11 Cylinder head - removal and installation

Warning:
Wait until the engine is completely cool before beginning this procedure.

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

Removal

1 Depressurize the fuel system (see Chapter 4A), then disconnect the battery negative lead. **Caution:** *If the radio in your vehicle is equipped with an anti-theft system, make sure you have the correct activation code before disconnecting the battery.*

2 Drain the cooling system (see Chapter 1).

3 Remove the air cleaner assembly and the airflow meter (see Chapter 4A).

4 Remove the upper and lower sections of the intake manifold (see Chapter 4A).

5 Remove the exhaust manifold (see Chapter 4A).

6 Disconnect the coolant hose from the cylinder head.

7 Remove the upper timing chain cover (see Section 6)

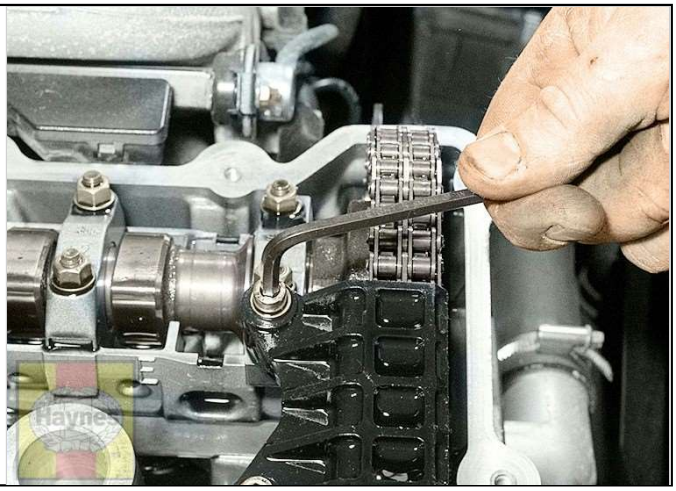
8 Position No. 1 piston at TDC, and lock the flywheel in position (see Section 3).

9 Unscrew the timing chain tensioner plug from the right-hand side of the engine. Recover the sealing ring.

10 Withdraw the timing chain tensioner assembly from its housing.

11 Unscrew the securing bolts, and withdraw the upper chain guide from the cylinder head **(see illustration)** .

11.11 Unscrewing an upper chain guide securing bolt



12 Unscrew the upper securing bolt from the left-hand chain guide.

13 Unscrew the bolts securing the chain sprockets to the camshafts. Take care not to move the camshafts - if necessary, the camshafts can be counterheld using a 27 mm wrench on the flats provided between No. 5 and 6 cam lobes.

14 Withdraw the sprockets from the camshafts, and disengage them from the chain. Note which way the sprockets face to ensure correct installation.

15 Ensure that tension is kept on the timing chain - tie the chain up or support it using wire, to prevent it from dropping into the lower timing chain cover.

16 If not already done, disconnect the wiring plugs from the coolant temperature sensors located in the left-hand side of the cylinder head. **Caution:** *To avoid any possibility of piston-to-valve contact when installing the cylinder head, it is necessary to ensure that none of the pistons are at TDC. Before proceeding further, remove the locking rod from the timing hole in the cylinder block, then turn the crankshaft approximately 90-degrees clockwise using a wrench or socket on the crankshaft pulley hub bolt.*

17 Make a final check to ensure that all relevant hoses and wires have been disconnected to allow cylinder head removal.

18 Progressively loosen the cylinder head bolts, working in a spiral pattern from the outside of the head inwards.

19 Remove the cylinder head bolts **(see illustration)** . Where applicable recover the washers under the cylinder head bolts. Note that the cylinder head originally fitted in production has captive washers.

11.19 Removing a cylinder head bolt

20 Release the cylinder head from the cylinder block and locating dowels by rocking it. Do not pry between the mating faces of the cylinder head and block, as this may damage the gasket faces.

21 Ideally, an assistant will now be required to help lift the cylinder head from the block - take care as the cylinder head is heavy **(see illustration)** .

11.21 Lifting off the cylinder head

22 Recover the cylinder head gasket.

Inspection

23 Refer to Chapter 2C for details of cylinder head dismantling and reassembly.

24 The mating faces of the cylinder head and block must be perfectly clean before installing the head. Use a scraper to remove all traces of gasket and carbon, and also clean the tops of the pistons. Take particular care with the aluminum cylinder head, 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. After cleaning each piston, rotate the crankshaft so that the piston moves down the bore, then wipe out the grease and carbon with a cloth rag.

25 Check the block and head for nicks, deep scratches and other damage. If very slight, they may be removed from the cylinder block carefully with a file. More serious damage may be repaired by machining, but this is a specialist job.

26 If warpage of the cylinder head is suspected, use a straight-edge to check it for distortion, with reference to Chapter 2C .

27 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.

28 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

Caution:
If the camshafts have been removed from the cylinder head, note the **Cautions** given in Section 10 , regarding expanded cam followers. Additionally, to minimize the possibility of piston-to-valve contact, after installing the camshaft(s) observe the following delays before installing the cylinder head.

Temperature	Delay
Room temperature (68°F)	4 minutes
50°F to 68°F	11 minutes
32°F to 50°F	30 minutes

29 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.

30 On M42 engines, make sure that the oil feed check valve and spacer are installed in the block.

31 Check that the cylinder head locating dowels are correctly positioned in the cylinder block. **Caution:** *To avoid any possibility of piston-to-valve contact when installing the cylinder head, it is necessary to ensure that none of the pistons are at TDC. Before proceeding further, if not already done, turn the crankshaft to position No. 1 piston at TDC (check that the locking rod can be engaged with the flywheel, then remove the locking rod and turn the crankshaft approximately 90-degrees clockwise using a wrench or socket on the crankshaft pulley hub bolt.*

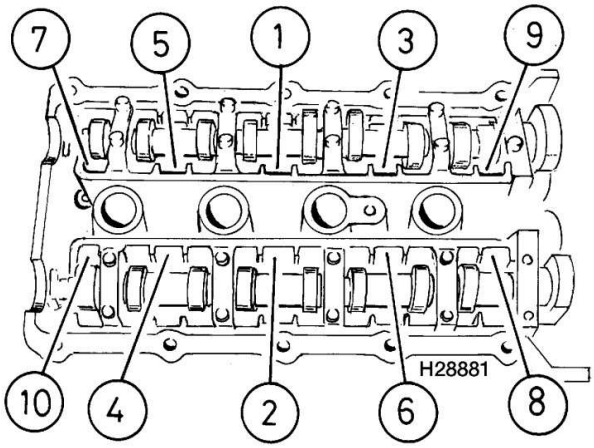
32 Fit a new cylinder head gasket to the block, locating it over the dowels. Make sure that it is the correct way up. Note that 0.012-inch (0.3 mm) thicker-than-standard gaskets are available for use if the cylinder head has been machined (see Chapter 2C).

33 If not already done, fit the template to the cylinder head to ensure that the camshaft is correctly positioned (No. 1 piston at TDC) - see Section 3 .

34 Lower the cylinder head into position. Ensure that the cylinder head engages with the locating dowels. Fit the new cylinder head bolts, complete with new 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 fitted to 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 used on all the bolts.*

35 Tighten the bolts in the sequence shown, and in the steps given in this Chapter's Specifications - i.e., tighten all bolts in sequence to the Step 1 torque, then tighten all bolts in sequence to the Step 2 angle-torque, and so on **(see illustrations)** .

11.35a Cylinder head bolt tightening sequence



11.35b Angle-tightening a cylinder head bolt

36 Turn the crankshaft back 90-degrees counterclockwise to the TDC position, then re-engage the locking rod with the flywheel to lock the crankshaft in position.

37 Manipulate the camshaft sprockets until the timing arrows on the sprockets are pointing vertically upwards, then engage the chain with the sprockets.

38 Install the sprockets on the camshafts, ensuring that the sprockets face the proper direction as noted before removal, then install the sprocket securing bolts.

39 Tighten the sprocket securing bolts to the specified torque - if necessary, the camshafts can be counterheld using a 27 mm wrench on the flats provided between No. 5 and 6 cam lobes.

40 Install and tighten the left-hand chain guide upper securing bolt.

41 Install the upper chain guide and tighten the securing bolts.

42 Install the timing chain tensioner (see Steps 25 through 29 in Section 7).

43 Further installation is a reversal of removal, bearing in mind the following points.

A. Install the upper timing chain cover (see Section 6).

B. On M44 engines, replace the seal for the oil supply tube (see illustration 11.35a).

C. Install the valve cover (see Section 4).

D. Install the exhaust manifold (see Chapter 4A).

E. Install the lower and upper sections of the intake manifold (see Chapter 4A).

F. Install the air cleaner assembly and the air mass meter (see Chapter 4A).

G. On completion, refill the cooling system (see Chapter 1), and prime the fuel system (see Chapter 4A).

Caution:
When the engine is first started, it must be run at a speed of 3500 rpm for 20 seconds as soon as it starts - this is to ensure that the tensioner is primed with oil.