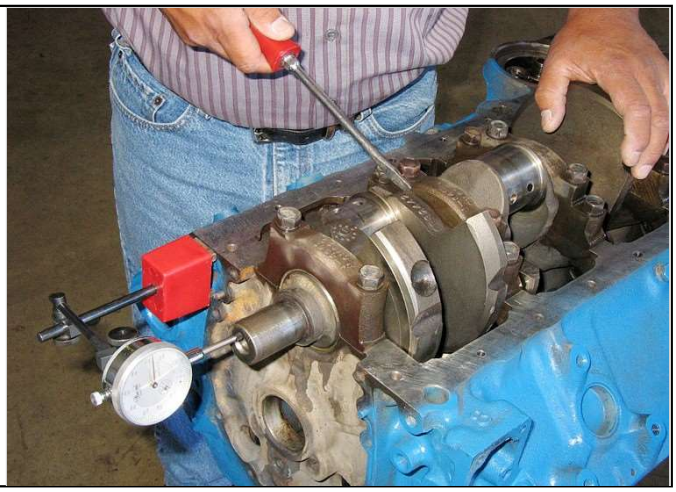
10 Crankshaft - removal and installation

Removal

Note:
The crankshaft can be removed only after the engine has been removed from the vehicle. It's assumed that the flywheel or driveplate, crankshaft pulley, timing chain, oil pan, oil pump body, and piston/connecting rod assemblies have already been removed. The rear main oil seal retainer must be unbolted and separated from the block before proceeding with crankshaft removal.

1 Before the crankshaft is removed, measure the endplay. Mount a dial indicator with the indicator in line with the crankshaft and just touching the end of the crankshaft as shown **(see illustration)** .

10.1 Checking crankshaft endplay with a dial indicator



2 Pry the crankshaft all the way to the rear and zero the dial indicator. Next, pry the crankshaft to the front as far as possible and check the reading on the dial indicator. The distance traveled is the endplay. A typical crankshaft endplay will fall between 0.003 to 0.010 inch (0.076 to 0.254 mm). If it is greater than that, check the crankshaft thrust surfaces for wear after it's removed. If no wear is evident, new main bearings should correct the endplay.

3 If a dial indicator isn't available, feeler gauges can be used. Gently pry the crankshaft all the way to the front of the engine. Slip feeler gauges between the crankshaft and the front face of the thrust bearing or washer to determine the clearance **(see illustration)** .

10.3 Checking the crankshaft endplay with feeler gauges at the thrust bearing journal

4 Loosen the main bearing cap bolts and lower cylinder block (bedplate) bolts 1/4-turn at a time each, until they can be removed by hand. Loosen the bolts in the reverse of the tightening sequence **(see illustration 10.19)**

5 Gently tap the lower cylinder block with a soft-face hammer around its perimeter. Pull the lower cylinder block straight up and off the cylinder block. Try not to drop the bearing inserts if they come out with the assembly.

6 Carefully lift the crankshaft out of the engine. It may be a good idea to have an assistant available, since the crankshaft is quite heavy and awkward to handle. With the bearing inserts in place inside the engine block and main bearing caps or lower cylinder block, reinstall the main bearing caps or lower cylinder block onto the engine block and tighten the bolts finger tight. If you're working on a four-cylinder engine, make sure you install the caps with the arrows pointing towards the front (timing belt end) of the engine.

Installation

7 Crankshaft installation is the first step in engine reassembly. It's assumed at this point that the engine block and crankshaft have been cleaned, inspected and repaired or reconditioned.

8 Position the engine block with the bottom facing up.

9 Remove the bolts and lift off the main bearing caps or lower cylinder block.

10 If they're still in place, remove the original bearing inserts from the block and from the main bearing cap assembly. Wipe the bearing surfaces of the block and main bearing cap assembly with a clean, lint-free cloth. They must be kept spotlessly clean. This is critical for determining the correct bearing oil clearance.

Main bearing oil clearance check

11 Without mixing them up, clean the back sides of the new upper main bearing inserts (with grooves and oil holes) and lay one in each main bearing saddle in the engine block. Each upper bearing (engine block) has an oil groove and oil hole in it. **Caution:** *The oil holes in the block must line up with the oil holes in the upper bearing inserts.* **Note:** *The thrust bearing is located on the 4th or 6th journal on the lower cylinder block.* Clean the back sides of the lower main bearing inserts and lay them in the corresponding location in the lower cylinder block/bridge. Make sure the tab on the bearing insert fits into the recess in the block or lower cylinder block.

Caution: *Do not hammer the bearing insert into place and don't nick or gouge the bearing faces. DO NOT apply any lubrication at this time.*

12 Clean the faces of the bearing inserts in the block and the crankshaft main bearing journal bridge with a clean, lint-free cloth.

13 Check or clean the oil holes in the crankshaft, as any dirt here can go only one way - straight through the new bearings.

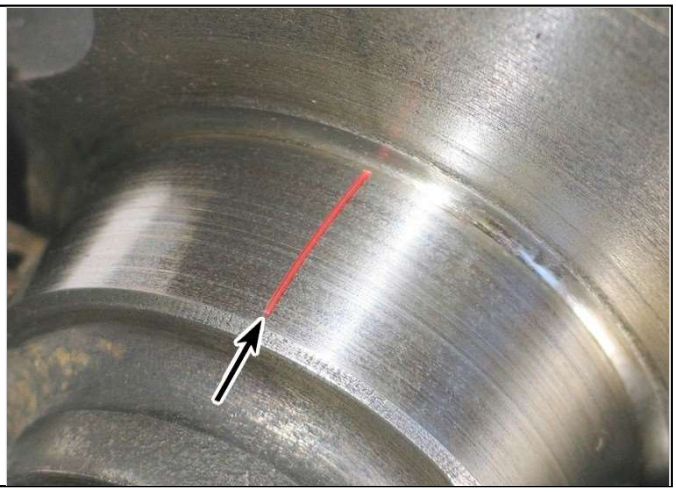
14 Once you're certain the crankshaft is clean, carefully lay it in position in the cylinder block.

15 Before the crankshaft can be permanently installed, the main bearing oil clearance must be checked.

16 Cut several strips of the appropriate size of Plastigage. They must be slightly shorter than the width of the main bearing journal.

17 Place one piece on each crankshaft main bearing journal, parallel with the journal axis as shown **(see illustration)** .

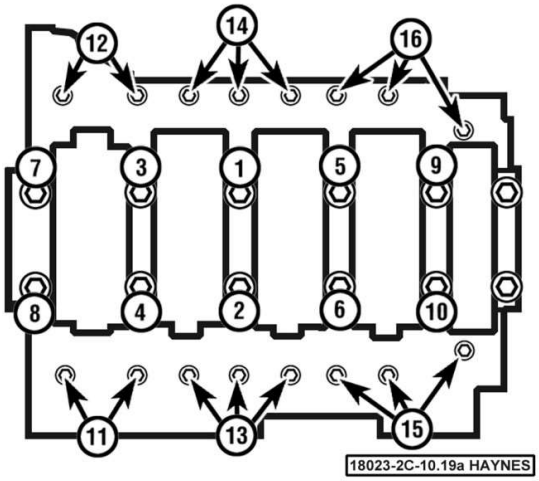
10.17 Place the Plastigage onto the crankshaft bearing journal as shown



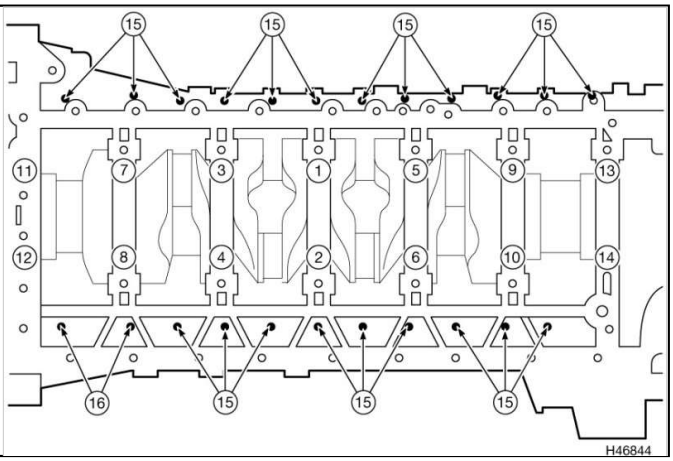
18 Clean the faces of the bearing inserts in the main bearing caps or the lower cylinder block. Hold the bearing inserts in place and install the caps or the lower cylinder block onto the crankshaft and cylinder block. DO NOT disturb the Plastigage.

19 Apply clean engine oil to all bolt threads prior to installation, then install all bolts finger-tight. Tighten the bolts in the sequence shown **(see illustrations)** progressing in steps, to the torque listed in this Chapter's Specifications . DO NOT rotate the crankshaft at any time during this operation.

10.19a 2.0L engine lower cylinder block/bedplate bolts and main bearing cap – TIGHTENING sequence



10.19b 3.0L engine lower cylinder block/bedplate bolts and main cap bolts - TIGHTENING sequence



20 Remove the bolts in the *reverse* order of the tightening sequence and carefully lift the caps and lower cylinder block straight up and off the block. Do not disturb the Plastigage or rotate the crankshaft.

21 Compare the width of the crushed Plastigage on each journal to the scale printed on the Plastigage envelope to determine the main bearing oil clearance **(see illustration)** . Check with an automotive machine shop for the oil clearance for your engine.

10.21 Use the scale on the Plastigage package to determine the bearing oil clearance - be sure to measure the widest part of the Plastigage and use the correct scale; it comes with both standard and metric scales

22 If the clearance is not as specified, the bearing inserts may be the wrong size (which means different ones will be required). Before deciding if different inserts are needed, make sure that no dirt or oil was between the bearing inserts and the cap assembly or block when the clearance was measured. If the Plastigage was wider at one end than the other, the crankshaft journal may be tapered. If the clearance still exceeds the limit specified, the bearing insert(s) will have to be replaced with an undersize bearing insert(s). **Caution:** *When installing a new crankshaft always install a standard bearing insert set.*

23 Carefully scrape all traces of the Plastigage material off the main bearing journals and/or the bearing insert faces. Be sure to remove all residue from the oil holes. Use your fingernail or the edge of a plastic card - don't nick or scratch the bearing faces.

Final installation

24 Carefully lift the crankshaft out of the cylinder block.

25 Clean the bearing insert faces in the cylinder block, then apply a thin, uniform layer of moly-base grease or engine assembly lube to each of the bearing surfaces. Be sure to coat the thrust faces as well as the journal face of the thrust bearing.

26 Make sure the crankshaft journals are clean, then lay the crankshaft back in place in the cylinder block.

27 Clean the bearing insert faces and apply the same lubricant to them. Clean the mating surfaces of the engine block and lower cylinder block/bedplate thoroughly. The surfaces must be free of oil residue.

28 Squeeze a bead of BMW liquid sealant into the groove in the bottom of the block before installing and tightening the bedplate. Follow the sealant manufacturer's instructions.

29 Install the lower cylinder block onto the crankshaft and cylinder block.

30 Prior to installation, apply clean engine oil to all bolt threads, wiping off any excess, then install all bolts finger-tight.

31 Tighten the lower cylinder block bedplate and main cap bolts in the correct sequence **(see illustration 10.19)** to the torque listed in this Chapter's Specifications .

32 Recheck the crankshaft endplay with a feeler gauge or a dial indicator. The endplay should be correct if the crankshaft thrust faces aren't worn or damaged and if new bearings have been installed.

33 Rotate the crankshaft a number of times by hand to check for any obvious binding. It should rotate with a running torque of 50 in-lbs or less. If the running torque is too high, correct the problem at this time.

34 Install a new rear main oil seal using a BMW seal kit (see Chapter 2A).