

SERVICE MANUAL

CARS AND VANS

PV 444—445—544—P 210

Part 4

PROPELLER SHAFT

Export Service Department

AKTIEBOLAGET

VOLVO

GÖTEBORG . SWEDEN

CONTENTS

Description	1
Repair instructions	2
Propeller shaft repair, one-piece model	2
Propeller shaft repair, two-piece model	2
Removal of rear propeller shaft with universal joints	2
Removal of front propeller shaft with bearing case and universal joint	2
Removal of bearing case with front propeller shaft bearing	3
Checking propeller shafts with dial indicator	3
Disassembly and assembly of collar bearing	3
Disassembly of universal joint to change cross and needle bearing	4
Assembly of universal joint	5
Installing bearing case with bearing	7
Checking companion flange with dial indicator	7
Installing propeller shafts	7
Tracing faults	8
Tools	9
Specifications	10

DESCRIPTION

The propeller shaft on PV 444 up to chassis No. 2505 is tubular and made in one piece, fig. 1.

On PV 444 chassis No. 2506 and up, PV 445, PV 544 and P 210 it is made in two pieces. The front part is carried by a ball bearing at its rear end. The ball bearing rests in a bearing case suspended by two rubber mounted bolts. The propeller shaft is fitted with three universal joints. Each universal joint consists of a cross with four ground journals, which are carried by needle bearings in flange yokes and stub ball yokes, fig. 2.

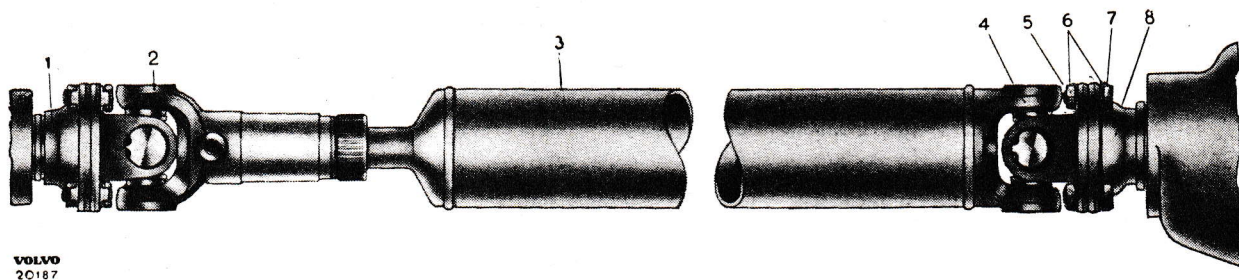


Fig. 1. Propeller shaft, early production.

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|--|--|
| 1. Companion flange on gearbox main shaft. | 5. Rear universal joint. |
| 2. Front universal joint. | 6. Lock plate. |
| 3. Propeller shaft. | 7. Screw. |
| 4. Stub ball yoke. | 8. Companion flange on drive pinion shaft. |

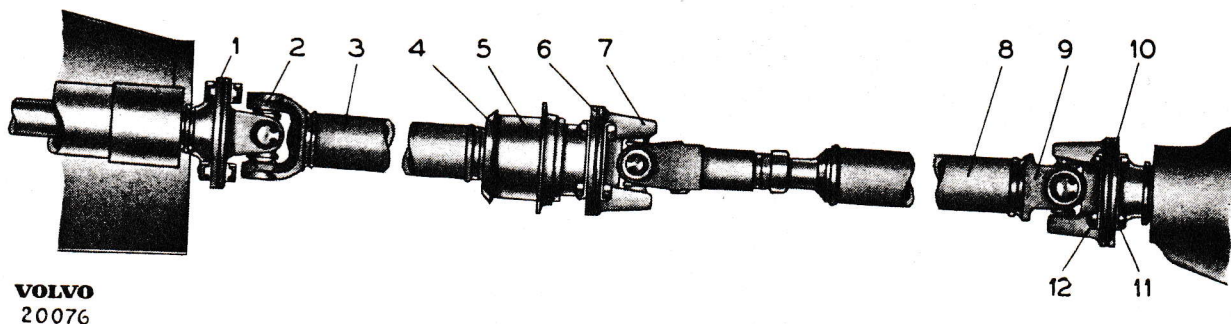


Fig. 2. Propeller shaft, later production.

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|---|---|
| 1. Companion flange on gearbox main shaft. | 7. Front universal joint on rear propeller shaft. |
| 2. Front universal joint. | 8. Rear propeller shaft. |
| 3. Front propeller shaft. | 9. Stub ball yoke. |
| 4. Splash cap. | 10. Companion flange on drive pinion shaft. |
| 5. Collar bearing case. | 11. Screw. |
| 6. Companion flange at collar bearing case. | 12. Lock plate. |

REPAIR INSTRUCTIONS

Propeller shaft repair, one-piece model

This type of propeller shaft can as a principle be repaired according to instructions given under "Propeller shaft repair, two-piece model".

NOTE: When *removing* the one-piece propeller shaft on PV 444, disconnect universal joints at gearbox and drive pinion shaft by removing the four companion flange screws. Propeller shaft can then be removed. Punch-mark companion flange to ensure correct re-installation. Concerning inspection, see "Checking propeller shafts with dial indicator" and "Checking companion flange with dial indicator".

Follow instructions given for the two-piece propeller shaft when *repairing* universal joints.

When *installing* propeller shaft, check that the balance arrows, fig. 12, are exactly opposite each other and that only undamaged lock plates are used to lock the nuts. Connect parts according to punch-marks.

Propeller shaft repair, two-piece model

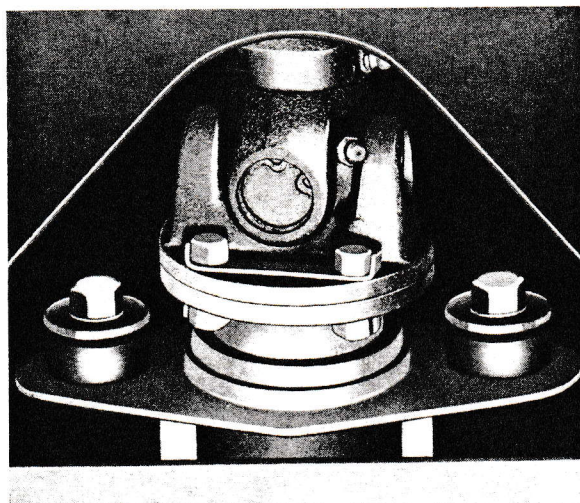
Removal of rear propeller shaft with universal joints

1. Disconnect propeller shaft front end at the universal joint by removing the four companion flange screws at collar bearing. Be careful not to drop propeller shaft to avoid damage on shaft and universal joints.
2. Disconnect propeller shaft rear end in the same manner at drive pinion companion flange. Propeller shaft can then be removed.

Removal of front propeller shaft with bearing case and universal joint

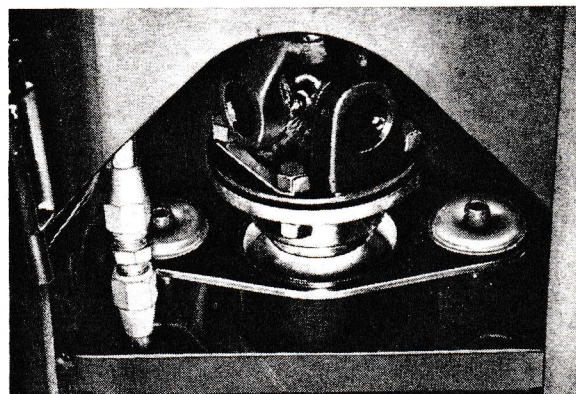
After the rear propeller shaft has been disassembled the front one can be removed as follows. There are two models of bearing case suspension (see fig. 3—4) and therefore the removal varies on the different cars.

1. Disconnect propeller shaft front end by removing the four screws in companion flange on gearbox main shaft.



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Fig. 3. Bearing case suspension,
early production.



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Fig. 4. Bearing case suspension,
later production.

2. Early production only:
Loosen the two nuts (2) holding the bearing case (1), see fig. 3.
3. Shaft with universal joint and bearing case can then be withdrawn backwards.

Both propeller shafts can be removed at the same time by disconnecting universal joints at drive pinion shaft and gearbox and loosening the two nuts (early production) at the bearing case. Both shafts should then be withdrawn backwards at the same time.

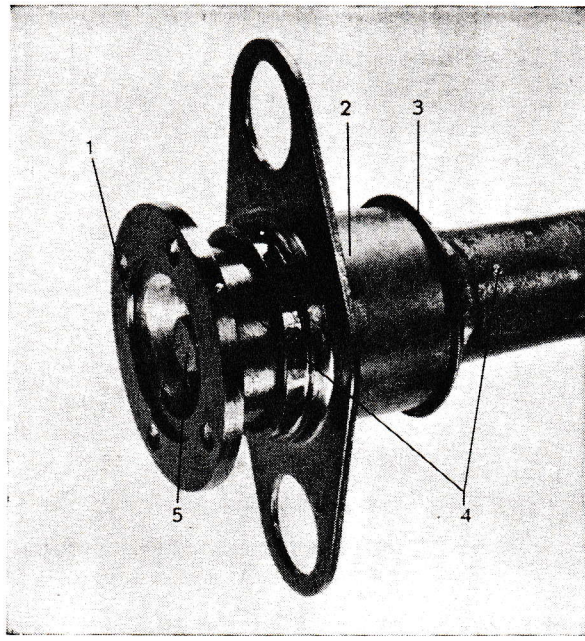


Fig. 5. Punch-marking, shaft and companion flange.

1. Companion flange.
2. Bearing case.
3. Splash cap.
4. Punch-marks.
5. Bolt

Removal of bearing case with front propeller shaft bearing

Place front propeller shaft in vice. Be careful not to damage or deform it.

1. Punch-mark propeller shaft and companion flange to ensure correct re-installation (4), fig. 4.
2. Remove bolt (5) complete with washers holding companion flange on shaft and pull off companion flange with tool SVO 2261. (SVO 4068 also can be used).
3. Collar bearing case (2), with bearing can by now be removed.

Checking propeller shafts with dial indicator

It is very important that a propeller shaft is absolutely straight. As even small damage on a propeller shaft causes vibrations, a careful inspection should be carried out. Place the shaft between centres and check it by means of a dial indicator all along its whole length when rotating. Should the runout exceed 0.25 mm (.01"), propeller shaft should be renewed.

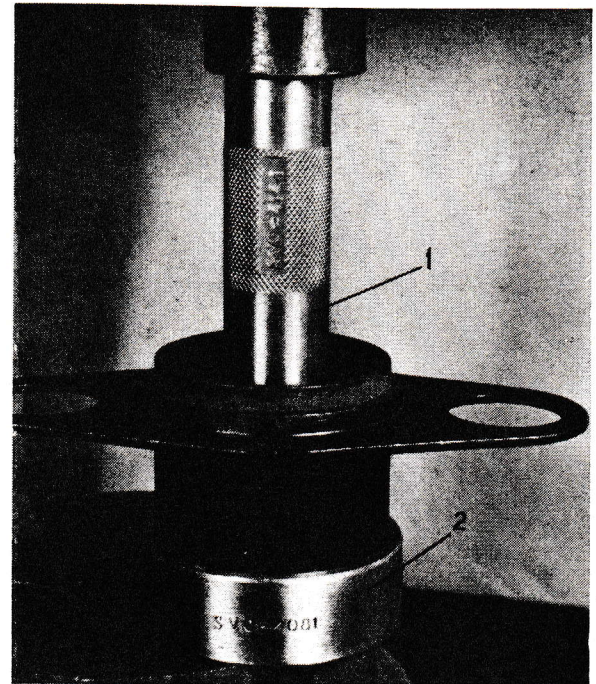


Fig. 6. Removing ball bearing.

1. Driver SVO 4141.
2. Spacer SVO 4081.

NOTE. A damaged propeller shaft must not be straightened or repaired but should be replaced with a new one.

Disassembly and assembly of collar bearing

Press ball bearing out by means of an arbor press. Use driver SVO 4141 (fig. 6) and SVO 4081 as a pad.

NOTE. Ball bearing is from the beginning packed with grease intended to last during its whole lifetime. Do not wash ball bearing in gasoline or any other solvent, causing lubricant to dissolve and run away. It should not be warmed up for the same reason.

When pressing in the ball bearing, which is also done in an arbor press, make sure that it is not pressed askew into the bearing case. Use driver SVO 4080, fig. 7. Install bearing case in spacer SVO 4081 exactly under tool (1). Place ball bearing (2) on the tool guide pin, true up and press it in as far as the tool permits. The ball bearing is similar on both sides and can consequently not be wrongly installed.

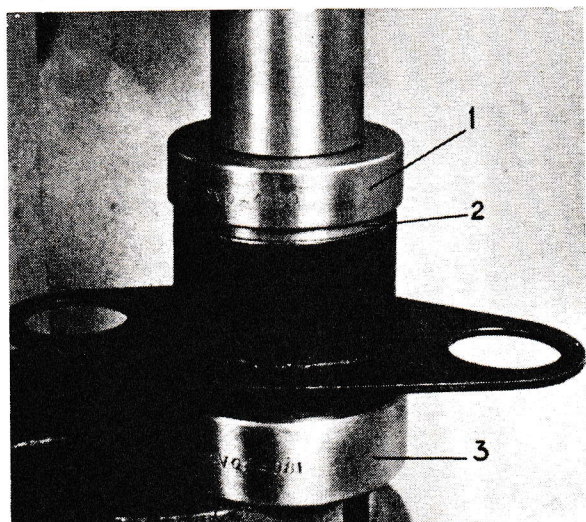


Fig. 7. Fitting ball bearing.

1. Driver SVO 4080.
2. Ball bearing.
3. Spacer 4081.

Inspection

Check ball bearing by pressing bearing races towards each other by hand and turn round. It should then run smoothly without sticking at any point. If not, reject the bearing and instal a new one.

A dry bearing should also be replaced.

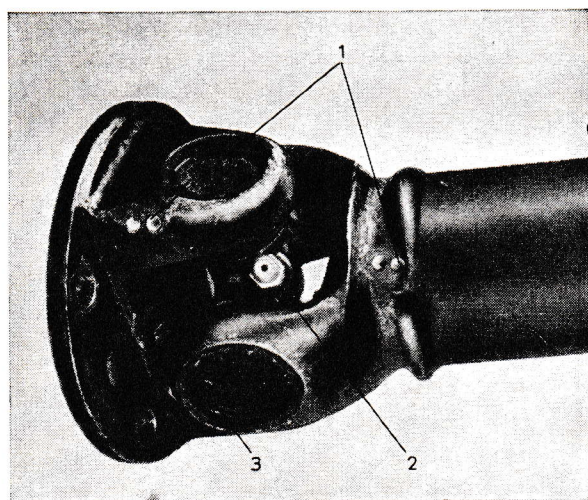


Fig. 8. Punch-marking the universal joint.

1. Punch-mark.
2. Lubricator.
3. Cirelip.

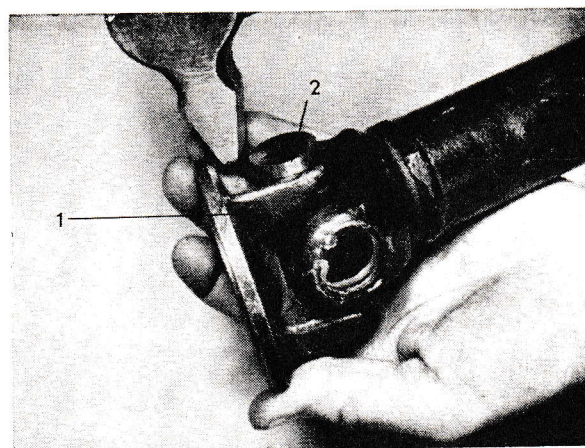


Fig. 9. Disassembling universal joint.

1. Companion flange yoke.
2. Needle bearing sleeve.

Disassembly of universal joint to change cross and needle bearing

Install propeller shaft (or universal joint if the middle one) in vice with the universal joint as close to the vice as possible. Remember that the propeller shaft itself is a tube, which easily can be deformed. Mark the universal joint in such a way that cross yokes can be re-assembled in their original positions (1, fig. 8). Line up marks with lubricator (2) on cross.

1. Remove the four circlips (3) locking needle bearing sleeve.
2. Remove lubricator.

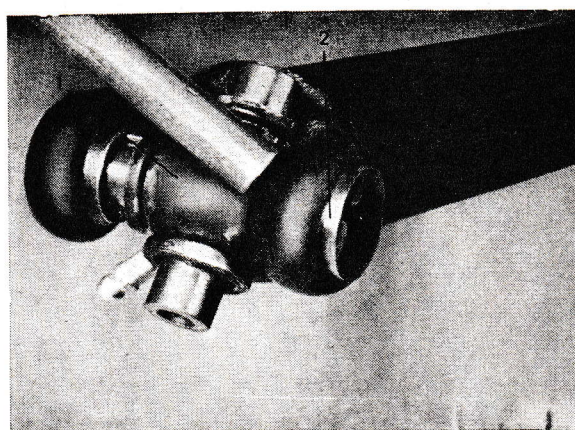


Fig. 10. Disassembling cross.

1. Cross.
2. Needle bearing sleeve.

3. Tap the free companion flange yoke (1, fig. 9) as far as possible towards the cross centre with a hammer. This will cause needle bearing sleeve (2) to creep half-way out at the side you tap.
4. Then drive yoke in opposite direction as far as possible thereby forcing the remaining needle bearing sleeve to creep out in the same manner.
5. Empty rollers out of both bearings (22 rollers in each bearing).
6. Push one needle bearing sleeve entirely out by means of a thin metal driver.
7. Remove companion flange yoke (1) and drive out the remaining needle bearing sleeve.

The cross should be removed as follows:

1. Drive cross (1, fig. 10) as far as possible in one direction by means of a hammer and a brass driver. Needle bearing sleeve (2) will then creep about half-way out.
2. Drive cross in opposite direction in the same manner.
3. Empty rollers out of both needle bearings.

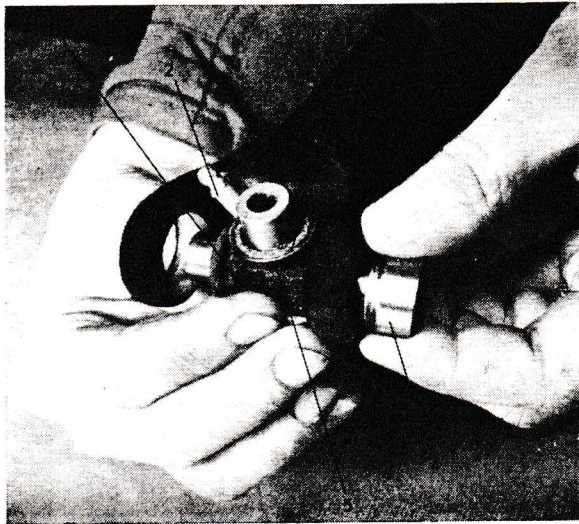


Fig. 11. Assembling universal joint.

1. Cross.
2. Lubricator.
3. Cork seal.
4. Needle bearing.
5. Cork seal retainer.

4. Drive one needle bearing sleeve entirely out by means of a thin metal driver.
5. Remove cross and drive the remaining needle bearing sleeve out.

Assembly of universal joint

1. Install propeller shaft (or cross if the middle one) in vice with the universal joint as close to the vice as possible (in order not to damage tube).
2. Fit new cork seals (3, fig. 11) and cork seal retainers (5) on cross journals (cork seals at the outside).
3. Install cross (1) in the same position as before disassembly, fig. 11. Check that lubricator (2) is turned as fig. 11 shows.
4. Move cross in one direction as far as the needle bearing (4) can be fitted on the journal.
5. Press in needle bearing as far as the lock ring can be fitted. Use a driver the diameter of which is some less than the needle bearing sleeve diameter.
6. Handle the remaining bearing in the same manner and press it on as far as the lock ring can be fitted. Fit companion flange yoke on cross in the same way.
7. Instal all lock rings.

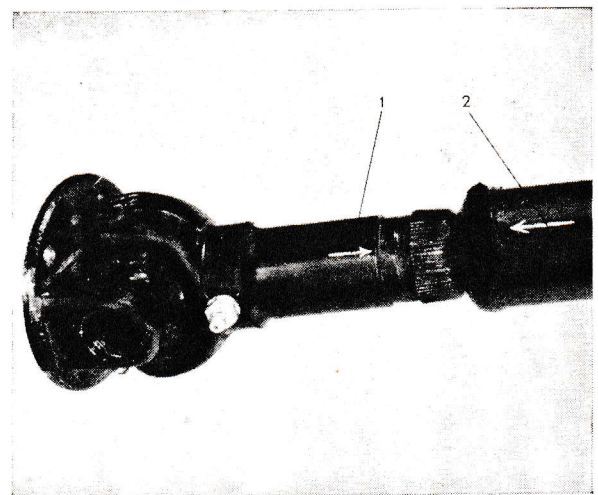


Fig. 12. Assembling universal joint. Assemble universal joint with the arrows exactly opposite each other.

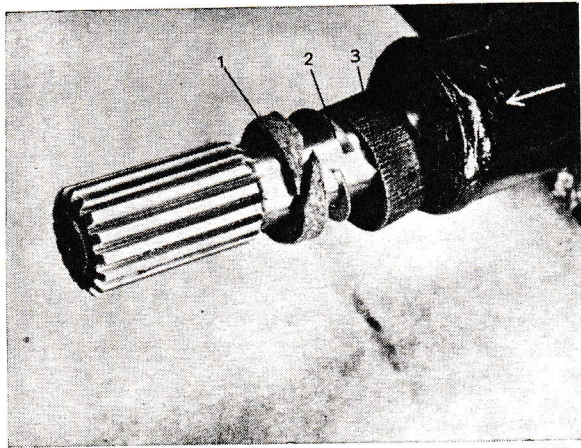


Fig. 13. Slip joint.

1. Cork seal.
2. Spring washer.
3. Retainer.

NOTE. When pushing front universal joint, on rear propeller shaft check that the arrow (1, fig. 12) stamped on the universal joint is placed exactly opposite the arrow (2) on shaft. If not, vibration will occur when propeller shaft revolves.

Renew cork packing ring (1, fig. 13), if necessary. It is split and easily changeable.

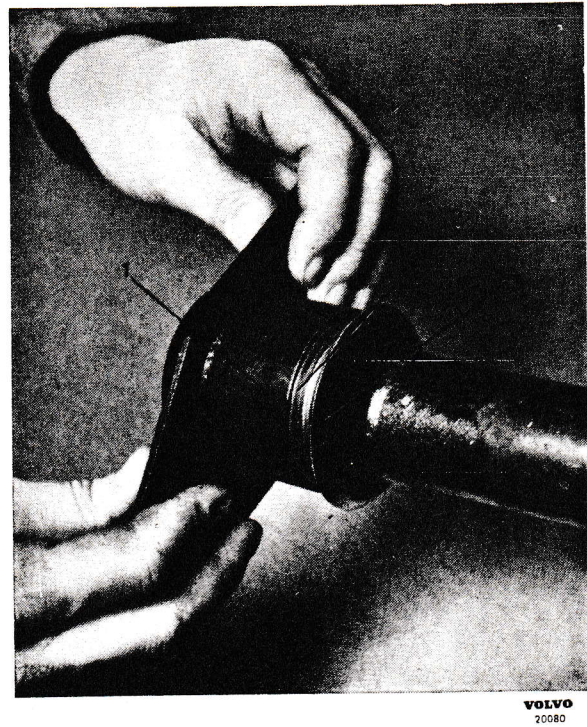


Fig. 14. Assembling bearing case.

1. Case.
2. Bearing.
3. Splash cap.

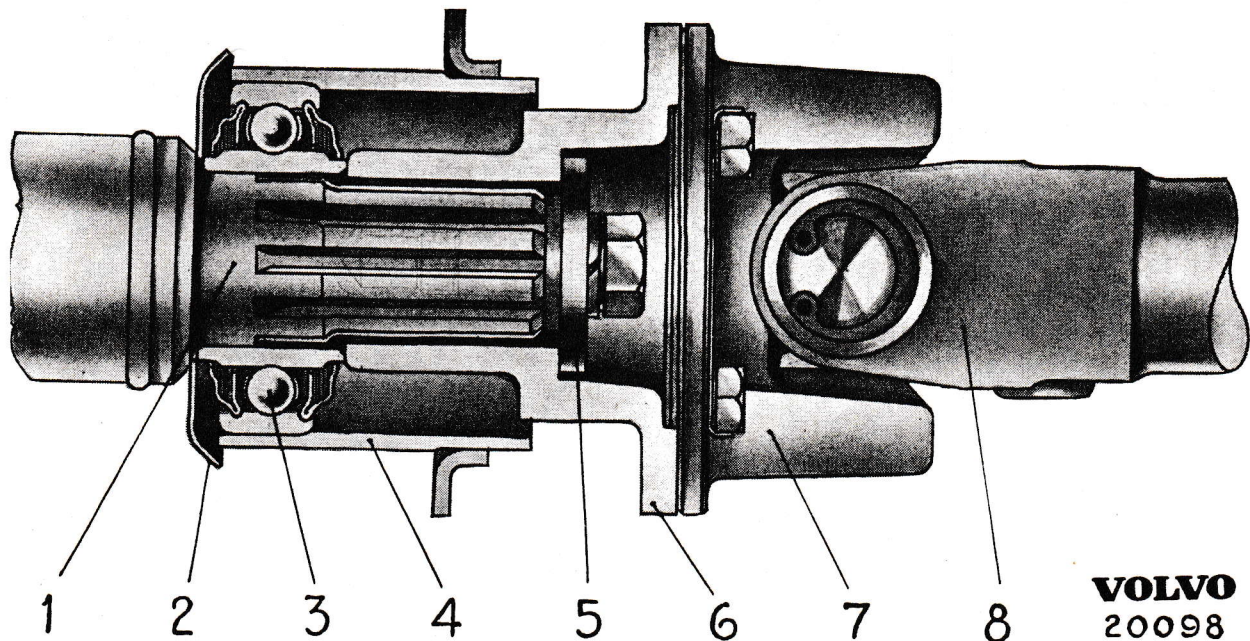


Fig. 15. Bearing case with bearing.

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|---------------------------|-----------------------------|---------------------|
| 1. Front propeller shaft. | 4. Collar bearing case. | 7. Universal joint. |
| 2. Splash cap. | 5. Washer. | 8. Universal joint. |
| 3. Ball bearing. | 6. Companion flange sleeve. | |

Installing bearing case with bearing

Fit bearing and collar bearing case on front propeller shaft *before* installing propeller shaft.

1. Install propeller shaft in vice.
2. Fit splash cap (3, fig. 14).
3. Push on bearing case (1) with bearing (2).
4. Push on companion flange sleeve (6, fig. 15) and check that the holes in companion flange sleeve are placed exactly opposite the holes in companion flange on gearbox main-shaft. Use driver SVO 4034.
5. Fit screw with washers and screws home. Hold companion flange sleeve with wrench SVO 4035.

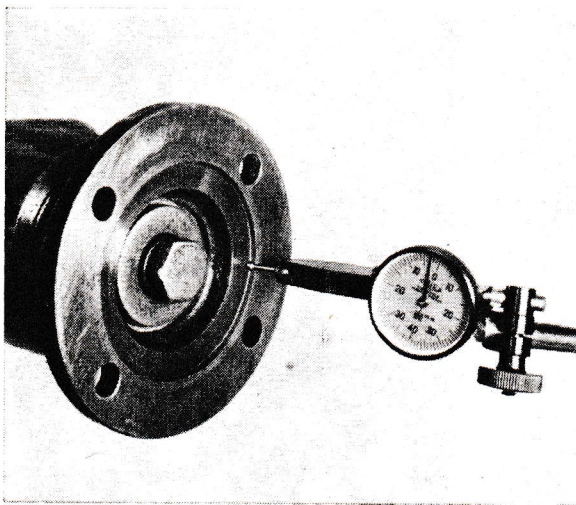


Fig. 16. Checking out-of-roundness.

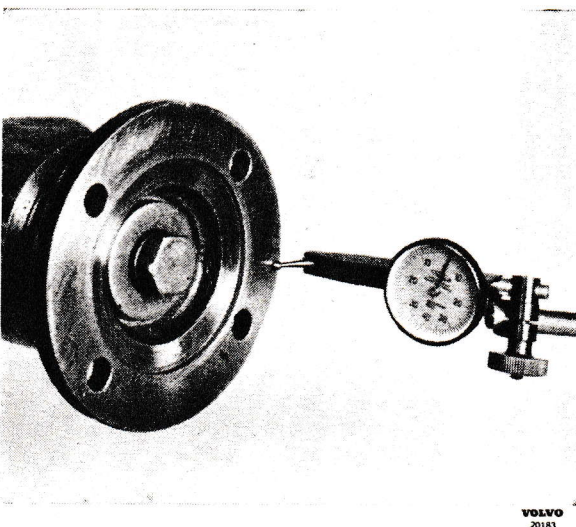


Fig. 17. Checking warping.

Checking companion flange with dial indicator

Check companion flanges with a dial indicator before installing propeller shafts. Place dial indicator as fig. 16 shows. Max. permissible out-of-roundness 0.07 mm (.003"). Max. permissible warping, 0.09 mm (.004") should be checked according to fig. 17.

NOTE. Companion flanges should be checked with a dial indicator after they are fitted to propeller shafts. Reject companion flanges not fulfilling demands above.

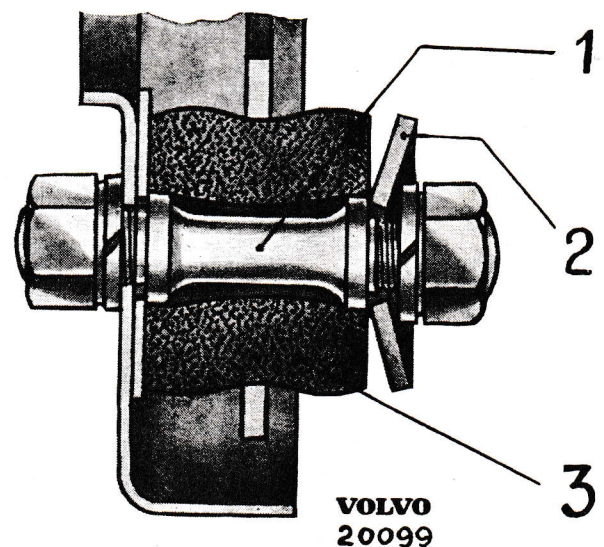


Fig. 18. Bearing case suspension, early production.

1. Bolt.
2. Washer.
3. Rubber bushing.

Installing propeller shafts

Install the front propeller shaft first.

1. Push it from behind through collar bearing case bracket.
- 2a. Early production:
Brace collar bearing case in bracket. Renew rubber bushings if damaged (3, fig. 18). Washers (2) at rubber bushings should be placed with their convex side facing rubber.
- 2b. Later production:
Thrust the bearing case bushings on to the pins.

3. Connect universal joint and companion flange at gearbox. Use new lock plates for nuts.
4. Connect front and rear propeller shafts at collar bearing. Check that all universal joints are placed in correct position in relation to each other. See fig. 2.
5. Connect the rear propeller shaft and companion flange on pinion shaft. Use new lock plates.

Lubricate all propeller shaft lubricating points with special lubricant.

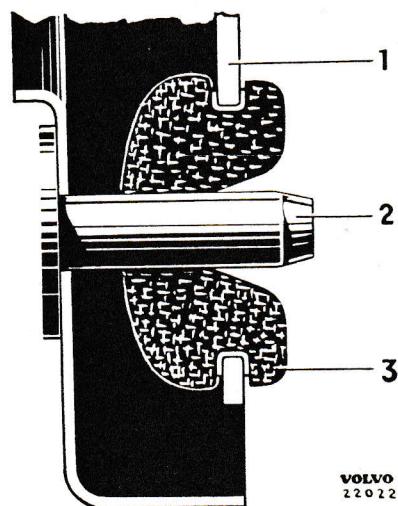


Fig. 19. Bearing case suspension, later production.

1. Bearing case.
2. Pin.
3. Rubber bushing.

TRACING FAULTS

Propeller shaft and universal joint troubles consist mostly of noise caused by vibration, knocks and clicks. Propeller shaft which is broken or damaged in any other way must not be repaired or trued up but should always be replaced by a new one. Vibrations may be caused

by wear, bad lubrication or faulty executed installation. The diagnosis of vibrations is a buzzing noise which increases at high speeds. Worn universal joints cause distinct clicks, which can be heard, when driving slowly, if the accelerator is pushed down and let up by turns.

CAUSE	REMEDY
Collar bearing case loose on its screws.	Renew rubber bushing on screws and fasten bearing case.
When this fault is the case, investigate also causes mentioned below, as bearing case may have come loose because of vibration caused by another fault.	
Collar bearing dry or worn.	Replace bearing.
Bearing loose in bearing case.	Renew bearing and bearing case.
Needle bearings in universal joints dry or worn.	Lubricate with special lubricant or fit new bearings.
Companion flange at gearbox, countershaft or pinion shaft warped.	Renew.
Companion flange screws loose.	Renew lock plates and screws and tighten nuts.
Propeller shaft bent.	Replace propeller shaft.
Installation not properly carried out.	See assembling and installation instructions. Check universal joint positions in relation to each other according to fig. 1 and 2.

TOOLS

The following special tools are necessary when repairing propeller shaft and universal joints:

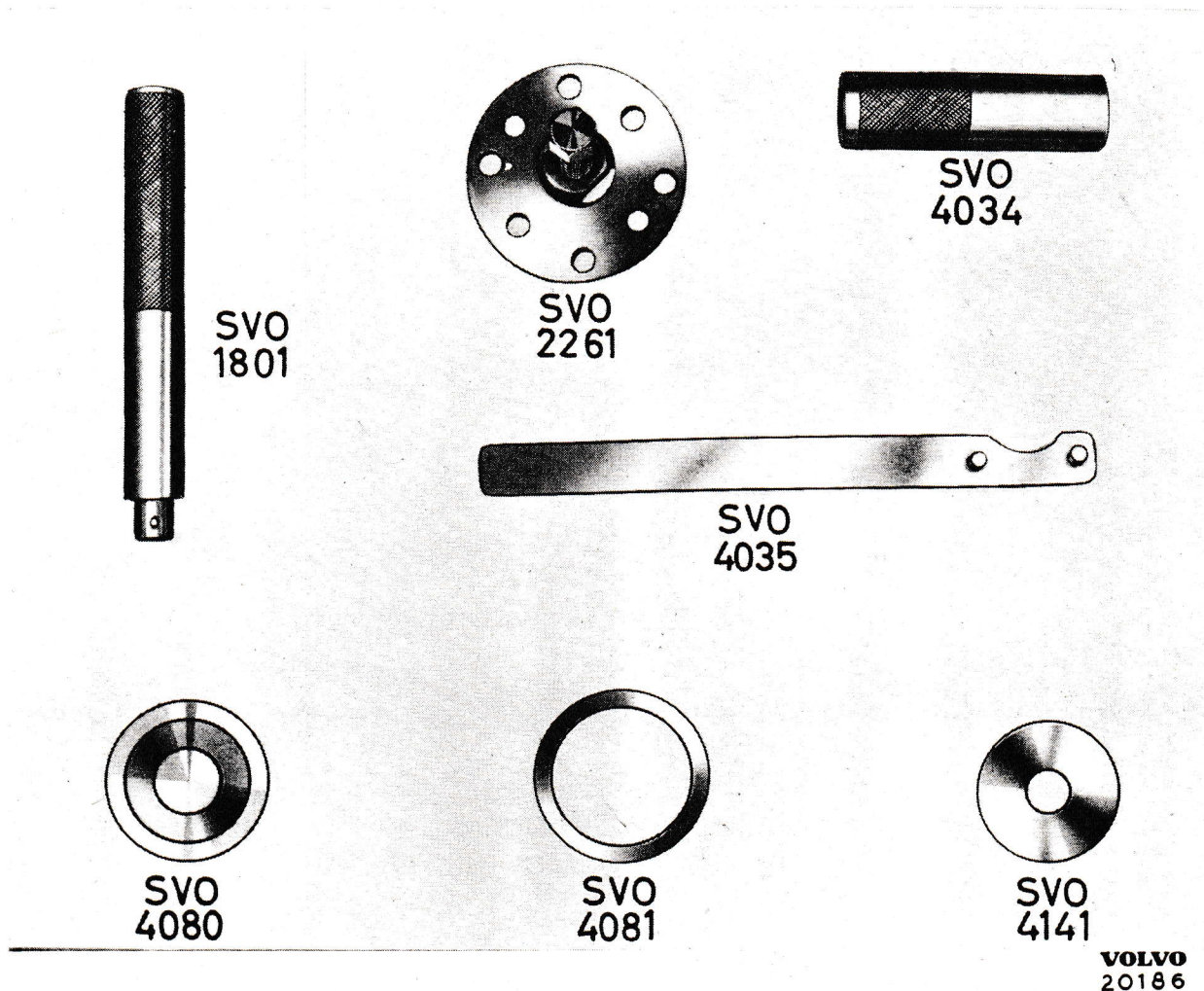


Fig. 20. Special tools.

SVO 1801	Standard handle 18×200 mm.	SVO 4035	Companion flange wrench.
SVO 2261	Companion flange puller (SVO 4068 can be used).	SVO 4080	Collar bearing installing driver.
SVO 4034	Companion flange driver.	SVO 4081	Spacer ring.
		SVO 4141	Collar bearing removing driver.

SPECIFICATIONS

Propeller shaft, PV 444 up to chassis No 2505	Tubular, one piece, two universal joints
PV 444 chassis No 2506 and up, PV 445, PV 544 and P 210	Tubular, divided, three universal joints
Manufacture and type	Hardy-Spicer with needle bearings
Number of roller in each bearing	22
Lubricant, universal joints	Special chassis lubricant

References to Service Bulletins