger.

Fit and progressively tighten all rear casing bolts to ensure layshaft extension bearing is pulled squarely into position.

Torque tighten rear casing bolts to:
15 Nm (11 lbf ft)

51. Fit end plate using new gasket.

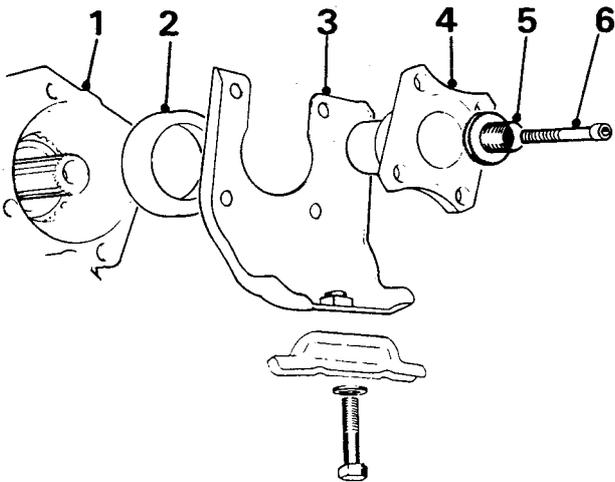


Fig.56

1. Rear casing
2. Oil seal
3. Support bracket
4. Flange
5. Crush sleeve
6. Allen screw

52. Fit:

- support bracket,
- propeller shaft flange.

53. Apply sealant to mating face of crush sleeve with flange, then fit sleeve and Allen screw.

Torque tighten Allen screw to 20 Nm (15 lbf ft).

Secure by crimping crush sleeve onto flats on screw head.

54. Fit:

- selector bias spring,
- speedometer drive,
- reverse detent cable,
- selector mechanism - position spacer correctly between casing and mechanism.

55. Refit gearbox to vehicle.

56. Fill to the level plug with the specified oil.

PROPELLER SHAFT ASSEMBLY

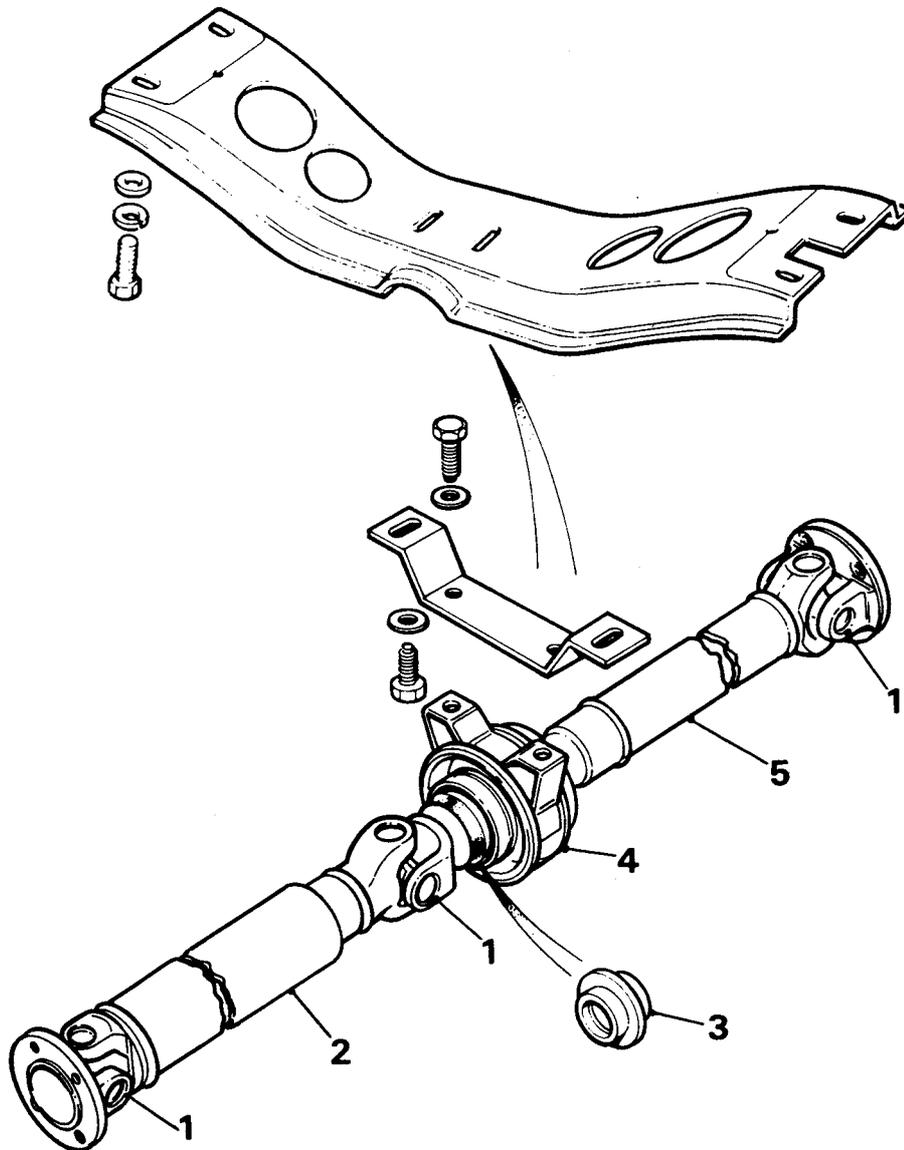


Fig.1 Propeller shaft

1. Universal joint
2. Rear shaft
3. Spline gaiter
4. Centre bearing
5. Front shaft

Description

The propeller shaft is a two-piece assembly having a sliding spline member in the centre. Three universal joints are employed, one at each end and one in the centre. The rear of the front shaft is supported by a sealed bearing suspended from the body.

Extra long wheelbase 400 vehicles have a 3-piece propeller shaft incorporating four universal joints, and supported by two sealed bearings.



Remove/Refit

It is permissible to remove one half of the assembly only, but the relationship between these two halves at the sliding spline must be marked with paint prior to separation.

Remove

1. Raise rear of vehicle and support rear axle.
2. Mark flanges and sliding splines, and disconnect flanges. Discard self-locking nuts.
3. Support propeller shaft and detach centre bearing attachment.. Lift propeller shaft clear.

Refit

4. Locate front of propeller shaft on gearbox flange, aligning correlation marks. Fit and tighten retaining nuts and bolts, using new self-locking nuts, to 41-56 Nm (30-41 lbf ft).
5. Attach centre mounting, but leave attachment bolts loose at this stage.
6. Locate rear of propeller shaft on drive flange, aligning correlation marks. Fit and tighten retaining nuts and bolts using new self-locking nuts.
7. Support centre bearing housing and turn propeller shaft a few times to allow bearing housing to align. Tighten centre mounting bolts.
8. Lower vehicle to ground.

Universal Joint Overhaul

Tool required: 18G 257 (or suitable circlip pliers)

Dismantle

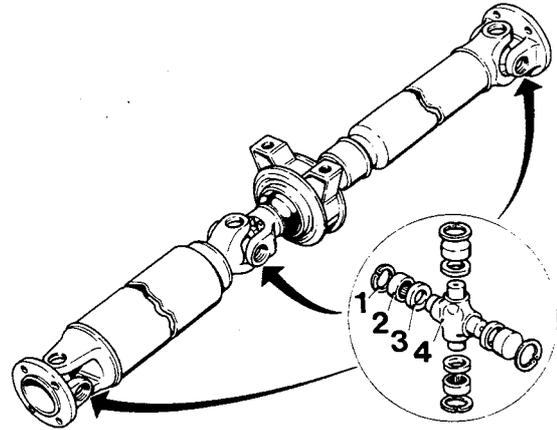


Fig.2 Universal joint

1. Circlip
 2. Yoke bearing
 3. Seal
 4. Cross-piece
1. Paint correlation marks on appropriate flange(s) and on sliding spline. Remove propeller shaft assembly, or front or rear shaft as required.
 2. Mark with paint the two halves of yoke to be dismantled, to maintain relationship on reassembly.
NOTE: If both yokes on rear shaft are being removed at same time, ensure components are not interchanged.
 3. Use tool 18G 257 fitted with suitable points to remove circlips securing fixed yoke bearings.
 4. Using soft metal thrust button, press one fixed yoke bearing towards centre of joint until opposite bearing protrudes from yoke. Pull that bearing clear of yoke.
 5. Press cross-piece from opposite side until other fixed yoke bearing protrudes; pull it clear.

6. Remove the two swinging yoke bearings in same way. Remove cross-piece from swinging yoke.
7. Clean and inspect yoke components for wear or damage, including bearing bores and circlip grooves.

Rebuild

8. Offer up cross-piece to swinging yoke.
9. Pack all bearing housings with recommended grease.
10. Press one bearing into swinging yoke sufficient only to allow circlip to be fitted. Fit circlip.
NOTE: Ensure bearing rollers do not become misplaced during fitting procedure.
11. Press in opposite bearing sufficient to allow circlip to be fitted, and fit circlip.
NOTE: When pressing in bearing, ensure cross-piece locates correctly inside it.
12. Offer up swinging yoke to fixed yoke, ensuring yoke correlation marks align.
13. Fit remaining bearings in same way, and retain with circlips.
14. If propeller shaft has been split, lubricate sliding splines with recommended grease, and align shaft correlation marks before refitting.
15. Refit propeller shaft to vehicle.

Centre Bearing

Remove and refit

Tool required: 0484820 (18G 47), or 0480042 (370) for use with hydraulic press.

Remove

1. Remove propeller shaft from vehicle.
2. Apply correlation marks to two halves of shaft for alignment on reassembly. Separate at sliding spline coupling.

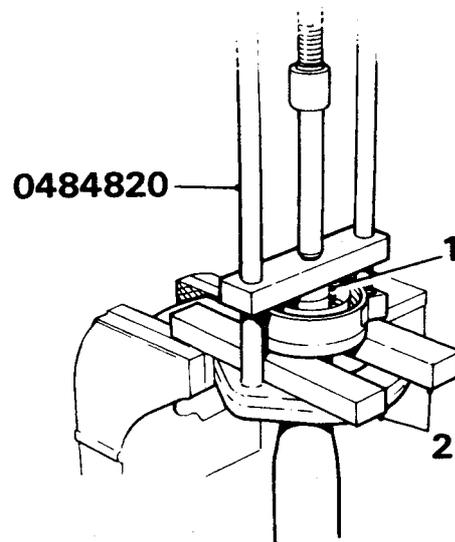


Fig.3 Removing centre bearing

1. Adaptor
2. Press bars
3. To remove centre bearing, use suitable adaptor on end face of shaft and suitable press bars to press off bearing in 0484820 (18G 47), or in base plate 0480042 (370) if using hydraulic press. Note positions of two deflector plates, before discarding them and bearing.



Refit

4. Lightly nip waisted area of propeller shaft in vice.
5. Use suitable tube to drift on new front deflector plate the correct way round, up to machined shoulder on shaft.

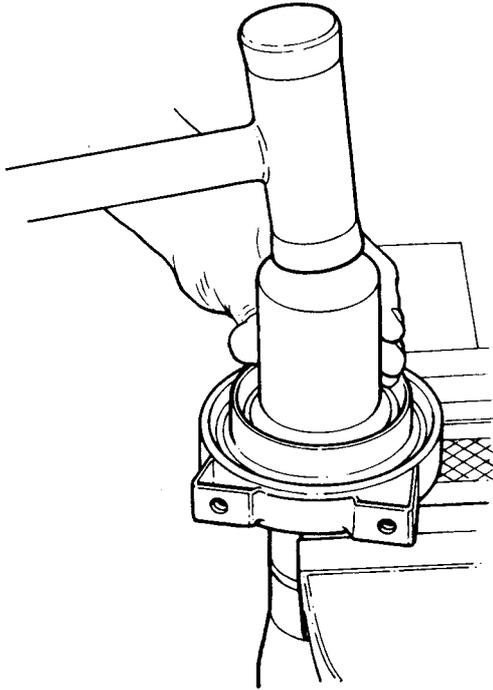


Fig.4 Fitting centre bearing

6. Drift on centre bearing correct way round, and new rear deflector plate.
7. Fit new spline gaiter, and smear splines with recommended grease. Align correlation marks and assemble two shafts together. Lip gaiter over flange on front shaft.
8. Refit propeller shaft to vehicle.

Part Number **DW 03907203**
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