

Chapter F

PROPELLER SHAFT AND UNIVERSAL JOINTS

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Chapter F

PROPELLER SHAFT AND UNIVERSAL JOINTS

Section F1

OVERHAUL

Introduction

Cars fitted with the torque converter transmission have a propeller shaft fitted with a Hardy Spicer universal joint at each end (*see Fig. F1*), whereas cars fitted with the four speed automatic gearbox have a propeller shaft fitted with a Hardy Spicer universal joint at the rear end, but a Detroit ball and trunnion joint at the forward end (*see Fig. F2*).

If a propeller shaft is dismantled and any parts other than the eight nuts and bolts securing the flanges are renewed, the propeller shaft must be re-balanced when assembled.

Shafts with the Hardy Spicer joints at each end must be dynamically balanced to within 0.25 oz. in. (18,00 gm. cm.) at 3,000 r.p.m. and shafts with the Detroit joint at the forward end should be balanced to within 0.25 oz. in. (18,00 gm. cm.) at 2,000 r.p.m.

If facilities for balancing the propeller shafts are not available, fully balanced assemblies can be obtained as Service Exchange Units.

Propeller Shaft—To remove

1. Place the car on a ramp and securely chock the road wheels.

2. Disconnect the battery located in the boot.
3. Release the hand brake lever to the 'off' position.
4. Unhook the hand brake return spring from the operating lever and unpin and remove the clevis pin from the pivot point in the end of the operating lever (*see Fig. F3*).
5. Remove the bolts securing the centre of the box section cross-member on which the hand brake operating and balance levers are mounted.
6. Remove the cross-member centre section and lever the assembly away from its mounting. The centre section may be moved to one side or lowered, away from the underside of the car, but it must be suitably supported to avoid strain or 'kinking' of the hand brake cables.

Note The cross-member centre section must not be allowed to hang on the hand brake cables.
7. Jack up one rear wheel to enable the propeller shaft to be revolved, in order to gain access to all the propeller shaft flange bolts.
8. Remove the four securing bolts and nuts from the propeller shaft rear flange. It is advisable to leave one bolt supporting the shaft.
9. Remove the four bolts and nuts securing the front flange to the transmission output flange.

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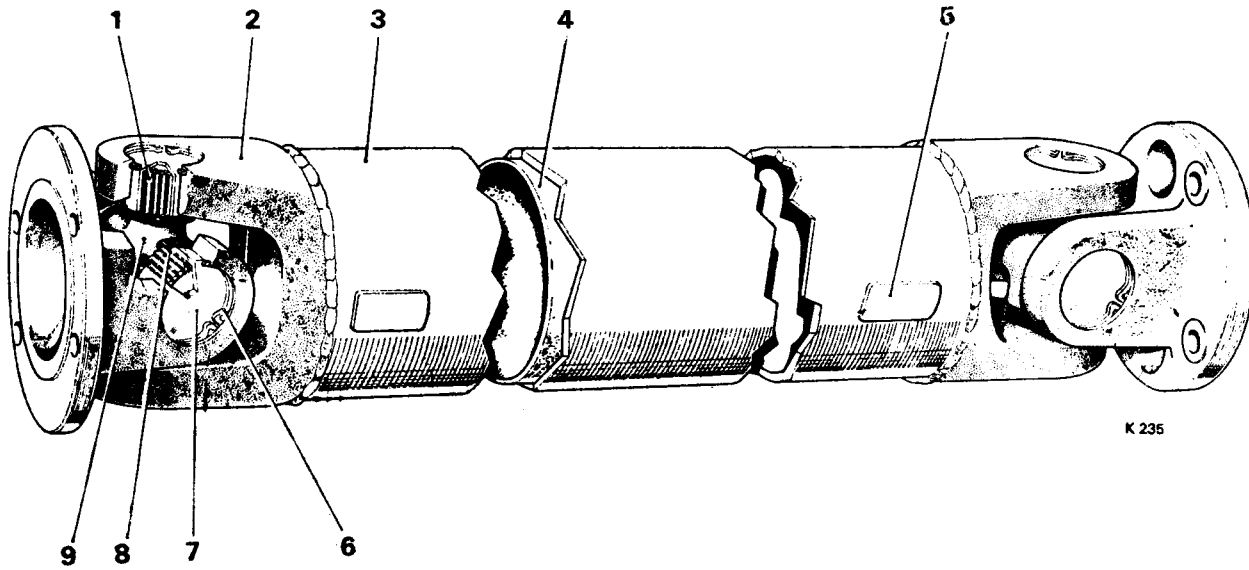


FIG. F1 PROPELLER SHAFT—TORQUE CONVERTER TRANSMISSION

- | | | |
|-------------------------------|-------------------------|---------------------------|
| 1 Needle bearing | 4 Damping insert | 7 Bearing retainer |
| 2 Universal joint yoke | 5 Balance weight | 8 Rubber seal |
| 3 Centre tube | 6 Circlip | 9 Cruciform |

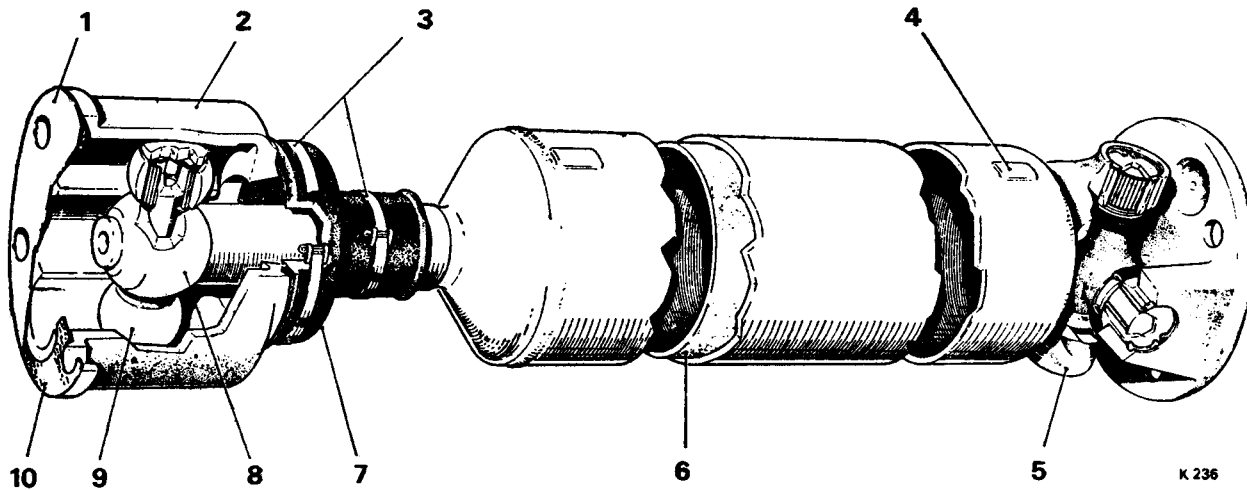


FIG. F2 PROPELLER SHAFT—FOUR SPEED AUTOMATIC GEARBOX

- | | |
|--|---------------------------------------|
| 1 End cover | 6 Damping insert |
| 2 Ball and trunnion joint housing | 7 Ball and trunnion joint seal |
| 3 Seal clips | 8 Ball and trunnion |
| 4 Balance weight | 9 Needle roller race |
| 5 Hardy Spicer joint | 10 Gasket |

10. Disconnect the ends of the rear hand brake cables from the caliper mechanism at the clevis pins on the two triangular operating levers.

11. Unclip the cables from the trailing arms.

12. Release the lock-nuts at the outer cable ends and release the clip securing the two cables to the abutment bracket at the rear end of the propeller shaft tunnel.

13. Pull the two cables forward through the aperture in the sub-frame cross-member.

14. Lower the propeller shaft front end and remove the shaft by moving it forward and downward.

Care must be taken when manoeuvring the rear universal joint through the aperture in the rear sub-frame member.

Hardy Spicer joint—To dismantle

If a Hardy Spicer joint becomes unserviceable it must be dismantled and a replacement joint fitted.

1. Clean and remove any paint from the yoke eyes.
2. Remove the circlips which retain the needle roller bearing races.
3. Using a hide mallet, tap the yokes until the races are driven out of the yoke eyes (see Fig. F4).

Hardy Spicer joint—To assemble

1. Fit the cross-piece and seals, hold the cross-piece centrally and carefully press the needle roller bearing assemblies into the yoke eyes far enough to enable the circlip to be fitted.
2. If this is found to be difficult to accomplish due to pressurisation, release the small setscrew situated between two of the cross-piece trunnions, thus allowing the trapped air to bleed.
3. Fit the circlips.
4. Tighten the screw between the cross-piece trunnions.

Ball and trunnion joint—To dismantle

The ball and trunnion joint may be readily dismantled for inspection. It is only necessary to remove the trunnion pin in the event of the neoprene seal requiring replacement or if it is necessary to replace the pin itself.

1. Bend the tabs of the front cover plate away from the trunnion joint body and remove the cover plate and gasket.

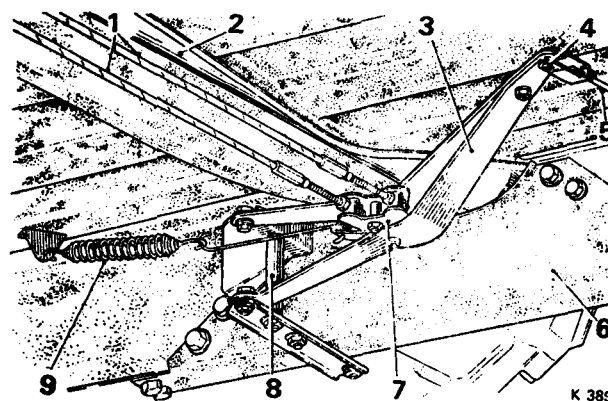


FIG. F3 HAND BRAKE OPERATING LEVER

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|-------------------|---------------------------|
| 1 Rear cables | 5 Front cables |
| 2 Propeller shaft | 6 Detachable cross-member |
| 3 Operating lever | 7 Balance lever |
| 4 Clevis pin | 8 Operating lever pivot |
| | 9 Return spring |

2. Remove the smaller of the two seal clips.
3. Move the joint body up the shaft far enough to remove the trunnion buttons, adjusting washers, 62 roller bearings and the bearing retainers from the trunnion pin (see Fig. F5).

Note The individual bearing assemblies should be kept apart from each other and the adjusting washers and thrust washers kept with their own particular assemblies.

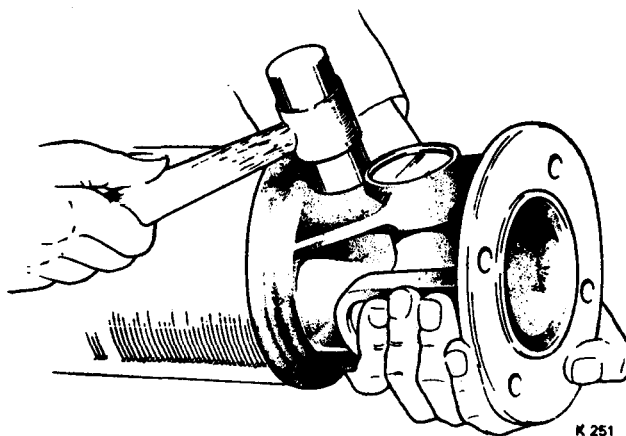


FIG. F4 REMOVING THE HARDY SPICER RACES

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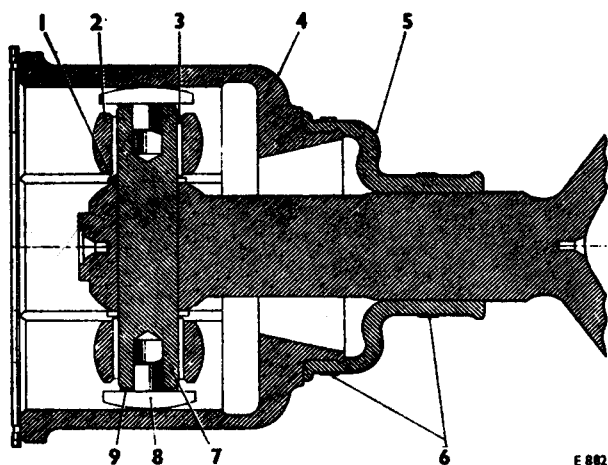


FIG. F5 BALL AND TRUNNION JOINT

- | | |
|--------------------------|-------------------|
| 1 Hardened washer | 5 Neoprene seal |
| 2 Bearing outer race | 6 Seal clips |
| 3 Needle roller bearings | 7 Trunnion pin |
| 4 Joint body | 8 Trunnion button |
| 9 Shim washer | |

4. Hold back the housing and neoprene seal and press out the trunnion pin. This operation may require a pressure of over 5 ton/sq. in. (7,874 kg/sq. mm.) but heat must not be used during this operation.

5. Remove the remaining seal clip; remove the trunnion joint body and seal.

6. Clean all parts and inspect for serviceability.

The bores in the trunnion body must be smooth and free from damage and the bearing surfaces of the buttons must also be undamaged.

Slight damage or marks on the trunnion buttons and housing bores may be removed by light stoning.

Ball and trunnion joint—To assemble

To assemble the ball and trunnion joint reverse the procedure given for its dismantling, noting the following points.

1. Whenever the trunnion pin has been removed, the opportunity should be taken on assembly to fit a new neoprene seal.

2. The trunnion pin should have an interference fit of 0.003 in. (0.08 mm.) in the shaft and a pressure of up to 5 ton/sq. in. (7,874 kg/sq. mm.) may be required to press it into the shaft.

The minimum interference pressure is 2½ ton/sq. in. (3,937 kg/sq. mm.).

3. It must be noted that the trunnion housing and the propeller shaft have correlation spots painted on them and when the joint is assembled, these marks must be aligned.

4. The pin must be pressed in squarely and, when the operation is complete, the amount by which the pin protrudes from each side of the shaft must be equal to within 0.006 in. (0.15 mm.) when checked with a depth micrometer (see Fig. F6).

5. The fit of the trunnion assembly in the trunnion housing should be checked and adjusted if necessary.

Adjustment is effected by altering the thickness of the shim washers fitted beneath the trunnion buttons, until the trunnion assembly is 0.0005 in. (0.013 mm.) slack to 0.0005 in. (0.013 mm.) tight in the housing.

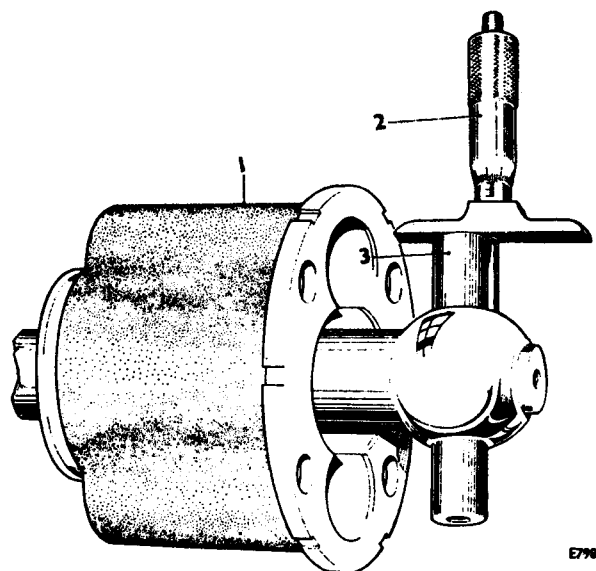


FIG. F6 TRUNNION PIN POSITION

- | |
|----------------|
| 1 Joint body |
| 2 Micrometer |
| 3 Trunnion pin |

These shim washers are available in a range from 0.012 in. (0,30 mm.) to 0.023 in. (0,58 mm.) in 0.001 in. (0,025 mm.) increments.

Note In order to preserve the balance of the assembly the shim washers must be selected to give not more than 0.003 in. (0,076 mm.) variation between the centre line of the joint housing and the centre line of the propeller shaft when the assembly is 0.0005 in. (0,013 mm.) slack to 0.0005 in. (0,013 mm.) tight in the joint housing.

6. Pack the trunnion joint with 1½ oz. (42,5 gm.) of Retinax 'A' grease.
7. Fit a new gasket and cover plate.
8. If any parts have been renewed the shaft must now be balanced to the limits stated previously. Balance is adjusted by weights spot-welded to each end of the centre tube.

Ball and trunnion joint seal—To renew

If a ball and trunnion joint seal requires renewal, the propeller shaft must be removed, the trunnion joint dismantled and the trunnion pin pressed out as described previously.

When the seal has been fitted, the pin must be replaced as described under 'Ball and trunnion joint—To assemble'.

Propeller shaft—To fit

To fit the propeller shaft, reverse the procedure given for its removal, noting the following points.

1. The joint faces of the flanges must be clean and free from damage and all bolts must be torque tightened.

The torque tightness of the flange bolts must be between 42 lb. ft. and 45 lb. ft. (5,80 kg.m. and 6,22 kg.m.) for front and rear Hardy Spicer joints, and between 70 lb. ft. and 75 lb. ft. (9,67 kg.m. and 10,36 kg.m.) for ball and trunnion forward joints.

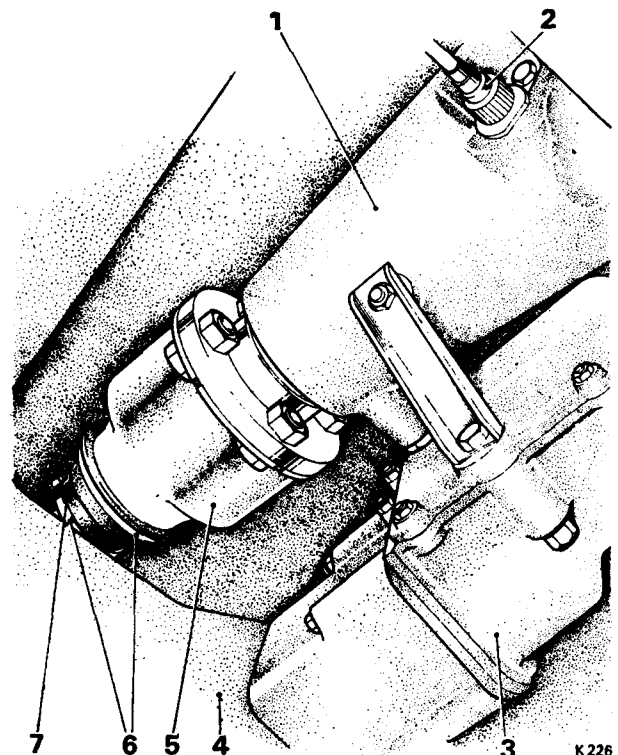


FIG. F7 PROPELLER SHAFT FRONT JOINT

- 1 Transmission extension
- 2 Speedometer cable
- 3 Electric gearchange actuator
- 4 Detachable cross-member
- 5 Ball and trunnion joint
- 6 Seal clips
- 7 Joint seal

2. All other bolts and nuts must be torque tightened in accordance with the standard torque figures given in Chapter P.

3. If a ball and trunnion joint has been dismantled for any reason, run the car for approximately 10 miles (16 km.), and then check and tighten the securing bolts to counteract any settling of the gasket.

4. The joint should also be inspected to ensure that the grease packed into the joint on assembly is not leaking from the joint seal.

Section F2

DIMENSIONAL DATA

DESCRIPTION	DIMENSION NEW	REMARKS
Ball and Trunnion joint housing Diameter of two outer bores Nominal dimension between extremities of outer bores	1.250 in. (3,175 cm.) 1.251 in. (3,177 cm.) 3.625 in. (9,207 cm.)	Bores must be in good condition and free from heavy indentations or pitting. The bores must be within 0.003 in. (0,076 mm.) of true position to centre line of body
Trunnion pin Diameter of pin	0.68975 in. (17,5196 mm.) 0.68955 in. (17,5133 mm.)	There should be 0.003 in. (0,076 mm.) interference between the trunnion pin and the knuckle end piece bore
Knuckle end piece Pin bore diameter Min. load for pressing in pin	0.6875 in. (17,4625 mm.) 0.685 in. (17,399 mm.) 2½ ton/sq. in. (3,937 kg/sq. mm.)	Pin must be pressed in squarely to within 0.006 in. (0,15 mm.) of centre position
Needle roller bearing (62 off) Diameter of roller	0.0772 in. (1,961 mm.) 0.0770 in. (1,956 mm.)	Rollers must be free from pitting or damage
Spherical bearing Inside diameter Outside diameter	0.8444 in. (21,448 mm.) 0.8439 in. (21,44 mm.) 1.2495 in. (3,1737 cm.) 1.2490 in. (3,1724 cm.)	Case hardened 0.040 in. (10,2 mm.) to 0.050 in. (12,7 mm.) deep
Bearing and button assembly Dimension over buttons when assembled	As diameter measured between extremities of housing outer bores	Trunnion assembly may be 0.0005 in. (0,013 mm.) slack to 0.0005 in. (0,013 mm.) tight in housing but must be shimmed so that when assembled the centre lines of the housing and the trunnion assemblies must be within 0.003 in. (0,08 mm.)
Propeller shaft balance assembly Hardy Spicer Ball and trunnion	To be within 0.025 oz. in. (18,00 gm. cm.) at 3,000 r.p.m. To be within 0.025 oz. in. (18,00 gm. cm.) at 2,000 r.p.m.	Balance by small weights welded on to Balance adjusted by small weights welded on to centre tube