Section E5

Crankshaft and Main bearings

The crankshaft is forged from chrome molybdenum steel. There are five main journals and four crankpins, each crankpin carries two connecting rods. The main journals and crankpins run in split, steel backed shell bearings that have a tin-aluminium lining.

The crankpins are drilled and plugged to form sludge traps that prevent dirt from reaching the bearings.

To improve the wear characteristics, the crankshaft is nitride hardened.

Crankshaft end float is controlled by split thrust washers fitted on either side of the centre main bearing assembly.

Bolted-on balance weights are fitted to the crank-shaft (late engines have integral balance weights) which is dynamically balanced before it is fitted to the engine. When the engine is partially built the crankshaft, connecting rods and pistons are dynamically balanced in the crankcase.

Oil flingers are fitted to the front and rear (except late engines) of the crankshaft to prevent oil leakage. The rear oil flinger is pressed onto the shaft and rotates inside a recess on the rear end backplate (on late engines the rear flinger is superseded by a 'lip' type of oil seal) as shown in Figure E6. At the front of the crankshaft there are two oil flingers that rotate inside recesses machined in the front half lower casing (on late engines a 'lip' type of oil seal is fitted).

It is important that the position of any component removed from the engine is noted so that it can be returned to its original position, otherwise, wear characteristics and engine balance may be impaired.

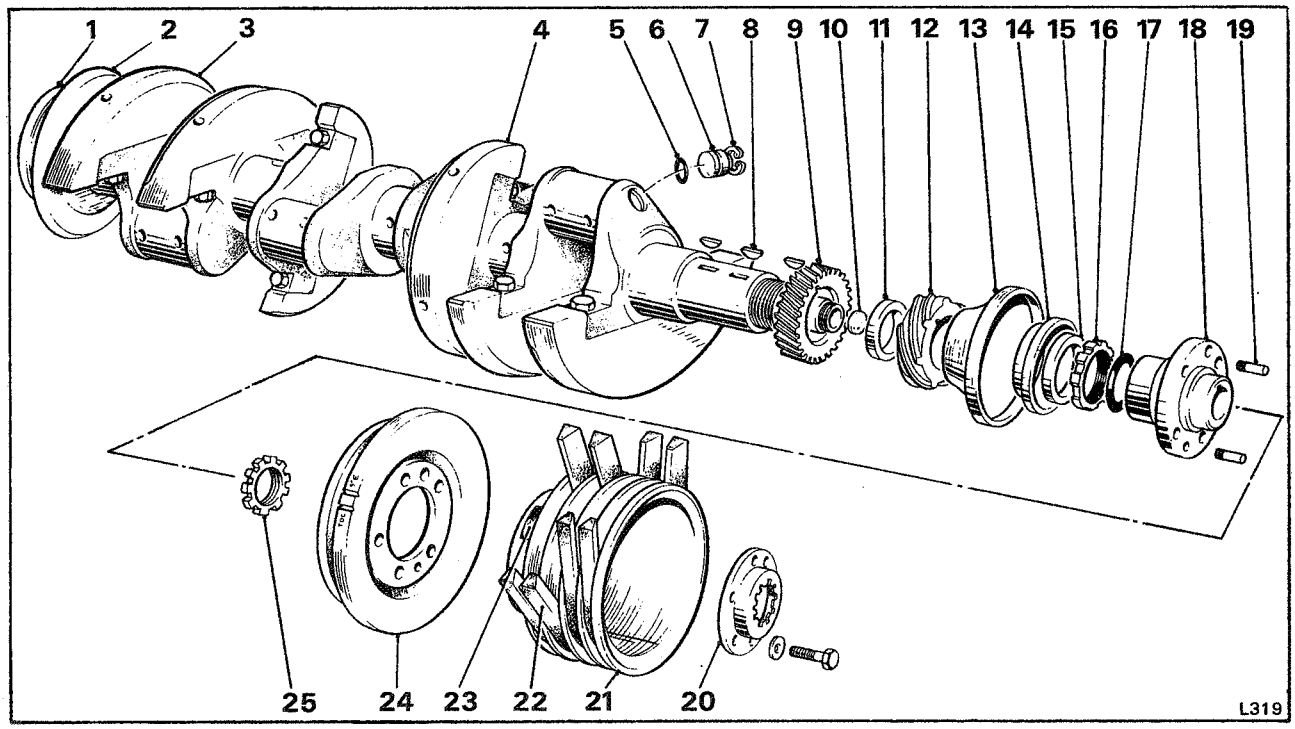


Fig. E5 Crankshaft assembly

1 Rear adapter	6 Plug	11 Washer	16 Nut	21 Pulley
2 Flinger	7 Circlip	12 Oil pump driving gear	17 Rubber 'O' ring	22 Belt
3 Bolted-on balance weight	8 Woodruff key	13 Flinger	18 Driving flange	23 Balance weight
4 Bolted-on balance weight	9 Timing gear	14 Flinger	19 Dowel	24 Damper
5 'O' ring	10 Disc	15 Washer	20 Lock-plate	25 Nut

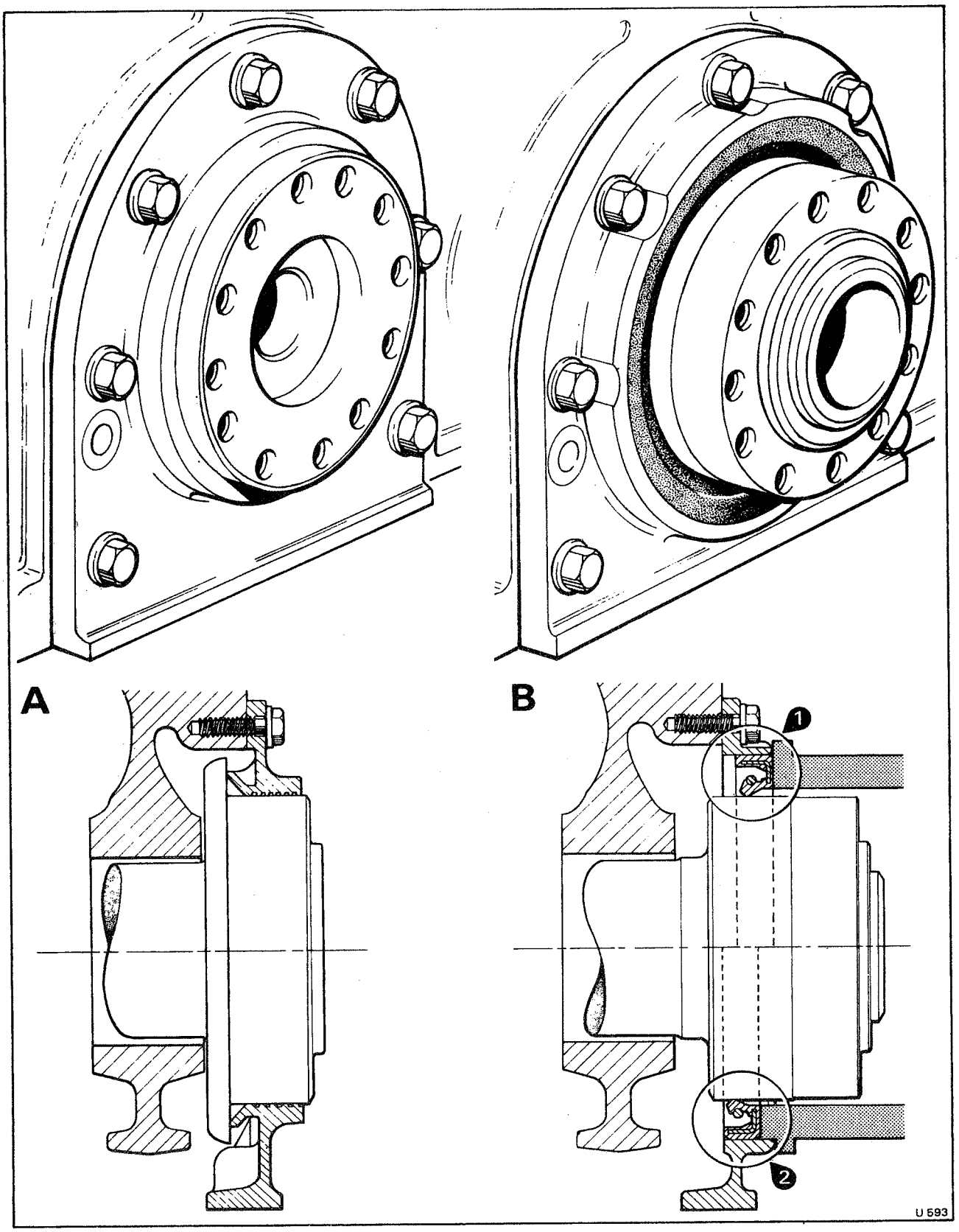


Fig. E6 Crankshaft rear seal arrangement
1 Initial position of seal
2 Service position of seal

A Oil flinger and backplate
B Oil seal and backplate (late engines)

Crankshaft - To remove

1. Remove the engine from the vehicle (see Section E12).
2. Fit the engine to a turnover stand.
3. Ensure that the engine oil has been drained.
4. Turn the engine upside down.
5. Unscrew the retaining setscrews and withdraw the sump. Discard the gasket.
6. Unscrew the four setscrews and withdraw the oil pedestal and strainer assembly.
7. Remove the coolant pump (see Chapter L).
8. Locate the lock-plate situated in the centre of the crankshaft pulley.
9. Unscrew the five setscrews and withdraw the lock-plate.
10. Using the special spanner (RH 7131) unscrew the serrated nut from the crankshaft.
11. Withdraw the pulley and damper.
12. Using an extractor (RH 7097) withdraw the pulley driving flange.
13. Ensure that all weight is removed from the engine front mounting foot.
14. Remove the setscrews from the engine mountings situated below the timing cover.
15. Unscrew the jockey pulley pivot pin, the two dowel setscrews (bottom left and top right), the two other corner setscrews (top left and bottom right) and the remaining centre setscrews.
16. Carefully withdraw the lower timing cover (the cover is dowelled to the crankcase), ensuring that the rubber bung situated inside the casing is not lost.
17. Unscrew the three setscrews retaining the oil pump and withdraw the assembly and dowel inserts together with the pipe and rubber 'O' ring.
18. Locate the flywheel setscrews.
19. Unscrew the setscrews securing the flywheel to the crankshaft.
20. Withdraw the flywheel assembly and adapter [on late engines the adapter is an integral part of the crankshaft (see Fig. E6)].
21. Unscrew the setscrews and withdraw the back-plate. The backplate is dowelled to the crankcase. Discard the gasket.
22. Unscrew the nuts from the connecting rod bolts, remove the connecting rod caps.
23. Fit protective rubber tubing over the connecting rod bolts to prevent damage to the crankpins (see Fig. E17).
24. Remove the shell bearings from both the connecting rod and cap.
25. Push the piston and connecting rod assemblies to the top of their respective bores.
26. Unscrew the main bearing cap nuts and withdraw the caps using the extractor (RH 7208) and attachment (RH 7498) as shown in Figure E7.
27. Remove the crankshaft thrust washers from the centre main bearing.
28. Fit protective rubber tubing over the main bearing studs to prevent damage to the crankshaft journals.
29. Carefully lift the crankshaft from the crankcase.

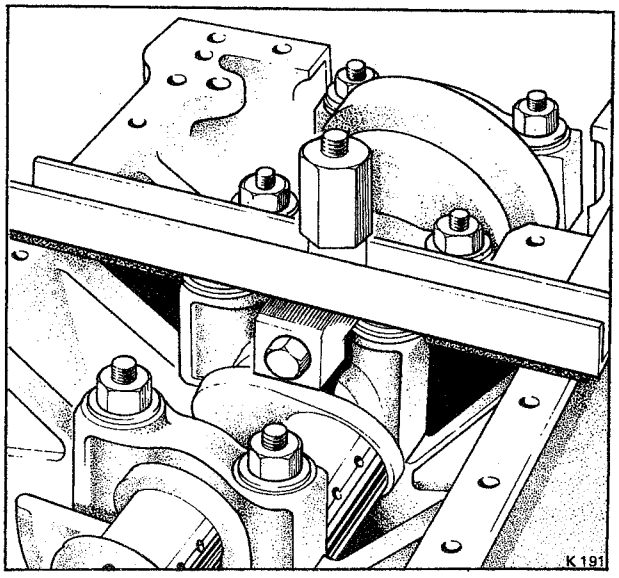


Fig. E7 Removing the main bearing caps

Crankshaft - To dismantle

1. Using the special spanner (RH 7110) unscrew and remove the serrated nut and washer from the front of the crankshaft (the nut has a left-hand thread).
2. Withdraw the oil flingers (early engines).
3. Ensure that the front face of the oil pump drive gear is identified (so that the gear can be fitted in its original position when assembling the crankshaft).

   Withdraw the oil pump driving gear.
4. Using a soft drift, remove the Woodruff key.
5. Withdraw the spacer.
6. Withdraw the timing gear and Woodruff key.
7. Dismantle the sludge traps by removing the retaining circlip and withdrawing the plug.

   The seal plugs can be removed with the aid of a setscrew screwed into the extraction hole, leverage then applied to the end of the setscrew will withdraw the plug.

   Discard the rubber 'O' ring from around each plug.
8. Unscrew the two setscrews securing each balance weight and withdraw the weight (late engines have integral balance weights).

Bolted-on balance weights need not normally be removed unless the crankshaft requires regrinding when they should be removed to allow access to the various pins and journals.

Crankshaft - To inspect

1. Thoroughly clean the crankshaft. This can usually be achieved by washing the shaft in a paraffin bath then drying it with compressed air. A set of small brushes may be useful to remove obstinate dirt.
2. Mount the crankshaft in 'Vee' blocks on an inspection table.

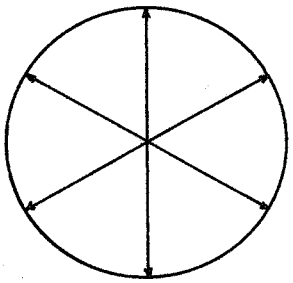
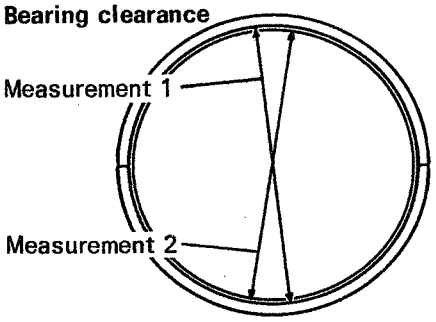
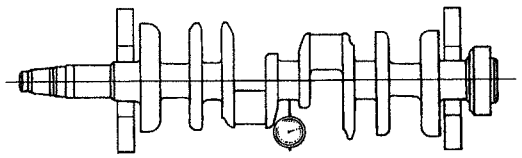
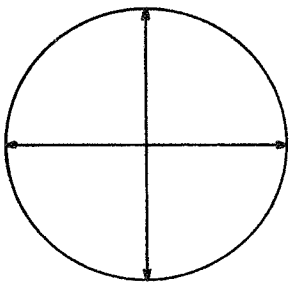
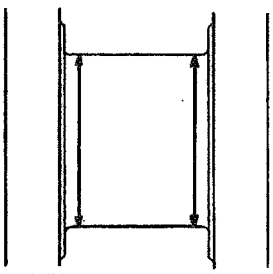
Measurement	Method
Mean size 	**Obtained on crankshaft main journal, crankpins and bearing shells** 1. (a) Measure the diameter of the journal or crankpin in two planes one at right angles to the other. (b) Ensure that the shell bearings are fitted in position and the retaining nuts correctly tightened. Measure the bore of the bearing in three places as shown. 2. Add the two journal or crankpin readings together (three readings for shell bearings) and divide by two (three for shell bearings).
Bearing clearance 	**Obtained between crankshaft main journals/crankpins and bearing shells** 1. Obtain mean size of shell bearing. 2. Obtain mean size of crankshaft main journal/crankpin. 3. Subtract measurement obtained in 2 from measurement obtained in 1 to give bearing clearance.
Bow 	**Measured on the crankshaft centre main journal** 1. Mount the crankshaft main journals 1 and 5 in 'Vee' blocks on a surface table. 2. Position the indicator gauge on the side of the centre main journal. 3. Rotate the shaft until the lowest reading is obtained on the gauge. Zero the gauge. 4. Rotate the shaft 180° and note the reading on the gauge. 5. Divide the reading by two to obtain the crankshaft bow.
Ovality 	**Measured on the crankshaft main journals and crankpins** 1. Measure across the centre of the journal or crankpin in two planes one at right angles to the other. 2. Subtract the smaller reading from the larger reading to give the ovality.
Parallelism (Taper) 	**Measured on the crankshaft main journals and crankpins** 1. Measure the diameter at both ends of the journal or crankpin, ensure that the measurements are taken on the same plane. 2. Subtract the smaller reading from the larger reading to give the taper.

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Fig. E8 Method of measuring the crankshaft

3. Using a micrometer check the crankshaft journals and crankpins for size, ovality, parrallelism and bow (see Fig. E8). Refer to Section E3, Dimensional data, for the service dimensions. If necessary, regrind the crankshaft.
4. Inspect the taper on the front of the crankshaft for wear and damage.

If the taper shows obvious signs of wear or damage, a replacement crankshaft should be fitted.
5. Inspect the Woodruff keys and keyways for wear. Oversize keys are available. However, if wear is apparent with the largest size Woodruff keys installed, a replacement crankshaft should be fitted.

Crankshaft - To regrind

1. The crankshaft should be reground when wear or ovality exceeds 0,025 mm. (0.001 in.), when the crankpins and journals are heavily scored or when the bow in the crankshaft exceeds 0,25 mm.(0.010 in.).
2. Replacement bearings are available in the following sizes, standard, minus 0,25 mm. (0.010 in.) and minus 0,50 mm. (0.020 in.).
3. The crankpins and journals should be ground and lapped to suit the nearest undersize bearing. (See Section E3 - Dimensional data).
4. When grinding, use a stone having a grit and grade equivalent to a NORTON A 46 NV or one grade softer. **A harder stone must not be used.**
5. For 'plunge' grinding, the width of the stone must be 0,51 mm. (0.020 in.) **less** than the dimension between the journal or crankpin end faces and the machine must be fitted with hydraulic stops. For traverse grinding a suitable width of stone should be selected (see Fig. E9).
6. Care must be taken to ensure that no sharp edges are left in the radii where the grinding wheel traverse ends and the radii of the grinding wheel must be carefully controlled to ensure that the grinding fades out not more that half-way up the radius on the crankshaft.

On no account must the grinding wheel touch the side faces of the crankpin or journal.

7. Lubrication must be continuous during re-grinding and the lubricant should be fed liberally

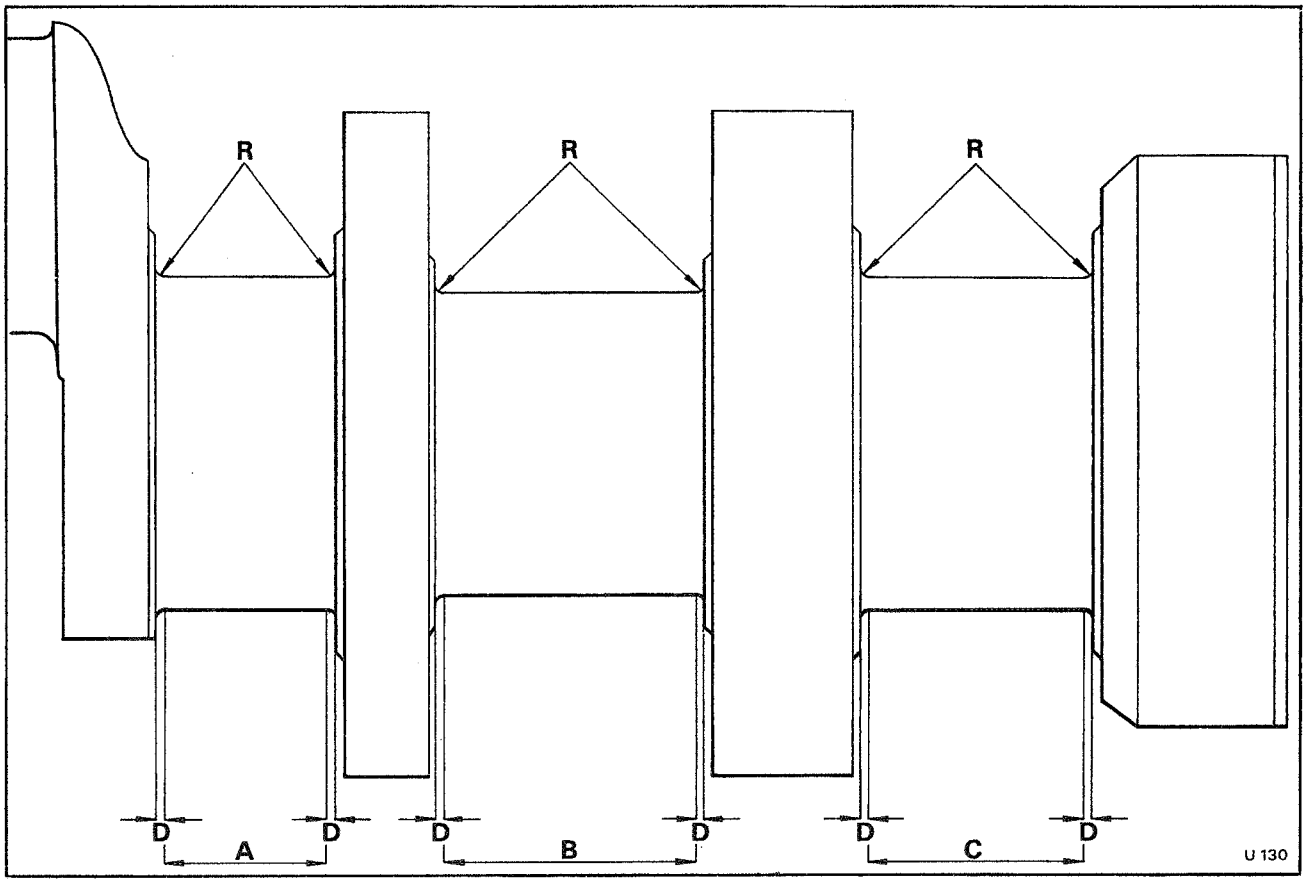

Fig. E9 Crankpin and journal grinding dimensions

A 32,97 mm. (1.298 in.) Grinding wheel travel - journals 2, 3 and 4
B 50,29 mm. (1.980 in.) Grinding wheel travel - crankpins
C 42,67 mm. (1.680 in.) Grinding wheel travel - journal 5.
D 0,254 mm. (0.010 in.) Minimum distance - side face to grinding wheel.
R 2,362 mm. to 2,108 mm. (0.093 in. to 0.083 in.) Radius.

onto the ingoing side of the grinding wheel. The grinding wheel must not be allowed to contact the journal or crankpin until the shaft is thoroughly wet. Any approved lubricant can be used.

8. Grind the crankpins and journals until they are 0,025 mm. (0.001 in.) larger than the required finished size. This will allow for lapping and polishing.

9. Crankshafts must be re-hardened by the nitriding process after each re-grind.

10. After hardening, test the hardness of the journals and crankpins. The minimum acceptance figure for the hardened crankshaft is 570 VPN/30 kg. using a Vickers Diamond Pyramid Machine.

11. After grinding and if the necessary equipment is available, the shaft should be magnetically crack tested. It should then be lapped and polished to the finished size.

Crankshaft - To lap

1. The crankshaft journals and crankpins should be lapped to produce a perfectly smooth finish after grinding and hardening.

2. Cast iron laps should be used and the machine set to run at between 220 r.p.m. and 250 r.p.m.

3. The lapping compound should consist of a mixture of grade M 303½ grit and vegetable oil in proportion of 1,134 kg. (2.5 lb.) of grit to 4,546

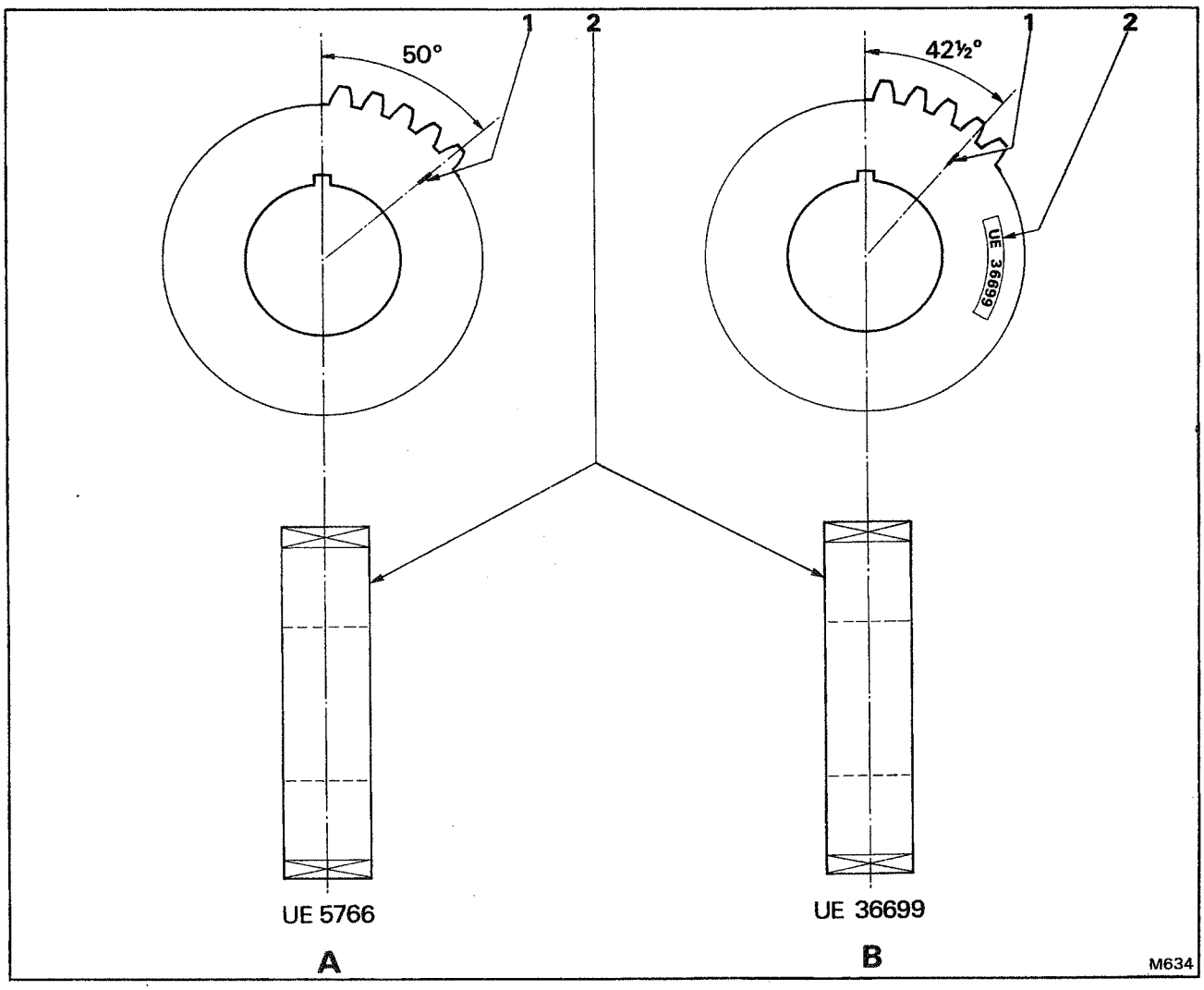

Fig. E10 Identification of timing gears

1 Timing mark
2 Position of part number
A Silver Shadow, T series, Corniche (U.S.A. and Canada) Camargue (U.S.A. and Canada) — Early engines
B Corniche (other than U.S.A. and Canada) Camargue (other than U.S.A. and Canada) — Early engines
B All late engines — Late engines

litres (1 gallon) of the oil. The compound must be mixed to a smooth consistency and injected into the laps at frequent intervals.

4. The crankpins and journals must be lapped paralled to within 0,010 mm. (0.0004 in.). Whilst lapping, the size of the crankpins and journals should be checked frequently; allowances must be made for the slight contraction which will take place as the shaft cools.

5. After lapping, wash the shaft thoroughly in a high pressure paraffin wash; blow off any surplus paraffin with compressed air and dry the shaft with a soft lint free cloth.

6. When the shaft is dry, polish the crankpins and journals with Corolite 320 grade abrasive tape 2,5 cm. (1 in.) wide liberally lubricated with vegetable oil.

7. After polishing, again wash the shaft and repeat the cleaning procedure.

Crankshaft - To assemble

1. Ensure that the threads of the balance weight bolts and the tapped holes in the crankshaft are clean.

2. Fit each balance weight to the crankshaft using two setscrews.

Important. It is essential that the balance weights are fitted to their original position, otherwise, the balance of the shaft will be impaired.

The word 'front' stamped onto each balance weight must face towards the front of the engine.

3. Ensure that each balance weight seats correctly and that the retaining setscrews are tightened to the torque figures quoted in Chapter P.

4. Fit new rubber sealing rings to the sludge trap plugs, then smear engine oil onto the rings.

5. Push each plug firmly home and fit the circlip into its groove; pull the plug outwards to meet the circlip face.

6. Fit the Woodruff key to the crankshaft then fit the timing gear.

Two types of crankshaft timing gear will be encountered in service and it is most important that the correct gear is fitted (see Fig. E10).

Ensure that the timing gear locates correctly onto the Woodruff key.

7. Fit the spacer.

8. Fit the second Woodruff key to the crankshaft, then fit the oil pump drive gear. Ensure that the gear is fitted with the front face towards the front of the crankshaft.

If a new gear is fitted, the mating gear on the oil pump should also be replaced.

Ensure that the oil pump drive gear locates correctly on the Woodruff key.

9. Fit the oil flingers (early engines).

10. Fit the washer and serrated nut.

Important. Always fit a new serrated nut. The nut has a left-hand thread.

11. Using special box spanner (RH 7110) torque tighten the serrated nut to the figures quoted in Chapter P.

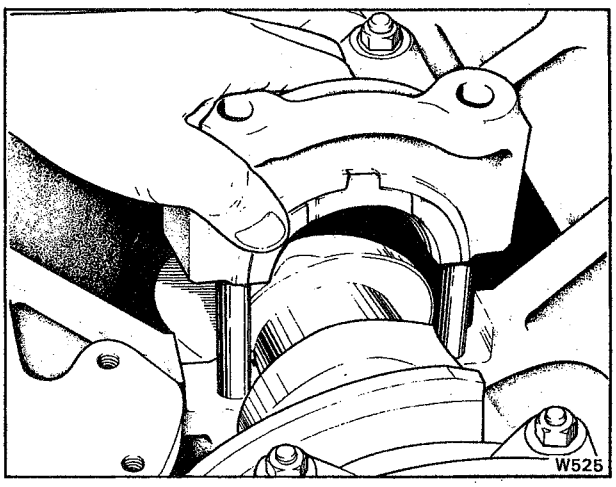

Fig. E11 Fitting the centre main bearing cap

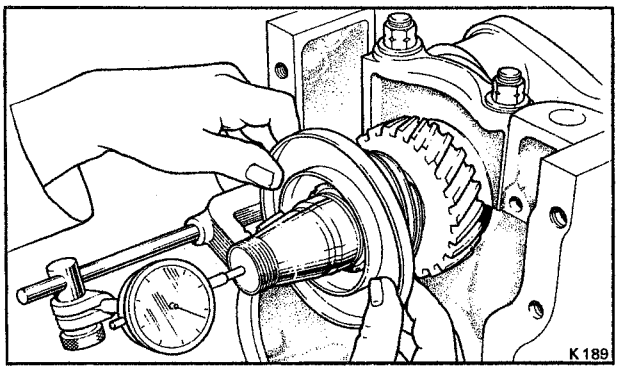

Fig. E12 Checking the crankshaft end-float

The crankshaft should be held firm whilst tightening the serrated nut. **This can be accomplished by fitting two long setscrews in the rear end of the crankshaft and inserting a bar between them. The force needed to tighten the serrated nut can be offset by levering on the bar.**

Crankshaft - To fit

1. Ensure that the bearing shells are the correct size for the journals and crankpins.

2. Ensure that all parts are clean. A lint-free cloth should be used for wiping all parts.

3. Position the upper bearing shells in the crankcase and lightly smear them with clean engine oil.

4. Place the crankshaft in position noting that the marks on the crankshaft and camshaft timing gears align (see Section E7). Fit the upper halves of the thrust washer to the centre main bearing.

5. Fit the main bearing caps and shells together with the two lower thrust washers for the centre main bearing (see Fig. E11). When fitting the bearing caps it may be necessary to tap them lightly into position. If this is done ensure that the bearing shells are not dislodged. The cap nuts should be torque tightened to the figure quoted in Chapter P.

6. Check that the crankshaft rotates freely.

7. Check the crankshaft end - float (see Fig. E12 and Section E3, Dimensional data).
8. Fit the bearing shells to the connecting rods and caps, then lightly smear the shells with clean oil.
9. Locate the lowest crankpin (the engine will be inverted therefore, this will be the crankpin that is uppermost).
10. Pull the two connecting rods upwards and position the big-ends around the crankpin.
11. Remove the protective rubber sleeve from each bolt.
12. Assemble the connecting rod big-ends (see Section E6).
13. Fit the oil pump and oil filter delivery pipe, using new rubber 'O' rings.
14. Fit the oil strainer pick-up and pedestal (see Fig. E13).
15. Assemble the front of the engine, fitting the lower front cover, coolant pump assembly, coolant pump pulley, alternator and refrigeration compressor.

Fit a new Neoprene seal between the lower front cover and the coolant pump.

16. Fit a new rubber 'O' ring to the crankshaft.
17. Fit the driving flange.
18. Fit the damper and crankshaft pulley.
19. Fit the serrated nut and torque tighten to the figure given in Chapter P, using the special spanner (RH 7131).
20. Check that the lock-plate aligns with the five setscrew holes. If necessary, further tighten the serrated nut to align the setscrew holes.

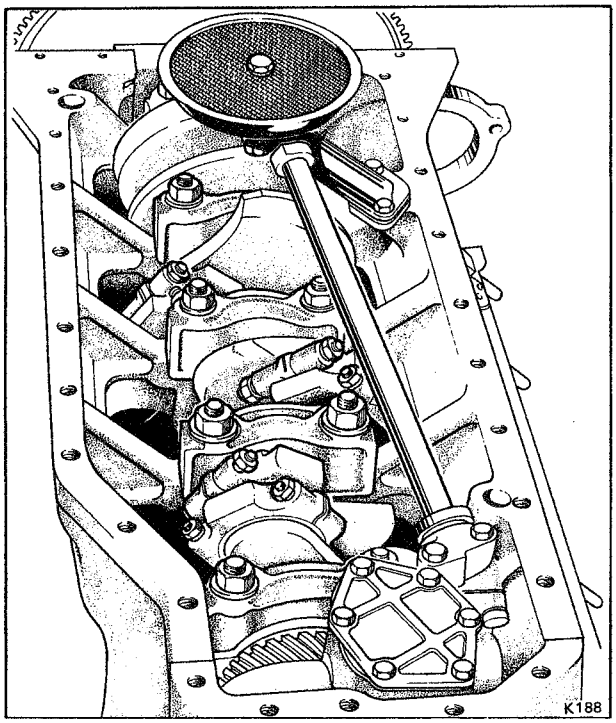

Fig. E13 View with the sump removed

21. Fit the setscrews and torque tighten them to the figures given in Chapter P.
22. Fit the driving belts, ensuring that they are correctly tightened (see Chapter L).
23. Fit the engine backplate and flywheel assembly.
24. Visually inspect the big-end and main bearings (see Fig. E13) and fit the engine sump, using a new gasket.
25. Fit the dipstick.
26. Fit the engine into the engine compartment (see Section E12).

Crankshaft damper - To remove

1. Carry out the usual Workshop safety precautions.
2. Slacken the driving belts.
3. Remove the five setscrews and the locking plate from the crankshaft pulley.
4. Withdraw the pulley and the damper.

Crankshaft damper - To fit

To fit the damper, reverse the procedure given for its removal, noting the following.

1. The damper and crankshaft pulley can only be fitted one way due to the positioning of the locating dowels.
2. Fit the setscrews and torque tighten them to the figures given in Chapter P.
3. Fit the driving belts and tension them as described in Chapter L.

Crankshaft backplate seal - To remove and fit

Late engines have a lip type seal fitted into the engine backplate (see Fig. E6, illustration B).

To renew the seal proceed as follows.

1. Remove the transmission (see Chapter T).
2. Remove the setscrews securing the flywheel and withdraw the assembly from the rear of the crankshaft.
3. Locate the engine backplate and unscrew the retaining setscrews. Collect the washers and withdraw the backplate. The backplate is dowelled to the crankcase.
4. Discard the crankcase gasket.
5. Using a hammer and drift carefully tap the seal out of the rear of the housing.
6. Fit the new seal by reversing the removal procedure noting that the special seal insertion tool (RH 9646) should be used to position the seal in the backplate. Figure E6, item 1 shows the initial position of the seal and item 2 shows the seal fitted in an alternative position.
7. Fit a new gasket to the crankcase.
8. Liberally oil the crankshaft and seal.
9. Ensure that the seal protection sleeve (RH 9655) is clean and liberally oiled. Fit the sleeve onto the crankshaft.
10. Fit the backplate assembly over the sleeve and secure in position with the setscrews and washers.
11. Carefully withdraw the seal protection sleeve.