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## Crankshaft assembly

14

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## General description

The crankshaft is a chrome-molybdenum forging which has five main journals for four cylinder engines and seven main journals for six cylinder engines.

End-float is controlled by two half thrust washers on both sides of the centre main bearing.

The main bearings have steel backs with a tin aluminium bearing material except the centre main bearing of six cylinder engines, which has a bearing material of lead bronze with a lead finish. The main bearing caps are made cast iron or spheroidal graphite (SG) iron.

The front and the rear oil seals are "Viton" lip seals with a dust lip to the outside of the main lip and with oil return grooves on the face of the main lip.

The nose of the crankshaft of four cylinder engines is serrated for location of the front pulley. The location of the front pulley of six cylinder engines is by a key in the crankshaft nose.

The crankshaft pulley of four cylinder engines is held in position by a plain thrust block and three setscrews. The crankshaft pulley of six cylinder engines is held in position by a "Ringfeder" arrangement (14A.03/B).

A separate damper is fastened to the rear face of the crankshaft pulley of six cylinder vehicle engines. An integral damper is built into the pulley of the remainder of six cylinder engines and some four cylinder engines.

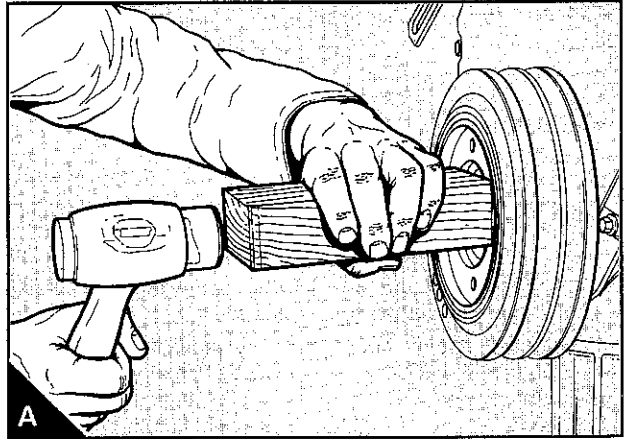
A balancer unit is fitted to certain four cylinder engines which have rigid mountings or which are part of the chassis or frame. The purpose of the balancer unit is to reduce the effect of the out-of-balance forces to a satisfactory condition.

## Crankshaft pulley

To remove and to fit -  
engine types AA, AB, AC and AD

14A-01A

- 1 Remove the drive belt(s), operation 23A-04.
- 2 Release the three setscrews which hold the pulley and remove the setscrews, the thrust block and the pulley.
- 3 Clean the components and check for damage. Renew damaged components.
- 4 Put the pulley in position on the crankshaft. Lubricate lightly the threads of the setscrews with engine lubricating oil. Fit the hub and the setscrews and tighten the setscrews gradually and evenly to 115 Nm 85 (lbf ft) 11,8 kgf m.
- 5 Check each setscrew again to ensure that they are still to the correct torque.
- 6 Fit the drive belt(s), operation 23A-04.



To remove and to fit -  
engine types YA, YB, YC and YD

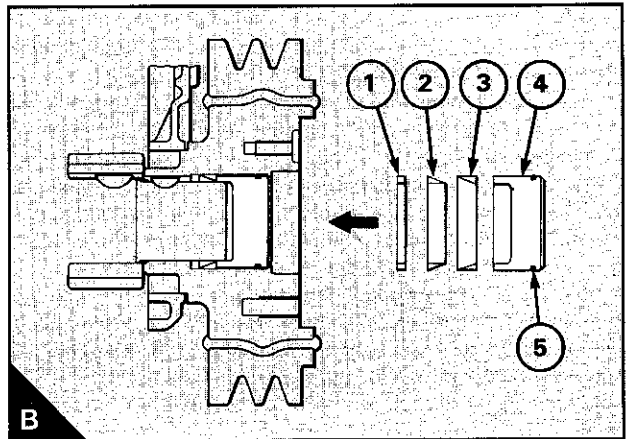
14A-01B

### To remove

- 1 Remove the drive belts, operation 23A-04.
- 2 Remove the three setscrews and the thrust block (B4). If the pulley is not free, Do not use an extractor to remove the pulley. Hold a wooden block against the inner hub of the pulley and with a hammer, lightly hit the wooden block towards the rear (A) to loosen the tapered rings.
- 3 If necessary, release the cap screws which fasten the separate damper to the pulley and remove the damper.

### To fit

- 1 If necessary, put the separate damper in position with its inner flange against the rear face of the pulley. Fit the clamp ring or washers and the cap screws and tighten the cap screws gradually and evenly to 35Nm (26 lbf ft) 3,6 kgf m.
  - 2 Clean thoroughly the nose of the crankshaft, the bore of the pulley and the "Ringfeder" components. Do not use a degreasing solution. Do not open out the tapered rings.
  - 3 Put the pulley on the crankshaft with the key engaged and push the pulley towards the rear.
  - 4 Fit the spacer (B1), then the inner ring (B2) and then the outer ring (B3). Ensure that the ring gaps are not aligned.
- Attention:** Extreme difficulty in pulley removal can occur if the tapered rings are not fitted correctly.
- 5 Lubricate lightly the "O" ring (B5) and the threads and the thrust faces of the setscrews with clean engine oil. Put the thrust block (B4) and setscrews in position.
  - 6 While the pulley is pressed to the rear, tighten the setscrews gradually and evenly to 115 Nm (85 lbf ft) 11,8 kgf m.
  - 7 Fit the drive belt(s), operation 23A-04.



## Rear oil seal assembly

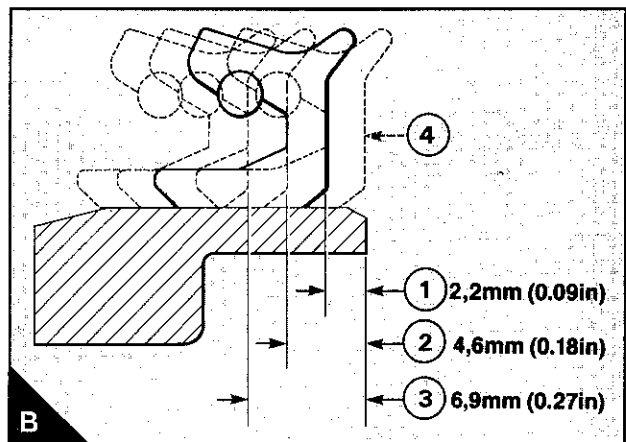
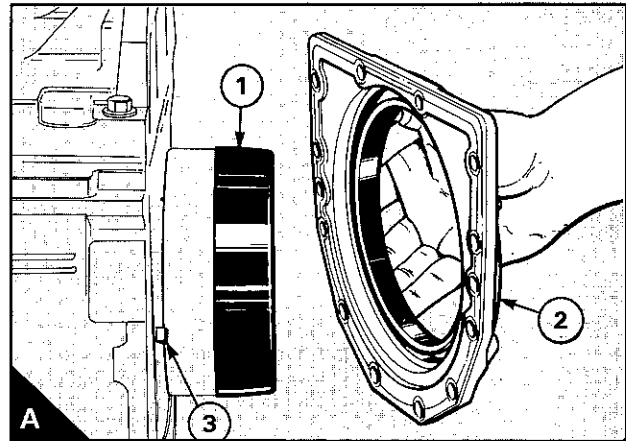
To remove and to fit

14A-02

Special tools:

Replacer tool for rear oil seal, PD.145D

- 1 Remove the drive components from the rear end of the engine.
- 2 Remove the flywheel and the flywheel housing, see section 22.
- 3 Remove the setscrews and the cap screws from the housing and remove the housing and seal assembly.
- 4 Inspect the seal for wear or for damage to the main lip and renew the seal, if necessary. If there is only a small scratch across the lip, renew the seal.
- 5 Clean the faces of the cylinder block, the oil seal housing and the crankshaft flange.
- 6 Check that the seal and the outer circumference of the crankshaft flange are not damaged. Where a new seal has been fitted, check that it is in the correct position in the housing.
- 7 Ensure that the two dowels are fitted in the cylinder block. Put a new joint in position on the dowels, no jointing compound is necessary.
- 8 Put the seal guide on the crankshaft flange. Lubricate the crankshaft flange, the main lip of the seal and the seal guide with clean engine lubricating oil. The lubrication of the seal is necessary to prevent damage to the seal when the engine is first started.
- 9 Put the seal and housing (A2) on the seal guide (A1) and carefully push the assembly into position on the crankshaft flange and onto the dowels (A3). Remove the seal guide, fit the setscrews and the cap screws. Tighten the setscrews to 22 Nm (16 lbf ft) 2,2 kgf m and tighten the cap screws to 18 Nm (13 lbf ft) 1,9 kgf m.



To renew the rear oil seal

14A-03

Special tools:

Replacer tool for rear oil seal, PD.145D

There are four positions in which the seal can be fitted in the housing (B).

Position "1" is used in the factory or if a new seal is fitted on a new or reground crankshaft in service.

Position "2" is used when a new seal is fitted in service and the crankshaft flange is worn in position "1".

Position "3" is used when a new seal is fitted in service and the crankshaft flange is worn in positions "1" and "2".

Position "4" can also be used with a new seal in service, if a wet clutch is not used.

If all positions have been used it is permissible to grind the crankshaft flange, see section 11C.

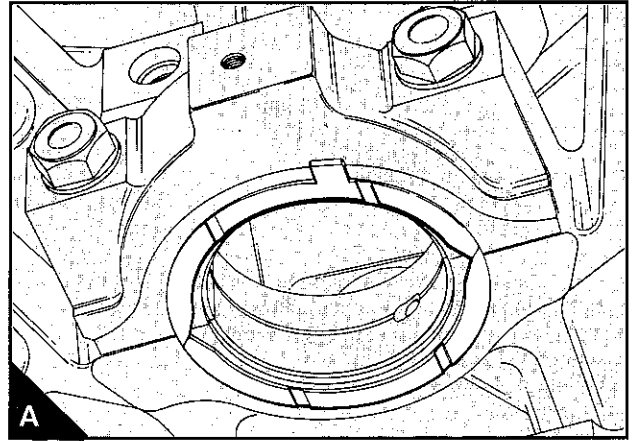
- 1 Remove the seal and housing assembly, operation 14A-02.
- 2 Put the engine side of the housing on a suitable support and press out the seal with a suitable adaptor.
- 3 Lubricate the outer circumference of the seal and the bore of the seal housing with clean engine lubricating oil.
- 4 Put the engine side of the housing on a suitable support and put the seal into position on the flywheel end of the bore with the spring of the seal towards the housing.
- 5 Press the seal into the housing to the correct position with the relevant side of the tool.

## Thrust washers

To check crankshaft end-float

14A-04

The axial movement of the crankshaft is controlled by two half thrust washers fitted both sides of the centre main bearing (A). The end-float can be checked with a feeler gauge between a thrust washer and the crankshaft (B), or with a dial test indicator on one end of the crankshaft to check the movement (C). If the end-float is more than the tolerance given in section 11C, thrust washers which are 0,019 mm (0.0075 in) oversize can be fitted to one or to both sides of the main bearing, instead of the standard size washer, to reduce the end-float to the factory tolerances.

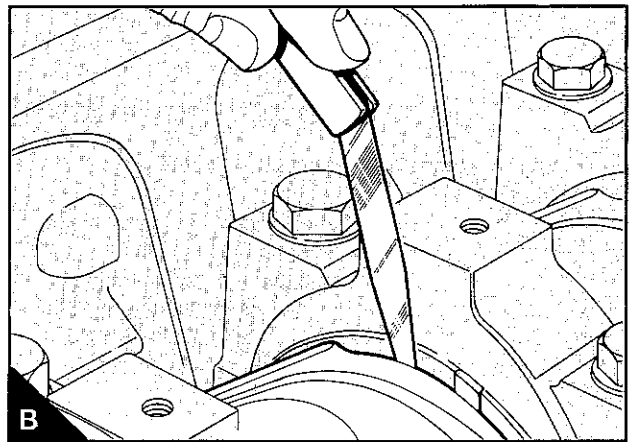


To remove and to fit

14A-05

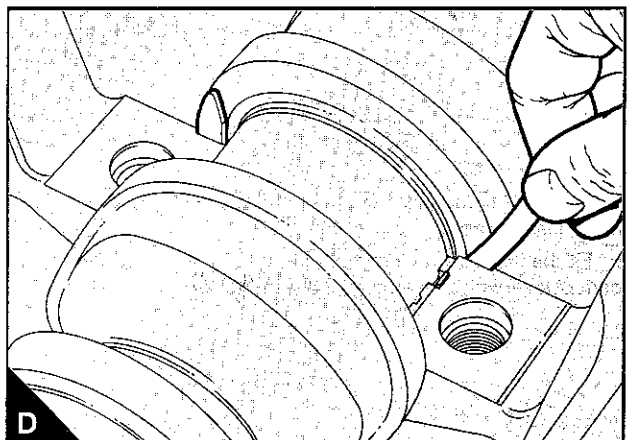
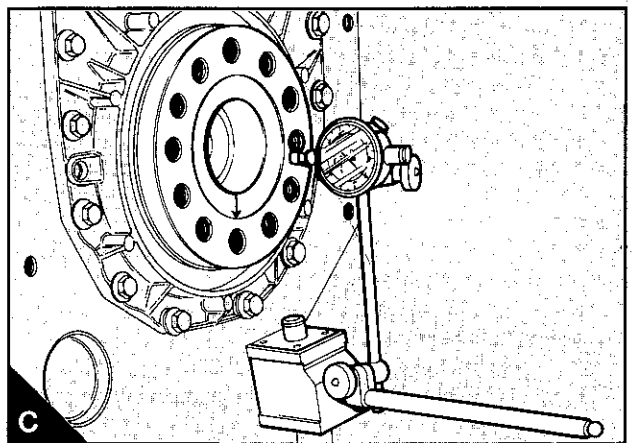
### To remove

- 1 Drain the lubricating oil and remove the lubricating oil sump, operation 19A-03.
- 2 Where necessary, remove the balancer unit, operation 14A-10.
- 3 Where necessary, remove the lubricating oil strainer and suction pipe; operation 19A-04.
- 4 Release the setscrews of the centre main bearing and remove the main bearing cap complete with the lower half thrust washers.
- 5 Press down one end of each upper half thrust washer, with a suitable tool made of a soft material, to slide the washer from its recess (D). Where necessary, move the crankshaft to the front or to the rear to loosen a tight washer.



### To fit

- 1 Lubricate the thrust washers with clean engine lubricating oil.
- 2 Slide the upper half thrust washers into their recesses in the cylinder block. Ensure that the sides of the thrust washers which have the grooves are against the crankshaft.
- 3 Fit the lower half thrust washers to the main bearing cap with the location tags in their recesses.
- 4 Ensure that the location thimbles are fitted correctly in the main bearing cap or in the cylinder block.
- 5 Ensure that the bearing is fitted correctly in the cap and that the the bearing and the crankshaft journal are clean. Lubricate the bearing with clean engine lubricating oil.
- 6 Fit the cap with the location tags of both half bearings to the same side (14A.06/A1). Tighten the main bearing setscrews gradually and evenly to 265 Nm (196 lbf ft) 27,0 kgf m.
- 7 Check the crankshaft end-float, operation 14A-04.
- 8 If necessary, fit the balancer unit, operation 14A-10.
- 9 If necessary, fit the lubricating oil strainer and the suction pipe, operation 19A-04.
- 10 Fit the lubricating oil sump, operation 19A-03, and fill it to the correct level with an approved lubricating oil.



## Main bearing

To remove and to fit  
(with the crankshaft in position)

14A-06

If the rear main bearing is to be removed with the crankshaft in position, the flywheel, the flywheel housing, the rear oil seal housing and the bridge piece will have to be removed.

Except for engines with a balancer unit fitted, the front main bearing can only be removed if a suitable spanner is available that will enable the torque to be applied correctly to the setscrews of the main bearing cap. If a suitable spanner is available, the front main bearing cap can be removed together with the oil pump. For six cylinder engines, it will be necessary to remove the suction pipe and strainer and the delivery pipe. For four cylinder engines, either the balancer unit or the suction pipe and strainer and the delivery pipe and the relief valve will have to be removed.

### To remove

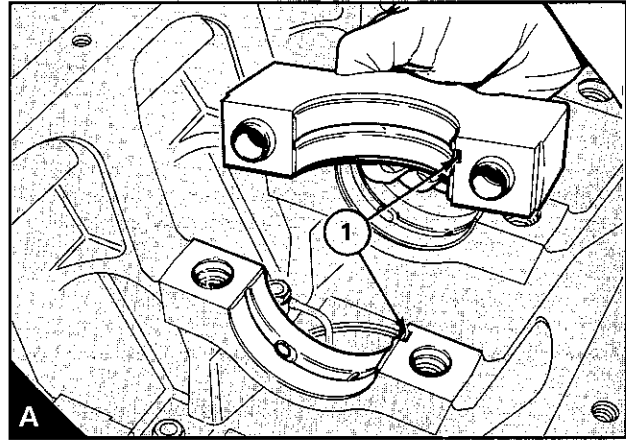
- 1 Drain the lubricating oil and remove the sump, operation 19A-03.
- 2 Remove all necessary components to get access to the specific bearing cap.
- 3 Release the setscrews of the bearing cap and remove the bearing cap. Remove the lower half bearing from the cap.
- 4 With a suitable tool, push the upper half bearing from the side opposite to the location tag to remove the bearing tag from its recess in the bearing housing. Carefully rotate the crankshaft to release the bearing from its housing. Keep the bearing halves in their relevant positions.

### To fit

- 1 Clean the upper half bearing and lubricate the bearing surface with clean engine lubricating oil.

**Attention:** Only the upper half bearing has lubrication holes and must be fitted to the cylinder block side.

- 2 Fit the plain end of the upper half bearing between the crankshaft journal and the side of the bearing housing which has the recess for the location tag. Slide the bearing into its housing until the tag on the bearing is fitted correctly in its recess in the housing.
- 3 Clean the lower half bearing and cap, lubricate the bearing surface with clean engine lubricating oil.
- 4 Fit the bearing into the cap with the tag of the bearing fitted correctly in the recess in the cap.
- 5 Ensure that the location thimbles are fitted correctly to the cap or to the cylinder block. Fit the bearing cap with the location tags of both bearings on the same side (A1).
- 6 Inspect the setscrews for damage and for distortion and renew them if necessary. Lightly lubricate the setscrew threads with clean engine lubricating oil. Fit the setscrews and the washers and tighten the setscrews gradually and evenly to 265 Nm (196 lbf ft) 27,0 kgf m.
- 7 Ensure that the crankshaft turns freely. If the thrust washers have been removed and fitted, check the crankshaft end-float, operation 14A-03.
- 8 Fit all the components which were removed for access to the main bearing cap.
- 9 Fit the lubricating oil sump, operation 19A-03 and fill it to the correct level with an approved lubricating oil.



To inspect

14A-07

Inspect the bearings for wear and for other damage. If a bearing is worn or damaged, renew both half bearings and check the condition of the other bearings.

## Crankshaft

To remove and to fit

14A-08

### To remove

- 1 Before the engine is removed from the vehicle or from the machine, drain the lubricating oil and the coolant.
- 2 Remove the lubricating oil sump, operation 19A-03.
- 3 Remove the fan, the drive belts, the fan drive pulley and housing and the coolant pump, see section 21.
- 4 Remove the crankshaft pulley, operation 14A-01.
- 5 Remove the alternator and its mounting bracket, see section 23.
- 6 Remove the compressor and its drive assembly or remove the exhauster, see section 24.
- 7 Remove the timing case cover, operation 15A-01.
- 8 Remove the fuel injection pump, see section 20.
- 9 Remove the timing gears and the timing case, see section 15.
- 10 Remove the flywheel and the flywheel housing, see section 22.
- 11 Remove the rear oil seal housing, operation 14A-02.
- 12 If a balancer unit is fitted, remove it, operation 14A-10. If a balancer unit is not fitted, remove the lubricating oil suction pipe and strainer, the lubricating oil pump, the delivery pipe and the relief valve (four cylinder engines) and the lubricating oil crossover pipe, if fitted, see section 19.
- 13 Remove the bridge piece and the rubber seals. Later engines may not have rubber seals fitted.
- 14 Remove the caps of the connecting rods. Keep the bearings and caps together. Remove the bolts of the connecting rods and carefully push the pistons into their bores.
- 15 Ensure that the tops of the main bearing caps are stamped with their relevant position number. Remove the main bearing caps, the lower half bearings and the upper and lower thrust washers. Keep the bearings with their relevant caps.
- 16 Lift out the crankshaft. Remove the upper half bearings and keep each bearing with its relevant lower half and cap.

### To fit

- 1 Ensure that all lubricating oil passages are clean and free from restriction.
- 2 Clean the main bearing housings and the upper half bearings. Fit the bearings with the location tags fitted correctly in their recesses. Lubricate the bearings with clean engine lubricating oil.
- 3 Ensure that the main journals of the crankshaft are clean. Put the crankshaft in position on the upper half bearings.
- 4 Clean and lubricate the upper half thrust washers and slide them into their recesses on both sides of the bearing housing. Ensure that the slotted sides of the thrust washers are towards the crankshaft.
- 5 Clean the bearing caps and the lower half bearings. Fit the bearings to the caps with the location tags fitted correctly in their recesses. Lubricate the bearings with clean engine lubricating oil.
- 6 Clean the lower half thrust washers and lubricate them with clean engine lubricating oil. Fit the thrust washers on both sides of the bearing cap for the centre main bearing.
- 7 Check that the location thimbles for the main bearing caps are fitted correctly in the caps or in the cylinder block. Fit the bearing caps in their correct positions (as shown by the position number stamped on the top of the cap) with the location tags of the bearings on the same side. In this position the serial numbers stamped on the bearing caps will be in line. The serial number stamped on the bearing caps must be the same as the number stamped on the bottom face of the cylinder block. The third and fifth bearing caps of six cylinder engines are not stamped with a serial number.

**8** Fit the setscrews and washers to the main bearing caps and tighten them gradually and evenly to 265 Nm (196 lbf ft) 27,0 kgf m.

**9** Clean the bridge piece and the location areas for the bridge piece in the cylinder block. Apply a narrow strip of POWERPART Hylosil sealant in the corners and around the thread holes of the bridge piece seat in the cylinder block. Fit the bridge piece and the two rubber seals (A). The rubber seals will be a little higher than the bridge piece when they are fitted correctly. Later engines may not have been fitted with rubber seals and the grooves in the bridge piece should be filled with POWERPART Hylosil sealant. Use a straight edge to ensure that the bridge piece is in line with the rear face of the cylinder block (B). Tighten the bridge piece capscrews.

**10** Fit the connecting rod caps, operation 13A-01. Turn the crankshaft two complete revolutions to ensure free movement.

**11** If necessary, fit the balancer unit, operation 14A-10. If a balancer unit is not used, fit the lubricating oil pump, the lubricating oil suction pipe and strainer, the delivery pipe and the relief valve (four cylinder engines) and if necessary, the lubricating oil crossover pipe, see section 19.

**12** Fit the rear oil seal housing, operation 14A-02.

**13** Fit the flywheel housing and the flywheel, see section 22.

**14** Fit the timing case and the timing gears, see section 15.

**15** Fit the fuel injection pump, see section 20.

**16** Fit the timing case cover, operation 15A-01.

**17** Fit the compressor and its drive assembly or fit the exhauster, see section 24.

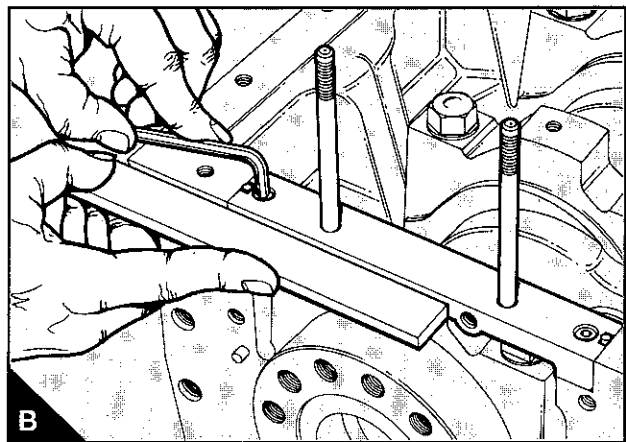
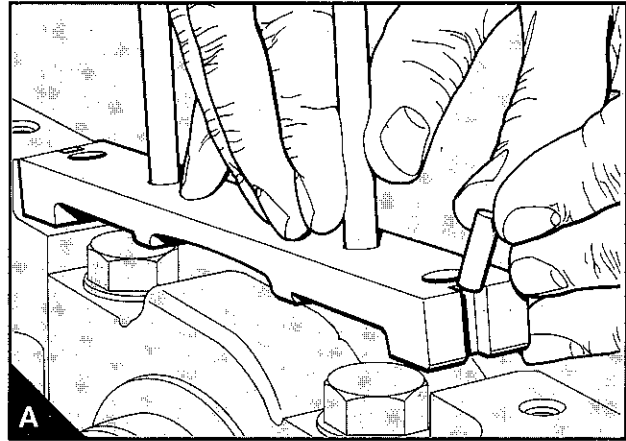
**18** Fit the alternator and its mounting bracket, see section 23.

**19** Fit the crankshaft pulley, operation 14A-01.

**20** Fit the coolant pump, the fan drive pulley and housing, the drive belts and the fan, see section 21.

**21** Fit the lubricating oil sump, operation 19A-03.

**22** After the engine has been installed, fill the lubricating oil sump to the correct level with an approved oil. Fill the cooling system.



## To inspect

### 14A-09

Check the crankshaft for wear and other damage. The maximum permissible wear and ovality on the crankshaft journals and crank pins is 0,04 mm (0.0016 in).

The main journals and the crankpins of standard size crankshafts can be machined to 0,25mm (0.010 in), 0,50mm (0.020 in) or 0,75 mm (0.030 in) undersize on diameter, see section 11C. Special undersize bearings are available.

The seal location area of the rear flange can be machined to remove the wear marks, if the seal has been used in all positions, see section 11C.



## Balancer unit

To remove and to fit

14A-10

### To remove

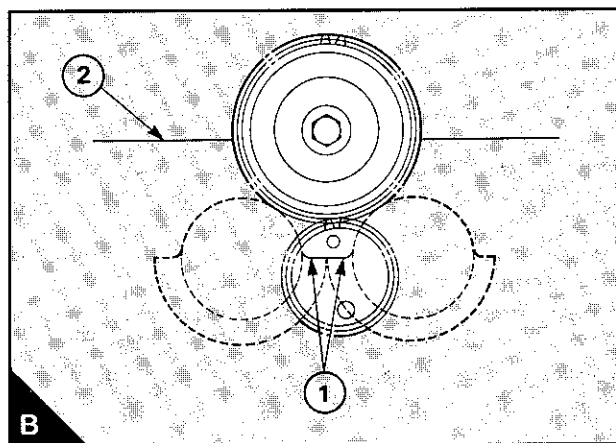
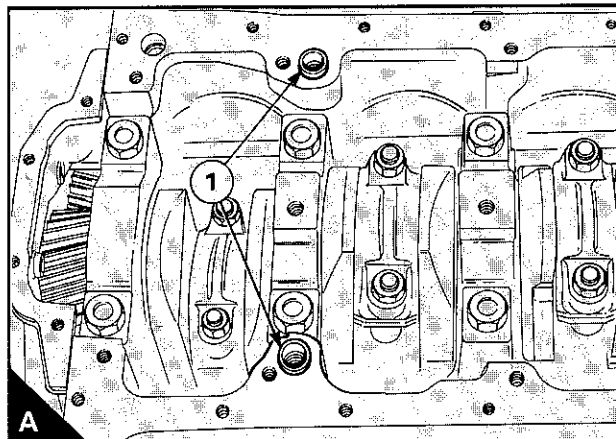
- 1 Drain the lubricating oil from the sump and remove the sump, operation 19A-03.
- 2 Provide a support for the balancer unit.

**Attention:** A support must be provided for the balancer unit because the weight of the unit is approximately 25 kg (55 lb).

- 3 Release the setscrews and lower carefully the balancer unit. Make a note of the positions of the setscrews of different lengths.

### To fit

- 1 Ensure that the contact faces of the cylinder block and of the balancer unit are clean and that the two thimbles (A1) are fitted correctly to the cylinder block.
- 2 Set the piston of number 1 cylinder to TDC, operation 17A-01.
- 3 Ensure that the timing of the balance weights to the drive shaft is correct (14A.11/B).
- 4 Before the balancer unit is fitted, ensure that the flat faces of the balance weights are level with each other (B1) and the weights hang down away from the cylinder block (B2).
- 5 Fit the balancer unit to the cylinder block with the correct screws in the centre positions of the balancer frame. Ensure, when the idler and crankshaft gears are in mesh, that the flat faces of the balance weight are level with each other and that they are towards the cylinder block. Check that the balancer unit is fitted correctly on the thimbles and fit the remainder of the setscrews in their correct position. Tighten the setscrews to 54 Nm (40 lbf ft) 5,5 kgf m.
- 6 Turn the crankshaft through two revolutions to ensure that it is free to rotate.
- 7 Fit the lubricating oil sump, operation 19A-03 and fill the sump to the correct level with an approved oil.

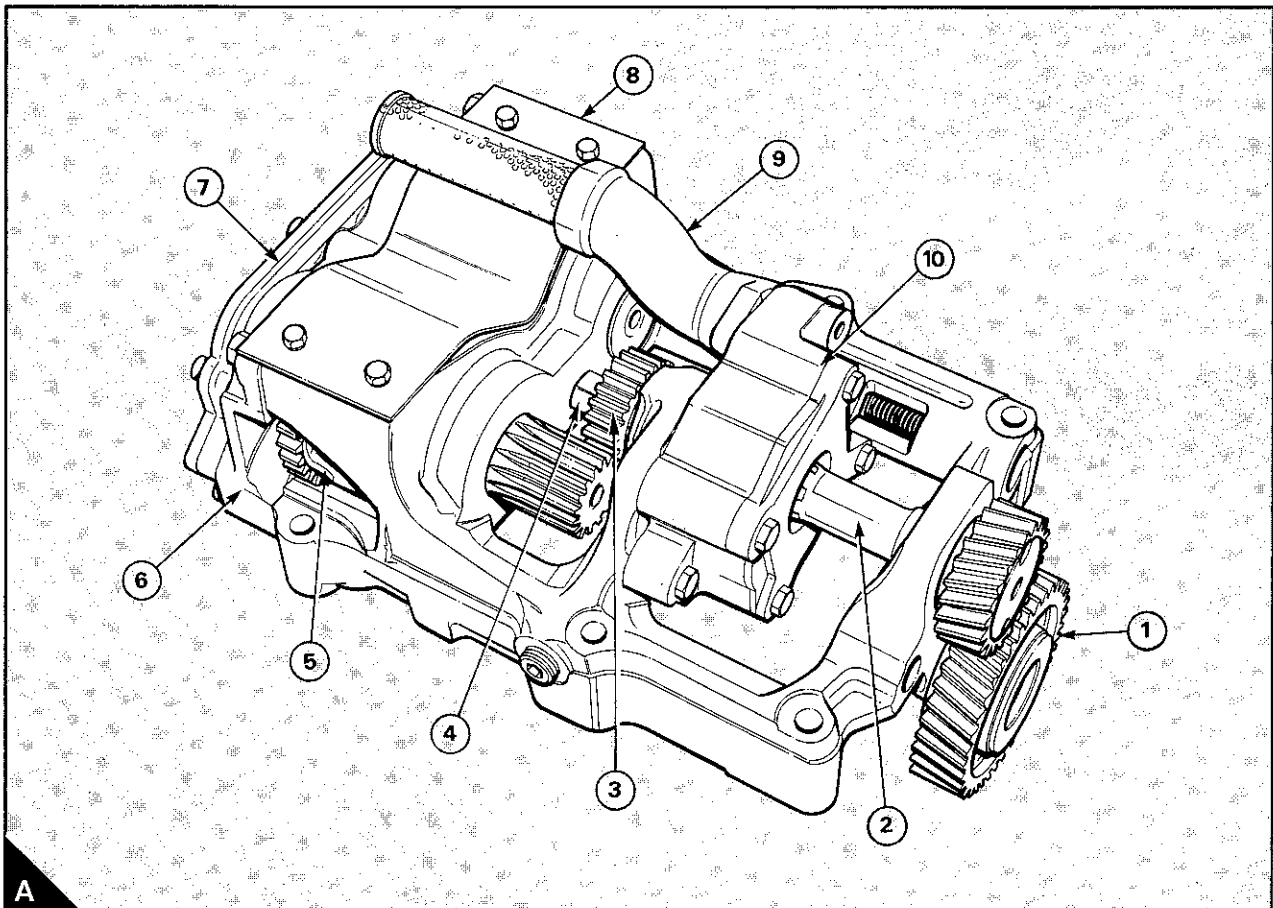


**To dismantle**

- 1 Remove the balance weight cover (A8).
- 2 Release the setscrew and remove the idler gear assembly (A1). Keep the components together as an assembly to protect the needle roller bearing.
- 3 Prevent movement of the drive shaft (A2) and loosen the nut (A4) of the drive gear for the balance weights (A3). Put a suitable flat distance piece in position between the nut and the balancer frame. Turn the nut until it is against the face of the distance piece. Continue to turn the nut with a suitable spanner until the Loctite seal on the splines of the drive shaft is broken and the gear is loose on the shaft. Remove the nut and the drive gear and remove the drive shaft. Ensure that the needle roller bearings are not damaged when the drive shaft is removed.
- 4 Release the setscrews which hold the lubricating oil pump and the suction pipe (A10 and A9) to the balancer frame and remove the lubricating oil pump and the suction pipe.
- 5 Release the setscrews and remove the transfer plate for the lubricating oil (A7) from the rear of the balancer unit. Make a note of the position of the direction arrows on the outside of the transfer plate (14A.12/A or B) to ensure that it can be assembled correctly.
- 6 Release the setscrews and remove the rear cover of the balancer frame (A6). A hammer and a suitable drift will be necessary to remove the rear cover from the dowels.
- 7 Remove the balance weights (A5). Ensure that the gear of the driven weight does not damage the bush in the balancer frame.
- 8 Dismantle the lubricating oil relief valve, operation 19A-09.

9 There are two plugs in the balancer frame, a short tapered plug with a hexagonal socket head and a long plug with a square socket head. These plugs control the flow of oil through the balancer frame. The position of the plugs is decided by which side of the engine the filter is fitted. When the filter is fitted on the left side, the short plug is fitted in the side of the balancer and the long plug is fitted in the bottom (14A.12/A). When the filter is fitted on the right side of the engine, the short plug is fitted in the bottom of the balancer and the long plug is fitted in the side (14A.12/B). Removal of these plugs can cause damage to the threads in the balancer frame and a new balancer frame would then be necessary. When a balancer unit is to be fitted, ensure that the lubricating oil flow through the balancer frame is correct for the position of the lubricating oil filter.

10 Clean the lubricating oil passages with kerosene and dry them with low pressure compressed air.



### To assemble

**1** Ensure that the location thimble (A8) in the rear of the lubricating oil pump is 5,6/6,4 mm (0.220/0.252 in) above the rear face of the pump. Clean the contact faces of the lubricating oil pump and the balancer frame. Fit the lubricating oil pump (A16) to the balancer frame and tighten the setscrews to 22 Nm (16 lbf ft) 2,2 kgf m.

**2** Assemble the lubricating oil relief valve, operation 19A-09.

**3** Lubricate the needle roller bearings (A7 and A10) with clean engine lubricating oil. Fit the drive shaft (A9) and engage the splines for the lubricating oil pump with the pump rotor. Ensure that the needle roller bearing at the front of the balancer frame is not damaged by the splines on the drive shaft.

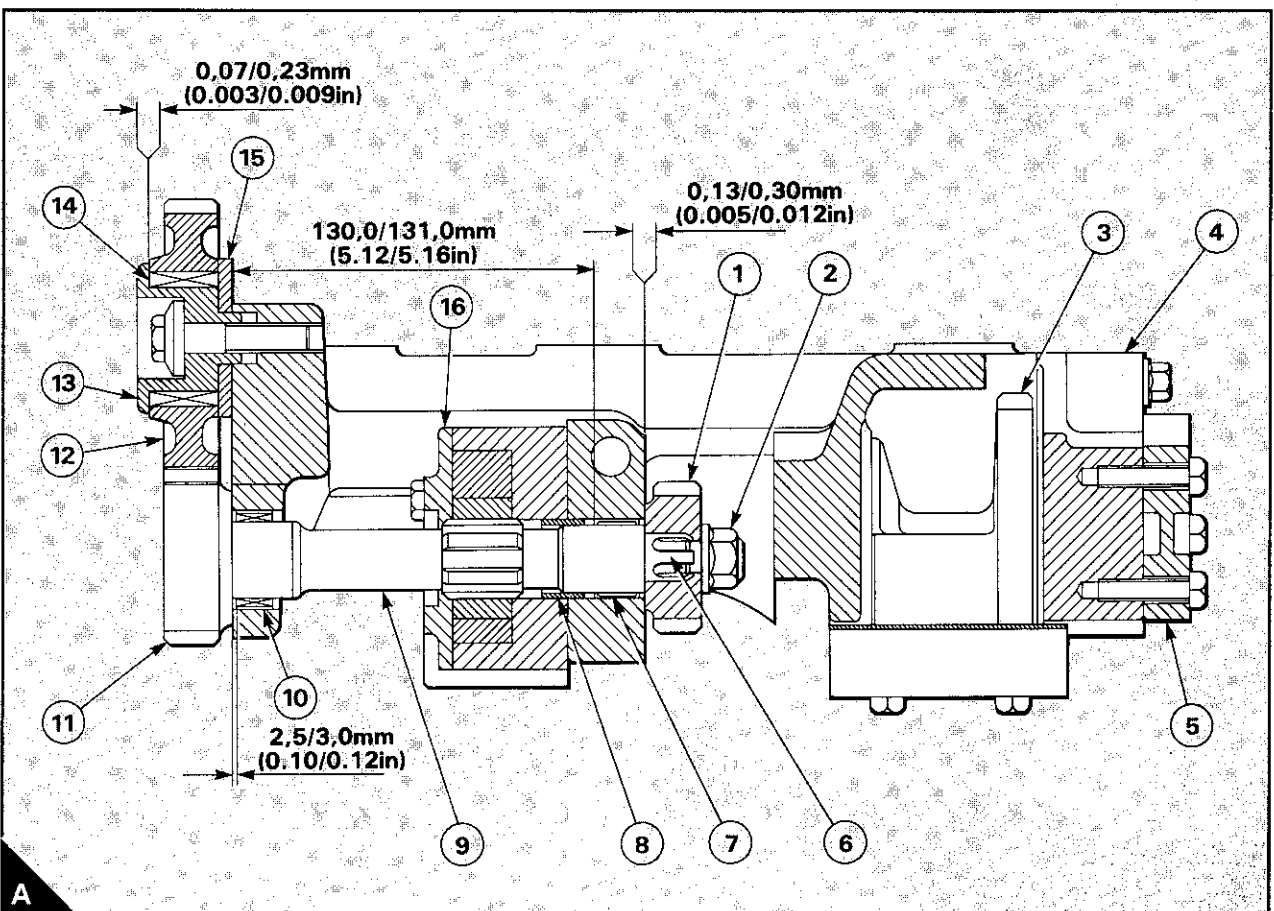
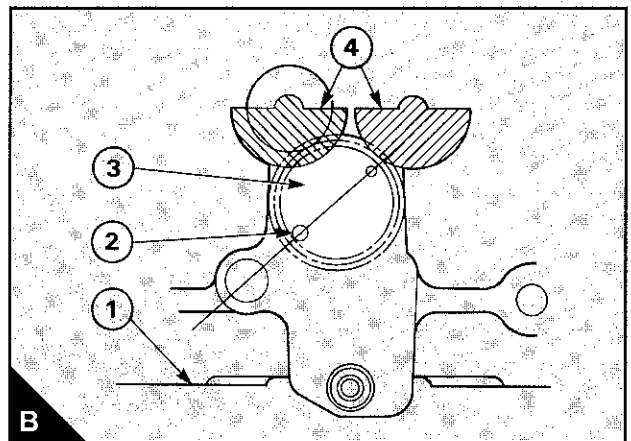
**4** Clean and dry the splines (A6) and the thread on the end of the drive shaft. Apply a small amount of Loctite 'Nutlock' to the splines and to the thread. Fit the drive gear of the balance weights (A1) with the flat face of the gear towards the rear of the balancer unit. Fit and tighten the nut (A2) to 85 Nm (63 lbf ft) 8,7 kgf m. To tighten the nut, a peg spanner must be made to fit into the two holes in the front of the drive shaft and be suitable for use with a torque wrench. Fit the peg spanner to the front of the drive shaft. Hold the nut with a suitable spanner and apply the torque to the peg spanner.

**5** Ensure that the drive shaft turns freely. Check the end-float of the drive shaft with feeler gauges between the front face of the drive gear for the balance weights and the frame (A).

**6** With the balancer frame upside down on the bench (B1), turn the gear of the drive shaft (B3) until the larger of the two outer holes (B2) in the front face of the drive gear is in the position shown in figure B. Ensure that the drive shaft will not move from this position. Lubricate the bushes in the rear of the balancer frame with clean engine lubricating oil and fit the balance weights in the position shown in figure B. Ensure that the flats on the

balance weights are level with each other (B4). With the balance weights in the correct position, check that the drive shaft is still in the correct position.

**7** Fit the two dowels to the rear face of the balancer frame. Lubricate the bushes in the rear cover of the balance frame with clean engine lubricating oil. Put the rear cover (A4) in position with the rear spigots of the balance weights in the bushes of the cover. Hit lightly the rear cover with a soft face hammer to fit the cover onto the dowels. Fit the cover setscrews and tighten them to 54 Nm (40 lbf ft) 5,5 kgf m. Check the end-float of the balance weights with feeler gauges between the rear face of the balance weights and the front face of the rear cover (14A.13/B). The correct end-float is given in section 11C. Check the backlash between the drive gear of the balance weights and the driven gear on the balance weight. The correct backlash is given in section 11C.

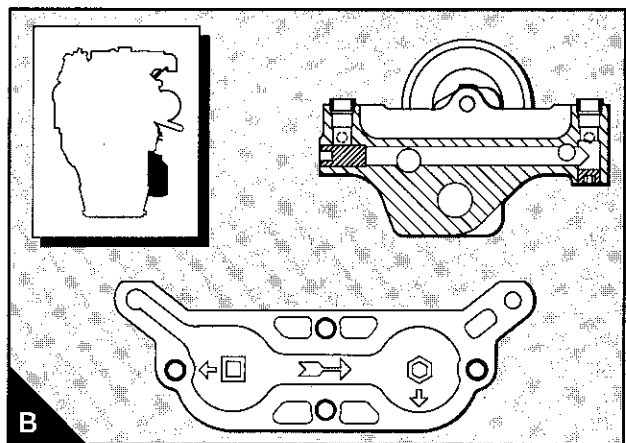
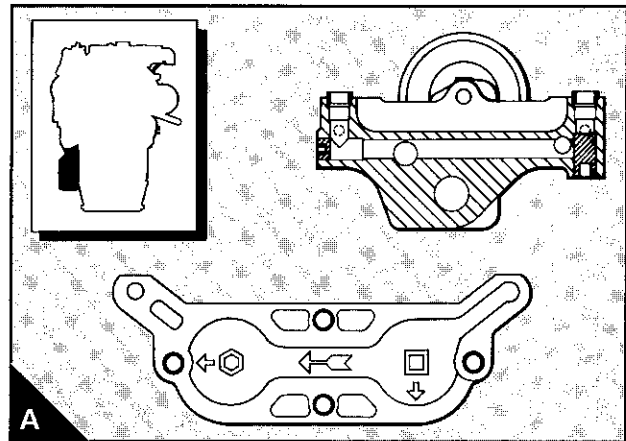


**8** Fit the oil transfer plate and the joint to the rear of the rear cover and tighten the setscrews to 30 Nm (22 lbf ft) 3,1 kgf m. Ensure that the plate is fitted correctly for the oil filter position. The direction arrow (A or B) indicates the direction of lubricating oil flow for left side (A) and right side (B) oil filter positions. The symbols and arrows (A or B) indicate the position of the plugs in the balancer frame and the shape of their socket heads. Ensure that the plug on the bottom face of the frame is just below the face. If a new frame and plugs are used, ensure that the plugs are fitted correctly for the oil filter position and the symbols on the oil transfer plate.

**9** If necessary, press a new bearing (14A.11/A14) into the idler gear (14A.11/A12). Lubricate the bearing with clean engine lubricating oil. Fit the hub (14A.11/A13) into the bearing and fit the thrust washer (14A.11/A15) onto the rear of the hub. Ensure that the threads of the setscrew are clean and dry. Fit the setscrew through the assembly and apply a small amount of 'Loctite Nutlock' to the thread. Fit the assembly to the front of the balancer unit with the idler gear in mesh with the gear of the drive shaft (14A.11/A11). Tighten the setscrew to 95 Nm (70 lbf ft) 9,6 kgf m. Check the end-float of the idler gear with a feeler gauge between the front face of the idler gear and the hub (A). Check the backlash between the idler gear and the drive shaft gear. The correct backlash is given in section 11C.

**10** Fit the balance weight cover and tighten the setscrews.

**11** Fit the suction tube and the joint and tighten the setscrews.



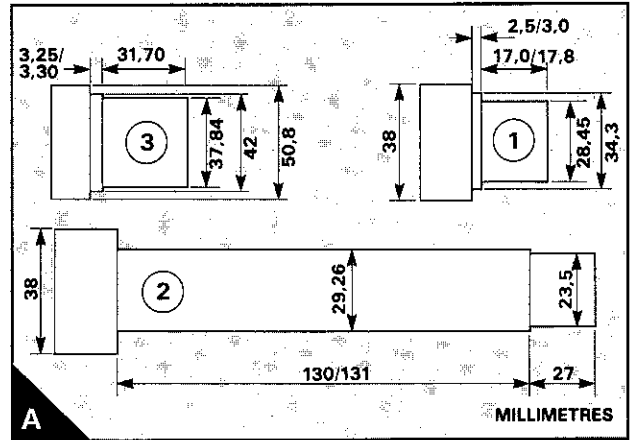
## To inspect

## 14A-12

- 1** Clean all the components before inspection.
- 2** Check the gear teeth and the splines of the drive shaft for wear or other damage. Renew the drive shaft if necessary.
- 3** Check the idler gear, needle roller bearing, hub and thrust washer for wear or other damage. Renew the components if necessary.
- 4** Check the drive gear for the balance weights for wear or other damage. Renew the gear if necessary.
- 5** Check the balance weights for wear or other damage. If either balance weight is worn or damaged, both balance weights must be renewed.
- 6** Check the needle roller bearings for the drive shaft for wear or other damage. Renew the bearings, operation 14A-13, if necessary.
- 7** Check the bushes for the balance weights for wear or other damage. Renew the bushes operation 14A-14, if necessary.
- 8** To inspect the lubricating oil pump, see operation 19A-07.

**To remove and to fit the needle roller bearings for the drive shaft 14A-13**

- 1 Press out the bearings with a suitable adaptor.
- 2 Clean the parent bores and lubricate them with clean engine lubricating oil.
- 3 Make a suitable adaptor to the dimensions given in (A2). Fit the rear bearing (14A.11/A7) onto the adaptor with the stamped face of the bearing towards the shoulder of the adaptor. Press the bearing into the parent bore in a continuous movement until the shoulder of the adaptor is against the front face of the balancer frame. In this position the front face of the bearing should be 130,0/131,0 mm (5.12/5.16 in) from the front face of the balancer frame (14A.11/A).
- 4 Make a suitable adaptor to the dimensions given in (A1). Fit the front bearing (14A.11/A10) onto the adaptor with the stamped face of the bearing toward the shoulder. Press the bearing into the parent bore in a continuous movement until the shoulder of the adaptor is against the front face of the balancer frame. In this position the front face of the bearing should be 2,5/3,0 mm (0.01/0.12 in) from the front face of the balancer frame (14A.11/A).



**To remove and to fit the bushes for the balance weights 14A-14**

- 1 Press the bushes out of the balancer frame and the rear cover with a suitable adaptor.
- 2 Clean the parent bores and lubricate them with clean engine lubricating oil.
- 3 Make a suitable adaptor to the dimensions given in (A3). Fit a bush onto the adaptor. Press the bush (B4) into the parent bore in the rear of the balancer frame (B3), in a continuous movement, until the shoulder of the adaptor is against the rear face of the balancer frame. In this position the rear face of the bush should be 3,25/3,30 mm (0.128/ 0.130 in) from the rear face of the balancer frame (B). Repeat this operation for the other bush.
- 4 Fit a bush (B1) onto the adaptor and put it into position at the front end of one of the parent bores in the rear cover (B2). Press in the bush, in a continuous movement, until the shoulder of the adaptor is against the front face of the rear cover. In this position the front face of the bush should be 3,25/3,30 mm (0.128/ 0.130 in) from the front face of the rear cover (B). Repeat this operation for the other bush.

