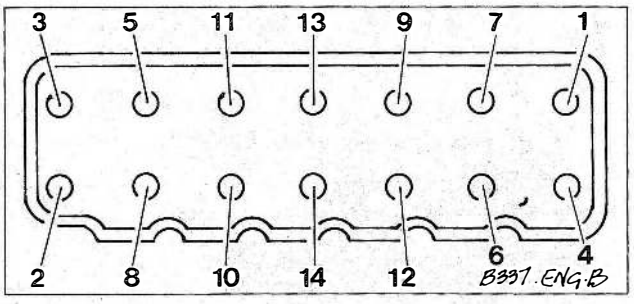


**Fig. 4-62.** Cylinder head bolt loosening sequence.

**To install (6-cylinder engines):**

1. Clean the cylinder head and the gasket surface of the cylinder block. Clean the threads of the head bolts and bolt holes with a thread chaser and remove all oil and foreign matter from the bolt holes. Avoid letting debris into the cylinders or oil passages in the cylinder block.

***CAUTION***

*Do not use a metal scraper or wire brush to clean the aluminum cylinder head or pistons. These tools may damage the cylinder head. Instead, use a solvent to soften carbon deposits and old sealing materials. If necessary, use a hard wooden or plastic scraper.*

2. Check the gasket surface of the cylinder head and the cylinder block for warpage as described under **4.9 Disassembly, Assembly, and Reconditioning Cylinder Head**.

3. Place a new cylinder head gasket on the surface of the cylinder block. The cylinder head gasket will fit correctly in only one orientation. The word "OBEN", found printed on the gasket, should face up.

***CAUTION***

*Cylinder head gaskets will make a reliable seal only once. Always use a new cylinder head gasket that has not been previously compressed by tightening the cylinder head bolts.*

**NOTE**

Head gaskets on some early 6-cylinder engines may have the engine displacement code stamped on the gasket flange as shown in Fig. 4-63. On 325, 325e, and 325es models, the code number is 2.7. On 325i, 325is and 325i Convertible models, the code number is 2.5. Replacement gaskets supplied by BMW no longer have the code number.

4. Place the cylinder head in position on the cylinder block. Check that the vent tube is correctly positioned. Loosely install the head bolts and their washers, then thread them in until they are finger tight. Guide the vent tube into its opening as the cylinder head bolts are tightened.

***CAUTION***

*BMW recommends replacing hex-head cylinder head bolts with the Torx-head bolts whenever the cylinder head is removed or if any bolts are found to be faulty (such as a broken off bolt head). When replacing bolts with the head installed, remove and install one bolt at a time until all 14 are replaced. The hex-head bolt was originally installed in all 6-cylinder 3-series engines up to April 1989. All 3-series engines produced after this date use the new Torx-head bolt.*

**NOTE**

To help install the cylinder head, insert two 8 in. long by ⅜ in. round wooden dowels into two of the outermost head bolt holes. The dowels will hold the gasket in position as the cylinder head is installed. Thread in several bolts, then remove the dowels and install the remaining bolts.

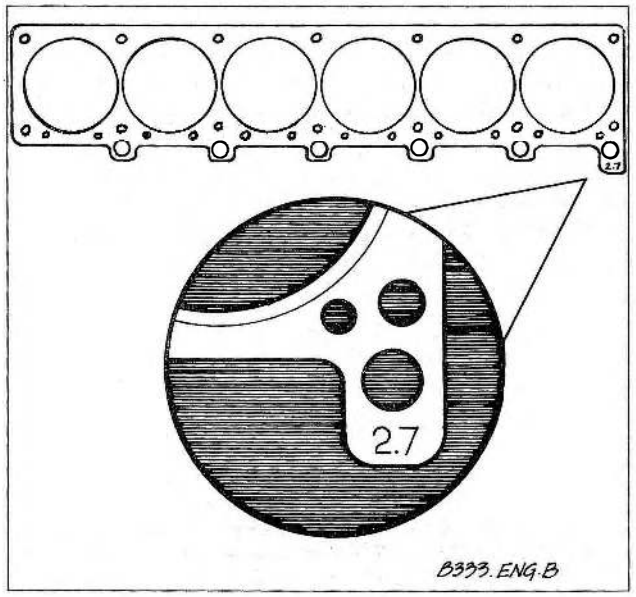


**Fig. 4-63.** Engine displacement code stamp on cylinder head gasket flange.

5. Tighten the cylinder head bolts in the sequence shown in Fig. 4-64. The bolts should be tightened in three stages as listed in **Table h**. The final stage(s) requires using a special tool (BMW Tool No. 11 2 110) or a suitable protractor to tighten the bolts to a specified torque angle.

*CAUTION*

*The cylinder head bolt torque is critical to proper engine operation. Tighten the bolts in the stages listed in the Table h.*

**NOTE**

On engines with Torx®head bolts, the torque angles can be done with engine cold. There is no specified waiting time or engine temperature.

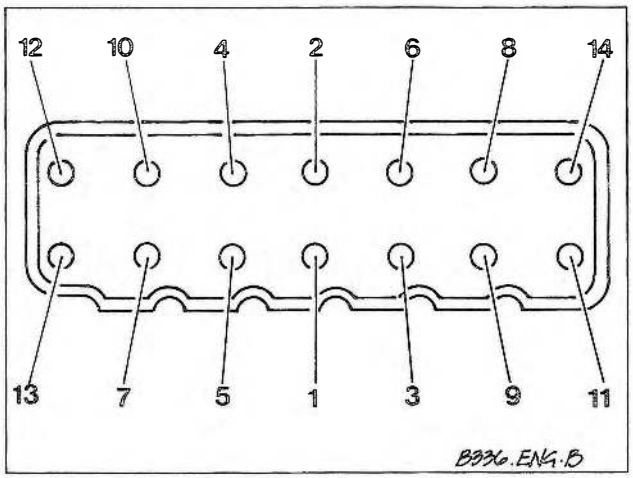


**Fig. 4-64.** Cylinder head bolt tightening sequence for 6-cylinder engine.

**Table h. Cylinder Head Tightening Torques (6-cylinder engines)**

| | Stage 1 | Stage 2 | Stage 3 |
|---|---|---|---|
| Torx®head bolts | 30 Nm (22 ft. lb.) | 90° | 90° |
| Hex-head bolts | 40 $^{+5}_{-0}$ Nm (30 $^{+4}_{-0}$ ft. lb.) | 60 $^{+5}_{-0}$ Nm (44 $^{+4}_{-0}$ ft. lb.) after waiting 15 minutes | 25 $^{+5°}_{-0}$ after running engine for 25 minutes |

Installation of the remaining parts is the reverse of removal. Adjust the valve clearances as described under **4.4 Valve Adjustment**. Install the camshaft drive belt as described under **4.2 Camshaft Drive Belt (6-cylinder engines)**. Install the front pipe to the exhaust manifold with CRC® copper paste or equivalent on the mounting studs. Replace the gasket if necessary. Refill and bleed the cooling system as described in **COOLING SYSTEM**. Change the engine oil and filter as described in **LUBRICATION AND MAINTENANCE.** Adjust idle speed and idle mixture as described in **FUEL SYSTEM.** Adjust the accelerator cable as described in **FUEL SYSTEM.** Adjust the transmission throttle cable as described in **AUTOMATIC TRANSMISSION.**

## 4.9 Disassembly, Assembly, and Reconditioning Cylinder Head

Disassembly, assembly, and reconditioning procedures for the BMW cylinder heads covered in this manual are similar to those for most other modern water-cooled engines. For anyone with the proper tools and equipment and basic experience in cylinder head reconditioning, this section provides the specifications and special reconditioning information necessary to repair the cylinder heads covered by this manual.

If machine shop services are not readily available, one alternative is to install a remanufactured cylinder head. Remanufactured cylinder heads are available from an authorized BMW dealer parts department.

4

### Cylinder Head Assembly

The cylinder head should be carefully inspected for warpage and cracks. Always decarbonize and clean the head before inspecting it. A high quality straight edge can be used to check for warpage. See Fig. 4-65. Visually inspect the cylinder head for cracks. If a cracked cylinder head is suspected and no cracks are detected through the visual inspection, have the head further tested for cracks by an authorized BMW dealer. A cracked cylinder head should be replaced.

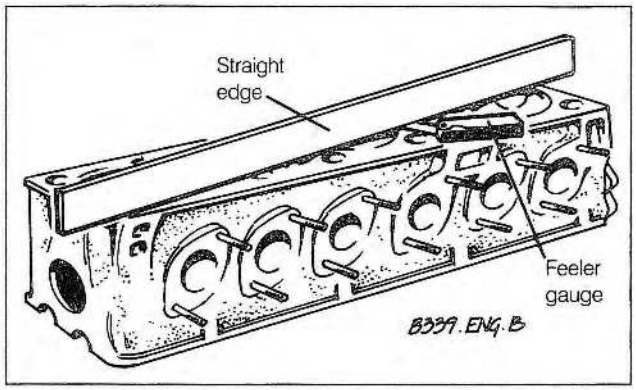


**Fig. 4-65.** Straight edge and feeler gauge being used to check straightness of cylinder head gasket surface.

A warped cylinder head can be machined provided no more than 0.3 mm (0.012 in.) of material is removed. If further machining is required, the head should be replaced. Removing more than this amount will reduce the size of the combustion chamber and adversely affect engine performance.

**NOTE**

A special gasket is available from an authorized BMW parts department for machined heads. The special gasket is 0.3 mm thicker than the original standard gasket.

Before machining the head to correct for warpage, measure the total height of the cylinder head as shown in Fig. 4-66. **Table i** lists the minimum resurfacing height specifications. If the cylinder head height will not meet the minimum height dimension after machining, the cylinder head should be replaced.

**NOTE**

When machining cylinder heads on 4-cylinder engines, the upper camshaft chain cover must be bolted to the cylinder head so that an identical amount of material is removed from each. Otherwise the upper camshaft chain cover would protrude below the cylinder head, preventing the cylinder head gasket from sealing properly.

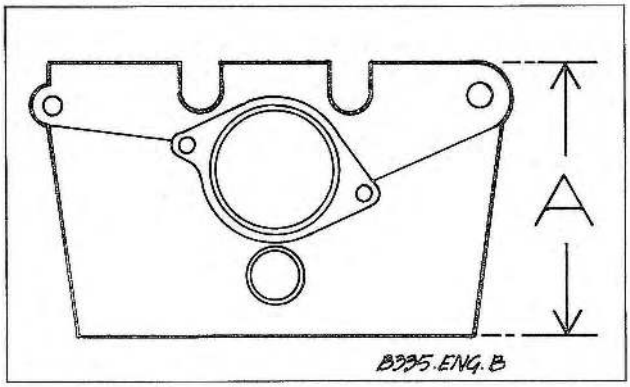


**Fig. 4-66.** Front view of cylinder head showing minimum resurfacing dimension (**A**). 6-cylinder engine shown.

**Table i. Cylinder Head Resurfacing Specifications**

| Engine | Minimum permissible height (dimension a) | |
|---|---|---|
| | new | after machining |
| 6-cylinder | 125.1 ± 0.1 mm (4.925 ± .004 in.) | 124.7 mm (4.909 in.) |
| 4-cylinder | 129.0 ± 0.1 mm (5.079 ± .004 in.) | 128.6 mm (5.063 in.) |

## Valve Guides

Special tools and a press are required to replace valve guides. It is also necessary to heat the cylinder head and to chill the valve guides. Check valve guide wear with a new valve as shown in Fig. 4-67. Inspect the valve seats to ensure that the cylinder head can be reconditioned before installing new valve guides.

**NOTE**

- If valve guide wear is greater than 0.8 mm (0.031 in.), but less than 1.0 mm (0.039 in.), the valve guide may be reamed out to accept valves with oversized stems as listed in **Table j**.
- If the radial clearance exceeds 1.0 mm (0.039 in.), the valve guide should be replaced.
- If valves with oversized stems are installed, the valve seat must also be machined to accept the new valve.

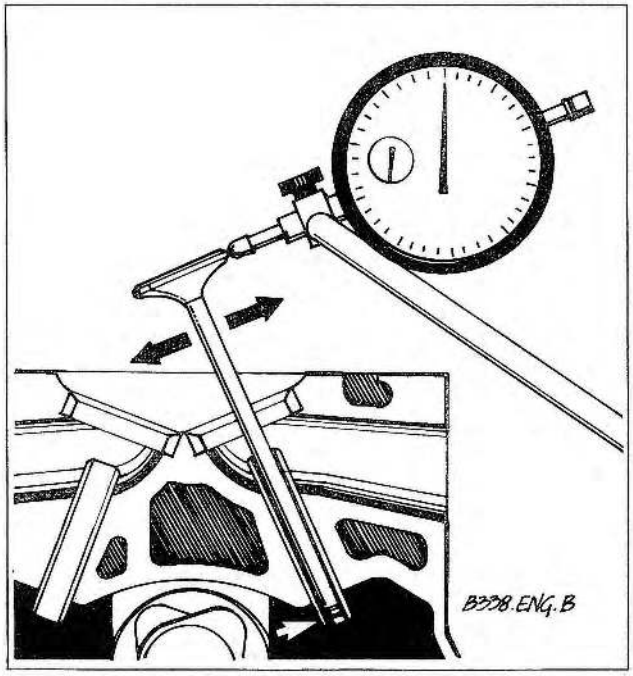


**Fig. 4-67.** Valve guide wear being checked with dial indicator. Insert new valve until stem end is flush with end of guide (white arrow). Play should not exceed 0.8 mm (0.031 in.).

Worn valve guides are driven out from the camshaft side of the cylinder head. The valve guides should be removed at room temperature. Install new valve guides from the camshaft side of the cylinder head with the stepped end of the valve guide facing the camshaft. Valve guide specifications, including correct installation temperatures, are listed in **Table j**.