7 Cylinder head and valves - cleaning and inspection

1 Thorough cleaning of the cylinder head and valve components, followed by a detailed inspection, will enable you to decide how much valve service work must be carried out during the engine overhaul. **Note:** *If the engine has been severely overheated, it is best to assume that the cylinder head is warped - check carefully for signs of this.*

Cleaning

2 Scrape away all traces of old gasket material from the cylinder head.

3 Scrape away the carbon from the combustion chambers and ports, then wash the cylinder head thoroughly with a suitable solvent.

4 Scrape off any heavy carbon deposits that may have formed on the valves, then use a power-operated wire brush to remove deposits from the valve heads and stems.

Inspection

Note:
Be sure to perform all the following inspection procedures before concluding that the services of a machine shop or engine overhaul specialist are required. Make a list of all items that require attention.

Cylinder head

5 Inspect the head very carefully for cracks, evidence of coolant leakage, and other damage. If cracks are found, a new cylinder head should be obtained.

6 Use a straight-edge and feeler gauge to check that the cylinder head gasket surface is not distorted **(see illustration)** . If it is, it may be possible to have it machined, provided that the cylinder head is not reduced to less than the specified height. **Note:** *If 0.012 inch (0.3 mm) is machined off the cylinder head, a 0.012 inch (0.3 mm) thicker cylinder head gasket must be fitted when the engine is reassembled. This is necessary in order to maintain the correct dimensions between the valve heads, valve guides and cylinder head gasket face.*

7.6 Checking the cylinder head gasket face for distortion

7 Examine the valve seats in each of the combustion chambers. If they are severely pitted, cracked, or burned, they will need to be renewed or re-cut by an engine overhaul specialist. If they are only slightly pitted, this can be removed by grinding-in the valve heads and seats with fine valve-grinding compound, as described later in this Section.

8 Check the valve guides for wear by inserting the relevant valve, and checking for side-to-side motion of the valve. A very small amount of movement is acceptable. If the movement seems excessive, remove the valve. Measure the valve stem diameter (see later in this Section), and replace the valve if it is worn. If the valve stem is not worn, the wear must be in the valve guide, and the guide must be reamed, and corresponding oversize (stem) valves fitted. The reaming of valve guides is best carried out by a BMW dealer or engine overhaul specialist, who will have the necessary tools available.

9 If reaming the valve guides, the valve seats should be re-cut or re-ground only *after* the guides have been reamed.

10 On six-cylinder engines, unscrew the oil pressure check valve from the bottom of the cylinder head. Check that the valve can be blown through from bottom-to-top, but not from top-to-bottom. Thoroughly clean the valve and fit a new O-ring, then install the valve to the cylinder head and tighten securely **(see illustration)** .

7.10 Fit a new O-ring to the cylinder head oil pressure check valve

11 Examine the bearing surfaces in the cylinder head or bearing castings (as applicable) and the bearing caps for signs of wear or damage.

12 Check the camshaft bearing casting mating faces on the cylinder head for distortion. Use a straight-edge and feeler gauge to check that the cylinder head faces are not distorted. If the distortion is outside the specified limit, the cylinder head and bearing castings must be renewed.

Valves

Warning:
The exhaust valves may be filled with sodium to improve their heat transfer. Sodium is a highly reactive metal, which will ignite or explode spontaneously on contact with water (including water vapor in the air). These valves must NOT be disposed of as ordinary scrap. Seek advice from a BMW dealer or your local authority when disposing of the valves.

13 Examine the head of each valve for pitting, burning, cracks, and general wear. Check the valve stem for scoring and wear ridges. Rotate the valve, and check for any obvious indication that it is bent. Look for pits or excessive wear on the tip of each valve stem. Replace any valve that shows any such signs of wear or damage.

14 If the valve appears satisfactory at this stage, measure the valve stem diameter at several points using a micrometer **(see illustration)** . Any significant difference in the readings obtained indicates wear of the valve stem. Should any of these conditions be apparent, the valve(s) must be renewed.

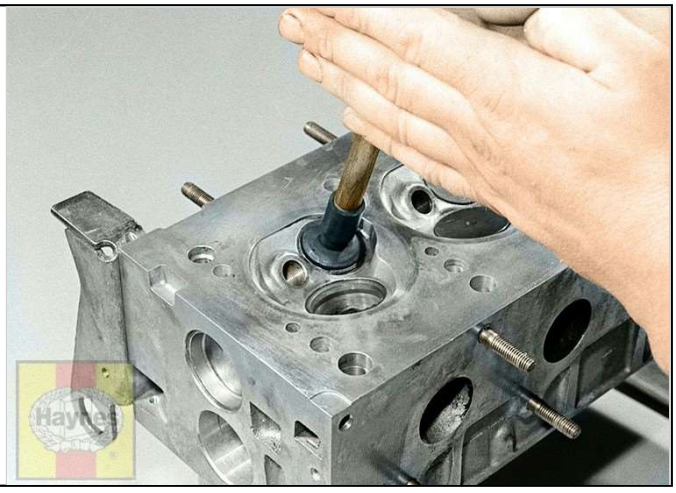
7.14 Measuring a valve stem diameter

15 If the valves are in satisfactory condition, they should be ground (lapped) into their respective seats, to ensure a smooth, gas-tight seal. If the seat is only lightly pitted, or if it has been re-cut, fine grinding compound *only* should be used to produce the required finish. Coarse valve-grinding compound should *not* be used, unless a seat is badly burned or deeply pitted. If this is the case, the cylinder head and valves should be inspected by an expert, to decide whether seat re-cutting, or even the replacement of the valve or seat insert (where possible) is required.

16 Valve grinding is carried out as follows. Place the cylinder head upside-down on a bench.

17 Smear a trace of (the appropriate grade of) valve-grinding compound on the seat face, and press a suction grinding tool onto the valve head **(see illustration)** . With a semi-rotary action, grind the valve head to its seat, lifting the valve occasionally to redistribute the grinding compound. A light spring placed under the valve head will greatly ease this operation.

7.17 Grinding-in a valve



18 If coarse grinding compound is being used, work only until a dull, matte even surface is produced on both the valve seat and the valve, then wipe off the used compound, and repeat the process with fine compound. When a smooth unbroken ring of light gray matte finish is produced on both the valve and seat, the grinding operation is complete. *Do not* grind-in the valves any further than absolutely necessary, or the seat will be prematurely sunk into the cylinder head.

19 When all the valves have been ground-in, carefully wash off *all* traces of grinding compound using a suitable solvent, before reassembling the cylinder head.

Valve components

20 Examine the valve springs for signs of damage and discoloration. No minimum free length is specified by BMW, so the only way of judging valve spring wear is by comparison with a new component.

21 Stand each spring on a flat surface, and check it for squareness. If any of the springs are damaged, distorted or have lost their tension, obtain a complete new set of springs. It is normal to replace the valve springs as a matter of course if a major overhaul is being carried out.

22 Replace the valve stem oil seals regardless of their apparent condition.

Cam followers/valve lifters

23 Examine the contact surfaces for wear or scoring. If excessive wear is evident, the component(s) should be renewed.