10 Cylinder head - removal, inspection and installation

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

Caution:
Do not remove the coating on the cylinder head bolts.

Removal

1 Drain the cooling system and engine oil (see Chapter 1).

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

3 Remove the catalytic converter (see Chapter 4).

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

5 Remove the intake and exhaust VANOS adjustment units (see Section 7).

6 Remove the injectors (see Chapter 4), then remove the injector shaft tube fasteners and pull the shaft assemblies off the cylinder head. Once the shafts are out, remove the alignment dowels from the cylinder head.

7 Using an open-end wrench on the slotted section of the eccentric shaft, adjust the servo motor using a 4 mm Allen wrench until the eccentric shaft is at its lowest position (minimum lift).

8 Rotate the eccentric shaft so the lobes are in the middle between maximum and minimum stroke and insert a 6 mm Allen wrench into the valvetronic servomotor located in the middle of the cylinder head, then remove the wrench from the eccentric shaft.

9 Remove the stop screw for the eccentric shaft from the cylinder head.

10 Disconnect the electrical connectors to the cylinder head components, then remove the harness retainers and place the harness out of the way.

11 Remove the timing chain module-to- cylinder head bolts.

12 Remove the vibration damper (see Section 5).

13 Remove the two screw plugs at the front of the engine. Working through the plug openings, release the timing chain module-to- crankcase bolts.

14 Move the timing chain module slightly to the side, then remove the reverse-Torx M9 x 30mm and M9 x 70mm cylinder head bolts from inside the timing chain end of the cylinder head and one on the outer side next to the first intake port.

15 Using suitable Torx driver bits (T60 for the M11 bolts, T50 or T55 for the M9 bolts), remove the cylinder head bolts, working in the order opposite that of the tightening sequence **(see illustration 10.30)** .

Note:
Keep track of the installed locations of the M9 bolts - they are different lengths.

16 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.

17 Remove the cylinder head gasket, then seal the oil pump galley openings in the cylinder block face with rubber/plastic plugs.

Inspection

18 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 automotive machine shop, where it can be tested for coolant leaks, resurfaced if necessary and the valves and valve seats machined.

19 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.

20 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.

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

22 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.

23 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

24 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.

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

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

27 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.

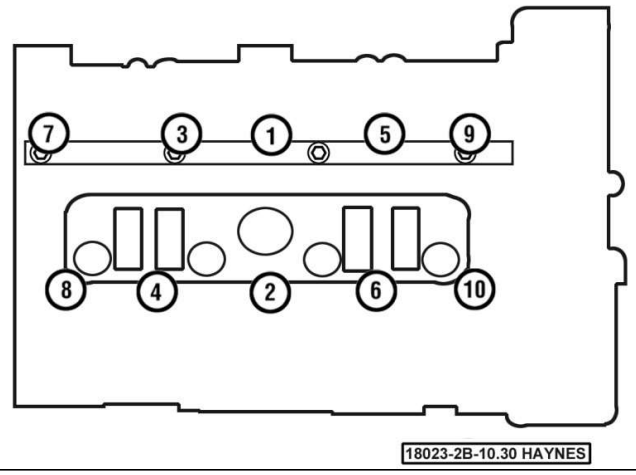
28 With the help of an assistant, lower the cylinder head onto the block, engaging it over the dowels.

29 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.

30 Tighten the bolts in order to the Step 1 torque setting given in this Chapter's Specifications **(see illustration)** .

10.30 Cylinder head bolt tightening sequence



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

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

33 Install the reverse Torx M9 x 30 mm and M9 x 70 mm cylinder head bolts in their proper locations at the timing chain end of the cylinder head and tighten the bolts to the torque listed in this Chapter's Specifications .

34 Install the eccentric shaft stop screw and tighten it to the torque listed in this Chapter's Specifications .

35 Install the timing chain module (see Section 6). Clip the module to the left-hand guide, insert the retaining bolts tighten the bolts to torque listed in this Chapter's Specifications .

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

37 The remainder of installation is the reverse of removal. Refill the cooling system and engine oil, and install a new oil filter (see Chapter 1).