10 Cylinder head - removal and installation

Note:
New cylinder head bolts and a new cylinder head gasket will be required on installation.

Removal

1 Drain the cooling system (see Chapter 1).

2 Remove the intake and exhaust manifolds (see Chapter 4).

3 Note the installed positions of the clamps, then release them and disconnect the various cooling hoses from the cylinder head.

4 Remove the VANOS adjustment units (see Section 7).

5 Remove the retaining bolts, then unclip the timing chain module from the left-hand guide rail. Lift the module upwards to remove it **(see illustration 6.14a)** . Gently set the timing chain down in the cylinder block. It is imperative that the crankshaft is not rotated, as the timing chain will become trapped.

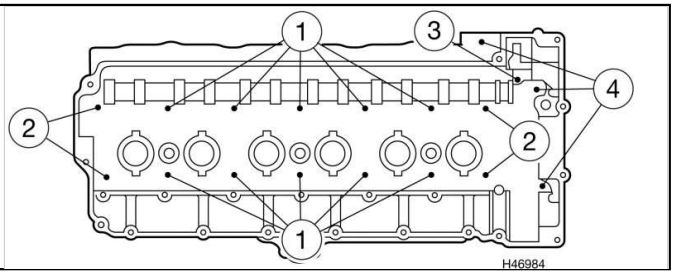
6 Remove the retaining bolts and pull the eccentric shaft position sensor forwards (see Section 9). Remove the retaining bolt and remove the magnetic sensor wheel from the end of the eccentric shaft **(see illustration 9.5)** . Take great care not to drop the bolt - retrieval would be difficult; the bolt is not magnetic.

7 Using a wrench on the hexagonal section, rotate the eccentric shaft so the lobes are pointing upwards, then remove the eccentric shaft M6 stop-screw between the 1st and 2nd cylinders.

8 Remove the M9 and M7 bolts at the timing chain end of the cylinder head.

9 Using suitable Torx driver bits, Remove the cylinder head bolts, working from the outside inward **(see illustration)** . **Note:** *There are M9 and M10 Torx bolts to remove. Keep track of the installed locations of the M9 bolts - they are different lengths* .

10.9 Cylinder head M10 bolts (1) and M9 bolts (2). Remove the M9 bolt (3) and M7 bolts (4) at the timing chain end of the engine



10 An assistant will now be required to help remove the cylinder head. Lift the cylinder head from the block - take care, as the cylinder head is heavy. As the cylinder head is removed, feed the timing chain through the opening in the front of the cylinder head, and support it from the cylinder block using wire. **Caution:** *Do not set the cylinder head down on the sealing face. The valves protrude beyond the face, and may be damaged.*

11 Remove the cylinder head gasket, then seal the oil pump galley openings in the cylinder block sealing face with suitable-sized rubber/plastic plugs.

Inspection

12 Cylinder head rebuilding requires special shop equipment. If the engine has over 100,000 miles on it and the heads have been removed for inspection or other work, the head should be brought to a competent engine machine shop, where it can be tested for coolant leaks, resurfaced if necessary and the valves and valve seats machined.

13 The mating faces of the cylinder head and block must be perfectly clean before installing the head. Use a plastic scraper to remove all traces of gasket and carbon, and also clean the tops of the pistons. Take particular care with the aluminum sealing faces, as the soft metal is easily damaged. Also make sure that debris is not allowed to enter the oil and water passages. Using adhesive tape and paper, seal the water, oil and bolt holes in the cylinder block. To prevent carbon entering the gap between the pistons and bores, smear a little grease in the gap.

14 Check the block and head for nicks, deep scratches and other damage. If very slight, they may be buffed out from the cylinder block. More serious damage, such as warpage, must be repaired with special shop equipment.

15 If warpage of the cylinder head is suspected, use a straight-edge to check it for distortion.

16 Clean out the bolt holes in the block using a pipe cleaner or thin rag and a screwdriver. Make sure that all oil and water is removed, otherwise there is a possibility of the block being cracked by hydraulic pressure when the bolts are tightened.

17 Examine the bolt threads and the threads in the cylinder block for damage. If necessary, use the correct size tap to chase out the threads in the block.

Installation

18 Ensure that the mating faces of the cylinder block and head are spotlessly clean, that the cylinder head bolt threads are clean and dry, and that they screw in and out of their locations.

19 Check that the cylinder head locating dowels are correctly positioned in the cylinder block.

20 Ensure the flywheel/driveplate is still locked in the TDC position (see Section 3).

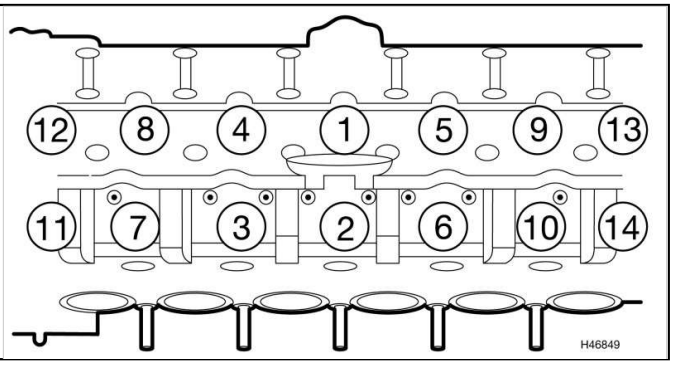
21 Place a new cylinder head gasket on the block, locating it over the dowels. Make sure that it is the correct way up. **Note:** *Thicker-than-standard gaskets are available for use if the cylinder head-to-block surface has been machined.*

22 Lower the cylinder head onto the block, engaging it over the dowels.

23 Use new cylinder head bolts that have the threads pre-coated. Do not apply any lubricant to the bolts, or wipe away the coating. Insert the new bolts, complete with washers where necessary, and tighten the bolts as far as possible by hand. Ensure that the washers are correctly seated in their locations in the cylinder head. **Note:** *Do not install washers on any bolts which are installed in locations where there are already captive washers in the cylinder head. If a new cylinder head is installed (without captive washers), ensure that new washers are installed to all the bolts.*

24 Tighten the bolts in order to the Step 1 torque setting given in the Specifications **(see illustration)** . **Note:** *Suitable T50 and T60 Torx bits are available from BMW (part No 11 5 190 and 11 4 420).*

10.24 Cylinder head bolt tightening sequence



25 Tighten all cylinder head bolts to the Step 2 angle using an angle-measuring gauge.

26 Tighten bolts 1 through 10 to their Step 3 angle.

27 Tighten the M10 cylinder head bolts to the last angle setting.

28 Install the new M7 and M9 aluminum bolts in their proper locations at the timing chain end of the cylinder head and tighten them to their specified torque.

29 Install the eccentric shaft stop screw and tighten it to the specified torque.

30 Install the magnetic sensor wheel to the eccentric shaft and tighten the retaining bolt securely.

31 Install the eccentric shaft position sensor and tighten the bolts securely.

32 Using a length of wire as a hook, pull the timing chain up through the cylinder head, and install it into the timing chain module. Clip the module to the left-hand guide, insert the retaining bolts and tighten them to the specified torque.

33 Install the VANOS adjustment units (see Section 7).

34 The remainder of installation is the reverse of removal. Refill the cooling system (see Chapter 1).