17 Crankshaft - installation and main bearing oil clearance check

Selection of bearing shells

1 Bearing shells are color-coded, and the upper and lower bearing shells may be of different thickness. BMW recommend that bearing shells matching the color code on the crankshaft should be fitted to the bearing shell locations in the bearing caps. Bearing shells matching the color codes on the inside of the crankcase are fitted to the upper bearing shell locations in the crankcase. If the color code markings in the crankcase have worn off, fit upper bearing shells with the same color code as the crankshaft. Three different bearing shell thickness are available, color-coded yellow, green and white. Consult a BMW dealer for further details.

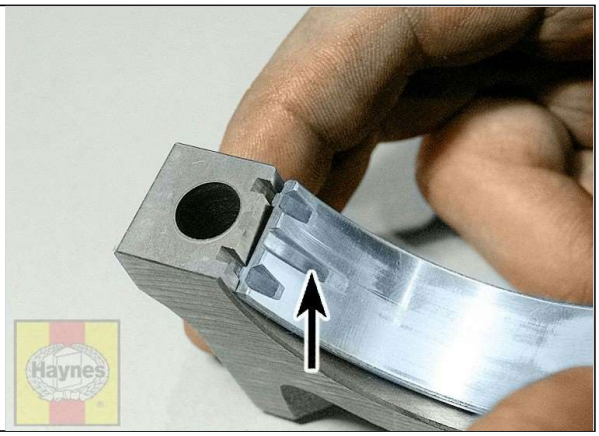
Main bearing oil clearance check

2 The oil clearance check can be carried out using the original bearing shells. However, it is preferable to use a new set, since the results obtained will be more conclusive.

3 Clean the backs of the bearing shells, and the bearing locations in both the cylinder block/ crankcase and the main bearing caps.

4 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch in the cylinder block/ crankcase or bearing cap. Take care not to touch any shell's bearing surface with your fingers. Note that the upper bearing shells have an oil groove running along the full length of the bearing surface, whereas the lower shells have a short, tapered oil groove at each end. If the original bearing shells are being used for the check, ensure that they are refitted in their original locations. The thrust bearing shells fit in No. 4 bearing location on four-cylinder engines, or No. 6 bearing location on six-cylinder engines **(see illustrations)** .

17.4a The lower bearing shells have short tapered oil grooves (arrow)



17.4b The thrust bearing shells fit in No. 6 bearing location on six-cylinder engines

5 The clearance can be checked in either of two ways.

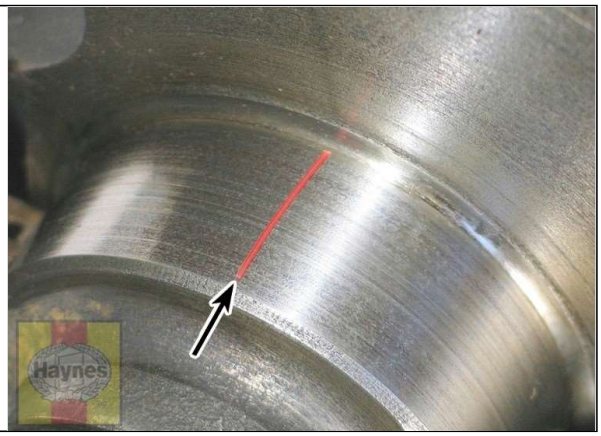
6 One method (which will be difficult to achieve without a range of internal micrometers or internal/external expanding calipers) is to install the main bearing caps to the cylinder block/ crankcase, with bearing shells in place. With the original cap retaining bolts tightened to the specified torque, measure the internal diameter of each assembled pair of bearing shells. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing internal diameter, the result will be the main bearing oil clearance.

7 The second (and more accurate) method is to use a product known as " Plastigage". This consists of a fine thread of perfectly-round plastic, which is compressed between the bearing shell and the journal. When the shell is removed, the plastic is deformed, and can be measured with a special card gauge supplied with the kit. The oil clearance is determined from this gauge. The procedure for using Plastigage is as follows.

8 With the main bearing upper shells in place, carefully lay the crankshaft in position. Do not use any lubricant; the crankshaft journals and bearing shells must be perfectly clean and dry.

9 Cut several lengths of the appropriate-size Plastigage (they should be slightly shorter than the width of the main bearings), and place one length on each crankshaft journal axis **(see illustration)** .

17.9 Plastigage in place on a crankshaft main bearing journal



10 With the main bearing lower shells in position, install the main bearing caps. Starting with the center main bearing and working outwards, tighten the original main bearing cap bolts progressively to their specified torque, in the two stages given in the Specifications.

Take care not to disturb the Plastigage, and *do not* rotate the crankshaft at any time during this operation.

11 Remove the main bearing cap bolts and carefully lift off the caps, keeping then in order. Again, take great care not to disturb the Plastigage or rotate the crankshaft. If any of the bearing caps are difficult to remove, free them by carefully tapping them with a soft-faced mallet.

12 Compare the width of the crushed Plastigage on each journal to the scale printed on the Plastigage envelope, to obtain the main bearing oil clearance **(see illustration)** . Compare the clearance measured with that given in the Specifications at the beginning of this Chapter.

17.12 Measure the width of the deformed Plastigage using the scale on the card

13 If the clearance is significantly different from that expected, the bearing shells may be the wrong size (or excessively worn, if the original shells are being re-used). Before deciding that different-size shells are required, make sure that no dirt or oil was trapped between the bearing shells and the caps or block when the clearance was measured. If the Plastigage was wider at one end than at the other, the crankshaft journal may be tapered.

14 If the clearance is not as specified, use the reading obtained, along with the shell thickness quoted in the Specifications, to calculate the necessary grade of bearing shells required. When calculating the bearing clearance required, bear in mind that it is always better to have the oil clearance towards the lower end of the specified range, to allow for wear in use.

15 Where necessary, obtain the required grades of bearing shell, and repeat the oil clearance checking procedure as described above.

16 On completion, carefully scrape away all traces of the Plastigage material from the crankshaft and bearing shells. Use your fingernail, or a wooden or plastic scraper which is unlikely to score the bearing surfaces.

Final crankshaft installation

Note:
New main bearing cap bolts must be used when finally installing the crankshaft.

17 Carefully lift the crankshaft out of the cylinder block once more.

18 Where applicable, ensure that the oil spray jets are fitted to the bearing locations in the cylinder block.

19 Place the bearing shells in their locations as described earlier. If new shells are being fitted, ensure that all traces of protective grease are cleaned off using solvent. Wipe dry the shells and connecting rods with a lint-free cloth. Liberally lubricate each bearing shell in the cylinder block/ crankcase and cap with clean engine oil **(see illustration)** .

17.19 Lubricate the bearing shells

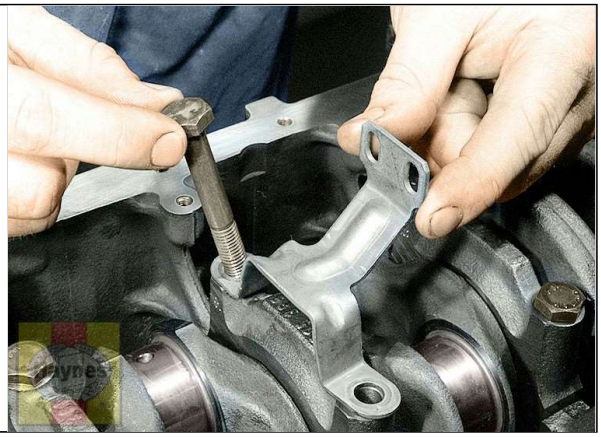
20 Lower the crankshaft into position so that No. 1 and 4 cylinder connecting rod journals (four-cylinder engines), or No. 1 and 6 cylinder connecting rod journals (six-cylinder engines), as applicable, will be at BDC, ready for fitting No. 1 piston. Check the crankshaft endplay (see Section 13).

21 Lubricate the lower bearing shells in the main bearing caps with clean engine oil. Make sure that the locating lugs on the shells engage with the corresponding recesses in the caps.

22 Fit the main bearing caps to their correct locations, ensuring that they are fitted the correct way (the bearing shell tab recesses in the block and caps must be on the same side). Thoroughly clean the new main bearing cap bolts, and lightly oil the threads, then insert the bolts, tightening them only loosely at this stage. On six-cylinder engines, ensure that the oil pick-up tube support bracket is correctly in position on the No. 5 main bearing cap bolts **(see illustrations)** .

17.22a Lightly oil the threads of the main bearing cap bolts

17.22b Ensure that the oil pick-up tube support bracket is in position on No. 5 main bearing cap bolts - six-cylinder engines



23 Tighten the main bearing cap bolts to the specified torque, in the two steps given in the Specifications **(see illustrations)** .

17.23a Tighten the main bearing cap bolts to the specified torque . . .

17.23b . . . then through the specified angle

24 Check that the crankshaft rotates freely.

25 Fit a new crankshaft rear oil seal to the oil seal carrier, then install the oil seal carrier using a new gasket, (see Chapter 2A or 2B , as applicable).

26 Where applicable, on six-cylinder engines, install the crankshaft sprocket and the oil pump drive chain, (see Chapter 2B).

27 Install the piston/ connecting rod assemblies (see Section 18).

28 On four-cylinder engines, install the flywheel/driveplate, the timing chain housing, and the oil pan, (see Chapter 2A).

29 On six-cylinder engines, install the flywheel/driveplate, the primary timing chain, and the oil pan, (see Chapter 2B).