



**Haynes**  
shows you how

[BMW 3-Series \(92-98\) & Z3 \(96-98\) Haynes Online Manual](#)

## 11 Cylinder head - removal and installation

### Warning:

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

### 1992 models

#### Note:

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

### Removal

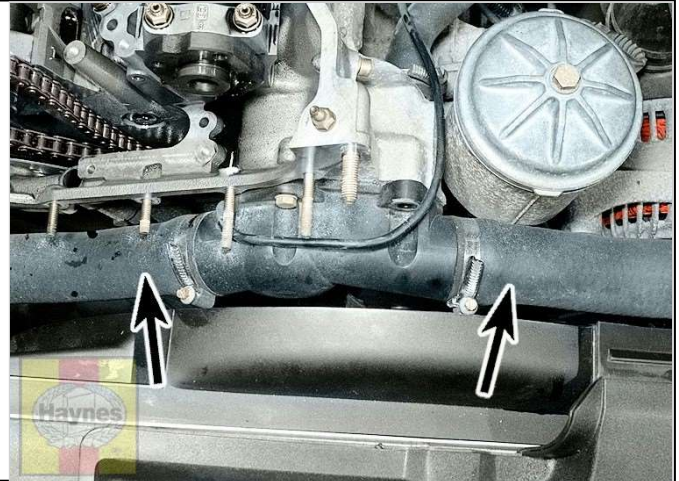
- 1 Drain the cooling system (see [Chapter 1](#) ).
- 2 Remove the intake and exhaust manifolds (see [Chapter 4B](#) ).
- 3 Remove the secondary timing chain (see [Section 7](#) ).
- 4 Trace the wiring back from the camshaft position sensor, then disconnect the sensor connector. Unscrew the securing bolt, and remove the sensor from the cylinder head.
- 5 Remove the tool locking the secondary timing chain tensioner in position. Lift out the tensioner pad and spring (note which way the tensioner pad fits to ensure correct installation).
- 6 Unscrew the securing bolts, and withdraw the secondary chain tensioner from the cylinder head.
- 7 Unscrew the securing bolts and withdraw the secondary chain guide.
- 8 Withdraw the primary timing chain sprocket from the exhaust camshaft, complete with the chain. Remove the sprocket. Note which way round the sprocket is fitted to ensure correct installation. **Caution:** *Keep tension on the chain, and tie up the end of the chain using wire or string to prevent it from dropping into the lower timing chain cover and/or disengaging from the crankshaft sprocket.* **Warning:** *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 30-degrees clockwise using a wrench or socket on the crankshaft pulley hub bolt.*

9 Unscrew the bolts securing the lower timing chain cover to the cylinder head (note that one of the bolts also secures the secondary timing chain tensioner).

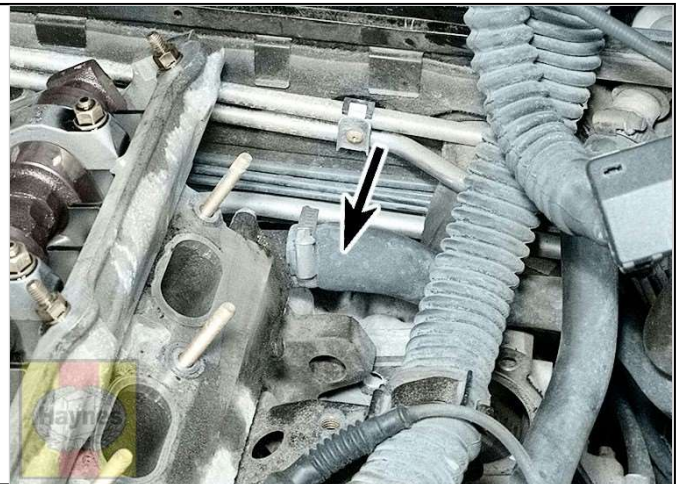
10 Disconnect the two coolant hoses from the thermostat cover at the front of the cylinder head (see illustration) .

**11.10 Disconnect the two coolant hoses (arrows) from the thermostat housing**



11 Disconnect the coolant hose from the rear left-hand corner of cylinder head (see illustration) .

**11.11 Disconnect the coolant hose (arrow) from the rear left-hand corner of the cylinder head**



12 Disconnect the remaining small coolant hose from the left-hand side of the cylinder head.

13 Disconnect wiring plugs from the temperature sensors located in the left-hand side of the cylinder head.

14 Unscrew the securing bolt and remove the crankshaft position sensor from the front of the engine. Trace the wiring back from the sensor, then disconnect the wiring plug and remove the sensor. **Caution:** *Mark the wiring plug for identification, as it is possible to mix up the camshaft sensor and crankshaft sensor wiring plugs .*

15 Progressively loosen the cylinder head bolts, working in a spiral pattern from the outside of the head inwards (see illustration) .

**11.15 Loosen the cylinder head bolts, working in a spiral pattern . . .**



16 Remove the cylinder head bolts, and recover the washers (see illustration) . Note that some of the washers may be captive in the cylinder head, in which case they cannot be withdrawn.

**11.16 . . . then withdraw the bolts**



17 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.

18 Ideally, two assistants will now be re-quired to help remove the cylinder head. Have one assistant hold the timing chain up, clear of the cylinder head, making sure that tension is kept on the chain. With the aid of another assistant, lift the cylinder head from the block - take care, as the cylinder head is heavy (see illustration) . As the cylinder head is removed, feed the timing chain through the aperture in the front of the cylinder head, and support it from the cylinder block using the wire.



### 11.18 Lifting off the cylinder head



19 Recover the cylinder head gasket.

## Inspection

20 Refer to [Chapter 2C](#) for details of cylinder head dismantling and reassembly.

21 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.

22 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.

23 If warpage of the cylinder head is suspected, use a straight-edge to check it for distortion, with reference to [Chapter 2C](#) .

24 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.

25 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

**Warning:**

If the camshafts have been removed from the cylinder head, note the warnings 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

26 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.

27 Check that the cylinder head locating dowels are correctly positioned in the cylinder block. **Warning:** *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 30-degrees clockwise using a wrench or socket on the crankshaft pulley hub bolt.*

28 Fit a new cylinder head gasket to the block, locating it over the dowels. Make sure that it is the correct way up (see illustration) . 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](#) ).

### 11.28 Fit a new cylinder head gasket



29 If not already done, fit the template to the cylinder head to ensure that the camshafts are correctly positioned (No. 1 piston at TDC) - see [Section 3](#) .

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

31 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 (see illustration) . **Note:** *Do not fit washers to any bolts which are fitted to locations where there are already captive*

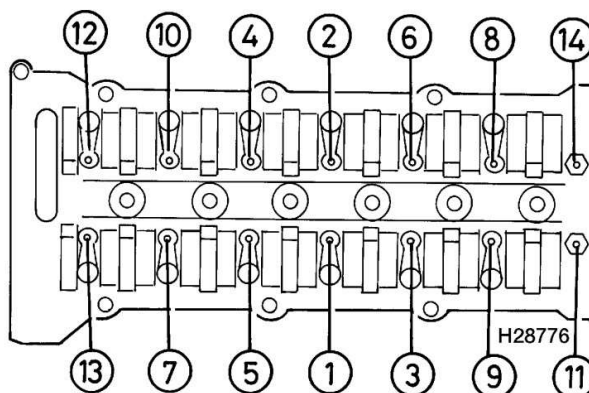
washers in the cylinder head. If a new cylinder head is fitted (without captive washers), ensure that new washers are fitted to all the bolts.

**11.31 Fit the washers by guiding them into position using a length of welding rod or stiff wire**



32 Tighten the bolts in the order shown, and in the stages given in the Specifications - i.e., tighten all bolts in sequence to the Step 1 torque, then tighten all bolts in sequence to the Step 2 torque, and so on (see illustrations) .

**11.32a Cylinder head bolt tightening sequence**



**11.32b Tightening a cylinder head bolt using an angle-gauge**



33 Install and tighten the bolts securing the lower timing chain cover to the cylinder head.

34 Turn the crankshaft back 30-degrees counterclockwise to the TDC position, then re-engage the locking rod with the flywheel to lock the crankshaft in position.

35 Manipulate the exhaust camshaft primary chain sprocket until the timing arrow on the sprocket is pointing vertically upwards (note that some sprockets have two arrows opposite each other), then engage the chain with the sprocket.

36 Fit the sprocket to the exhaust cam-shaft, aligning the sprocket so that the tapped holes in the camshaft flange are positioned at the left-hand ends of the elongated slots in the sprocket.

37 Install the secondary chain guide and tighten the securing bolts.

38 Install the secondary chain tensioner and tighten the securing bolts. Install the spring and tensioner pad, ensuring that the pad is fitted the correct way round (as noted before removal).

39 Temporarily install the tool to lock the secondary chain tensioner in position, then install the secondary timing chain (see [Section 7](#) ).

40 Further installation is a reversal of removal, but install the intake and exhaust manifolds (see [Chapter 4B](#) ), and on completion refill the cooling system (see [Chapter 1](#) ).

## 1993 and later models

### Note:

BMW special tool No. 11 3 390 or a suitable equivalent will be required to carry out this operation. New cylinder head bolts and a new cylinder head gasket will be required on installation.

## Removal

41 Follow the procedure outlined in steps 1 through 4.

42 Unscrew the primary timing chain tensioner plunger cover plug from the right-hand side of the engine. Recover the sealing ring. **Warning:** *The chain tensioner plunger has a strong spring. Take care when unscrewing the cover plug.*

43 Recover the spring and withdraw the tensioner plunger.

44 Follow the procedure outlined in steps 5 through 19.

## Inspection

45 Follow the procedure outlined in steps 20 through 25.

## Installation

46 Follow the procedure outlined in steps 28 through 38, noting the warning at the beginning of paragraph 28.

47 Fit special tool No. 11 3 390 into the primary timing chain tensioner aperture, then turn the adjuster screw on the tool until the end of the screw just touches the tensioning rail (see illustration 9.27a) . Note that the exhaust camshaft sprocket should now have moved counterclockwise so that the tapped holes in the camshaft flange are centered in the elongated holes in the sprocket.

48 Follow the procedure outlined in steps 39 through 40.

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