

116 Cylinder Head and Valvetrain

GENERAL	116-1	Camshaft	116-14
VALVE CLEARANCE	116-2	Rocker arms and rocker arm shafts (M30 engine)	116-15
Valve clearance, adjusting (M30 engine)	116-2	Valve guides	116-16
Hydraulic cam followers, checking and replacing (M60 engine)	116-4	Valves	116-17
Hydraulic valve adjusters (HVA), checking and replacing (M70 engine)	116-5	Testing valves for leakage	116-17
CAMSHAFT REPLACEMENT	116-6	Valve stem oil seals	116-18
Camshaft, removing and installing (M30 engine)	116-6	Valve seats	116-18
Camshafts, removing and installing (M60 engine)	116-9	Valve springs	116-18
Camshafts, removing and installing (M70 engine)	116-12		
CYLINDER HEAD AND VALVETRAIN RECONDITIONING	116-13	TABLES	
Cylinder head	116-13	a. Engine Application Codes	116-2
		b. Valve Clearance Specifications	116-3
		c. Camshaft Identification (M60 Engine)	116-11
		d. Cylinder Head Height	116-14
		e. Camshaft Specifications	116-14
		f. Valve Guide Specifications	116-16
		g. Valve Specifications	116-17
		h. Valve Seat Dimensions	116-19
		i. Valve Seat Replacement Specifications	116-20

GENERAL

This repair group covers cylinder head and valvetrain service and repair. Most of the repairs described here require that the cylinder head first be removed as described in **113 Cylinder Head Removal and Installation**.

NOTE—

- For cylinder head cover replacement information see **113 Cylinder Head Removal and Installation**.
- For timing chain repair information see **117 Camshaft Timing Chain**.

Special tools are required for most cylinder head service, disassembly and reconditioning described in this repair group. Be sure to read each procedure thoroughly before starting a job to determine which tools and equipment will be necessary.

NOTE—

If it is determined that the cylinder head will require significant reconditioning work, a remanufactured cylinder head may be a good alternative. Remanufactured cylinder heads are available from an authorized BMW dealer.

116-2 CYLINDER HEAD AND VALVETRAIN

The information given in this repair group is organized according to engine code. **Table a** is a basic list of engine application codes. For additional engine application information, see **100 Engine-General**.

Table a. Engine Application Codes

Model	Engine code
735i/735iL	M30 (single overhead cam 6-cylinder, 3,5 liter)
740i/740iL	M60 (dual overhead cam V-8, 4 liter)
750iL	M70 (single overhead cam V-12, 5 liter)

VALVE CLEARANCE

Only the M30 engine has mechanically adjustable valve clearances. The M60 and the M70 engines are designed using hydraulic cam followers or hydraulic valve adjusters (HVA) which need no adjustment.

Valve clearance, adjusting (M30 engine)

Valve adjustment on the M30 engine should be done as part of scheduled maintenance. For a listing of recommended adjustment intervals, see **020 Maintenance**.

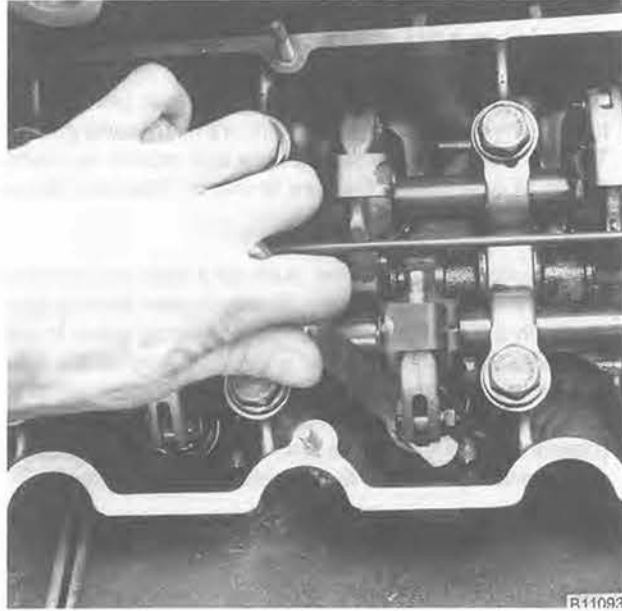
A special tool (BMW Tool No. 11 3 070) is available to help turn the rocker arm eccentric when setting valve clearances. As an alternative, a tool can be easily fabricated from stiff wire (approximate diameter of 3/32 in.). The valves can be adjusted with the engine hot or cold.

- Remove cylinder head cover as described in **113 Cylinder Head Removal and Installation**.
- Using socket wrench on vibration damper nut, hand-turn crankshaft clockwise until no. 1 cylinder camshaft lobes are pointing approximately down (valves fully closed).

NOTE—

- * No. 1 cylinder is closest to the radiator.
- * It is much easier to reach the crankshaft vibration damper nut after removing the radiator cooling fan and plastic radiator cowl as described in **170 Radiator and Cooling System**.
- * Crankshaft rotation is easier if you remove the spark plugs.

CYLINDER HEAD AND VALVETRAIN 116-3



- Measure valve clearances of no. 1 cylinder intake and exhaust valves using a feeler gauge. Compare measured clearance values with specifications listed in **Table b.**

Table b. Valve Clearance Specifications

Engine	Engine warm— coolant temp. above 176°F (80°C)	Engine cold— coolant temp. below 95°F (35°C)
M30	0.35 mm (0.014 in)	0.30 mm (0.012 in)

NOTE—

Valve clearance specifications for both intake and exhaust valves are the same.



- To adjust valve clearance, loosen setscrew locknut (A) with a 10 mm box-end wrench. Rotate eccentric (B) until specified clearance is obtained and tighten nut.

Tightening Torque

- Rocker arm eccentric locknut 10 ± 1 Nm (89 ± 0.9 in-lb)

- Repeat adjusting procedure for each pair of valves. Follow sequence listed below. Rotate crankshaft until camshaft lobes for next cylinder are pointing approximately down (valves fully closed).

NOTE—

Rotate crankshaft approximately 1/3 of a turn (120°) between adjustments.

Valve Adjustment Sequence

- Cylinder no. 1-5-3-6-2-4

- Recheck all clearances before installing cylinder head cover. This will require two complete rotations of crankshaft pulley.

VALVE CLEARANCE

116-4 CYLINDER HEAD AND VALVETRAIN

Hydraulic cam followers, checking and replacing (M60 engine)

The M60 engine uses self-adjusting hydraulic cam followers to keep the valve clearances within a limited working range. The cam followers are sealed units and require no maintenance or adjustment. Be sure to inspect the cam follower bores for wear or scoring.

Under some circumstances, such as a cold start, the cam followers may become noisy. Hydraulic cam follower noise is usually a high-pitched tapping or chattering noise. In most instances, this is considered normal as long as the noise goes away in a few minutes (maximum 20 minutes). If the noise does not go away, either the follower is faulty or the oil pressure to the follower is low. Hydraulic cam follower replacement requires that the camshaft first be removed.

- Run engine until it reaches normal operating temperature.
- Turn engine off and remove top engine covers, ignition coils, and cylinder head covers. See **113 Cylinder Head Removal and Installation**.
- Turn engine in direction of normal rotation until cam lobes of follower to be checked are pointing away from follower.
- Using plastic or wooden stick, press down on top of follower. If there is any noticeable clearance, lifter is faulty and should be replaced.

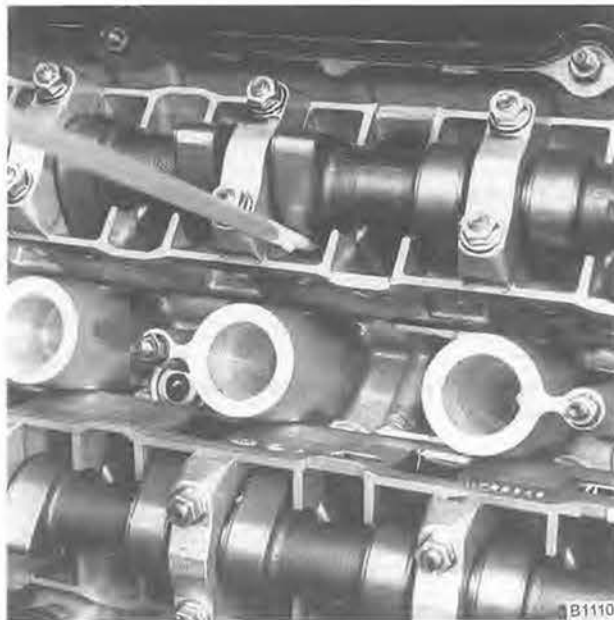
NOTE—

When checking the lifter, make sure the camshaft lobe is facing up so that there is no valve spring pressure on the cam follower.

- If a cam follower is faulty, remove camshaft and withdraw follower as described under **Camshafts, removing and installing (M60 engine)**.

Tightening Torque

- Cylinder head cover to cylinder head/
timing chain cover
- | | |
|----------|------------------|
| M6. | 10 Nm (89 in-lb) |
| M7. | 15 Nm (11 ft-lb) |



VALVE CLEARANCE

**Hydraulic valve adjusters (HVA),
checking and replacing (M70 engine)**

The M70 engine uses hydraulic valve adjusters (HVA) to keep valve clearances within a limited working range. HVAs are sealed units and require no maintenance.

Under some circumstances, such as a cold start, the hydraulic units may become noisy. HVA noise is usually a high-pitched tapping or chattering noise. In most instances, this is considered normal as long as the noise goes away in a few minutes (maximum 20 minutes). If the noise does not go away, either the HVA is faulty or the oil pressure to it is low.

NOTE—

Before checking valve adjusters, make sure engine oil is fresh and at proper level.

- Run engine until it reaches normal operating temperature.
- Turn engine off and remove cylinder head covers. See **113 Cylinder Head Removal and Installation**.
- Rotate engine in normal direction until cam lobe points away from lifter to be checked.
- Use a plastic or wooden stick to press down on top of rocker arm end (side away from camshaft). If any play can be detected, the HVA is faulty and should be replaced.

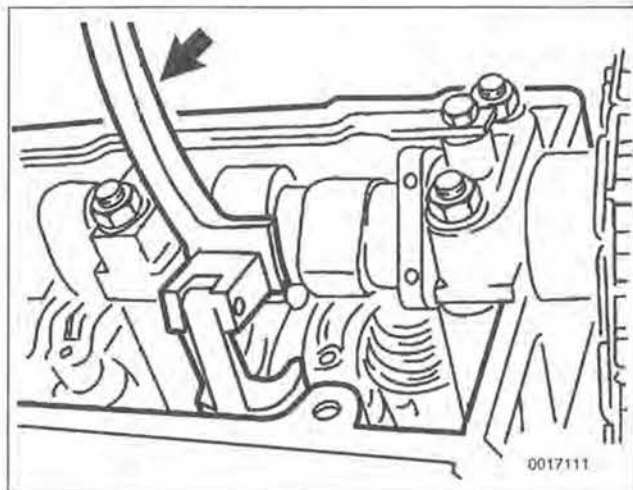
NOTE—

When checking the HVA, make sure the camshaft lobe is facing up so that there is no valve spring pressure on the adjuster.

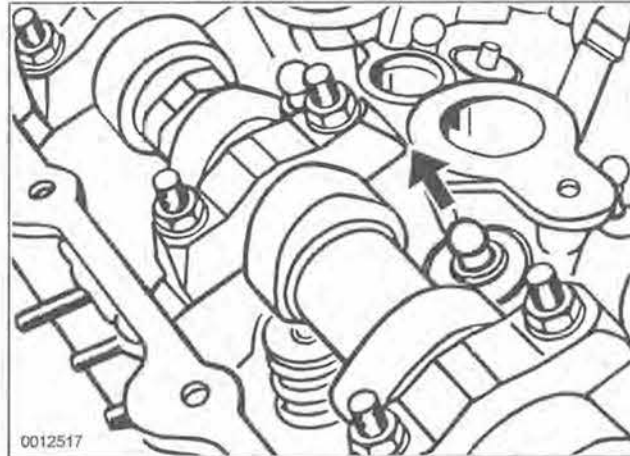
- To remove an HVA, turn engine over until camshaft lobe points straight up. Using BMW special tool no. 11 5 180 (arrow), depress valve spring and remove rocker arm from under camshaft.

CAUTION—

Removed rocker arms must be reinstalled in the same locations.



116-6 CYLINDER HEAD AND VALVETRAIN



➤ Pull hydraulic valve adjuster straight out (arrow) of cylinder head.

- Installation is reverse of removal. Be sure to inspect HVA bore in the cylinder head for wear or scoring.

NOTE—

Store removed HVAs upright to prevent oil leakage.

Tightening Torque

- Cylinder head cover to cylinder head/timing chain cover
 - M6 bolt 10 Nm (89 in-lb)
 - M7 bolt 15 Nm (11 ft-lb)

CAMSHAFT REPLACEMENT

Some of the disassembly procedures recommend the use of BMW special tools. Many of these tools are expensive and are only available through an authorized BMW dealer. If the special tools are not available, one alternative is to remove the cylinder head and have it disassembled by an authorized BMW dealer. Be sure to read each procedure thoroughly before starting a job to determine which special tools and equipment will be necessary.

NOTE—

On the M30 engine the cylinder head must be removed before removing the camshaft.

Camshaft, removing and installing (M30 engine)

- Remove cylinder head as described in 113 Cylinder Head Removal and Installation.
- Remove oil sprayer bar mounting bolt from center of head. Discard bolt and crush-type washers.
- Adjust all valve clearances so that hole in eccentric cam points inward (maximum clearance).
- Rotate camshaft until cutouts in front flange are aligned with guide plate mounting bolts on front of cylinder head. Remove two bolts.

NOTE—

At this point, valve spring pressure on the camshaft must be relieved. This can be done in one of two ways. The first method requires the BMW special tool (BMW tool no. 11 1 060), which is a large press that mounts over the top of the entire head and presses down on all of the rocker arms. The second method is to manually lever the necessary rocker arms down using appropriate tools. Once the pressure on the camshaft is relieved, it can be easily withdrawn from the head.

CYLINDER HEAD AND VALVETRAIN 116-7

- Where available, install BMW special tool no. 11 1 060 to top of cylinder head and tighten clamping nuts on exhaust side first. Then tighten intake side clamping nuts, making sure valve heads don't contact each other. Pull camshaft out of head.

CAUTION—

- When tightening down the BMW special tool, be sure to tighten the exhaust side first to prevent damaging the valves.
- The BMW special tool may not work on cylinder heads with non-factory (aftermarket) camshafts. If an aftermarket camshaft is installed, watch the valves as the tool is slowly tightened into place.

- If special tool is not available, rotate camshaft until least number of rocker arms are exerting pressure on camshaft. Relieve pressure on remaining rocker arms by levering them down using a helper(s), and pull camshaft out of head.

WARNING—

The valves are under considerable pressure from the valve springs. Use extreme care when depressing the rocker arms. Wear hand and eye protection.

- Remove rear cover plate from back of head. Note location of sealing washer and O-ring on one of cover mounting bolts.

NOTE—

Always replace the rear cover sealing washer and O-ring to prevent oil leaks.

- Remove rocker arm retainers (**arrow**) by sliding rocker arms and thrust rings to side and prying off thin retaining rings.

- Remove threaded end plugs from front and rear of rocker arm shafts.

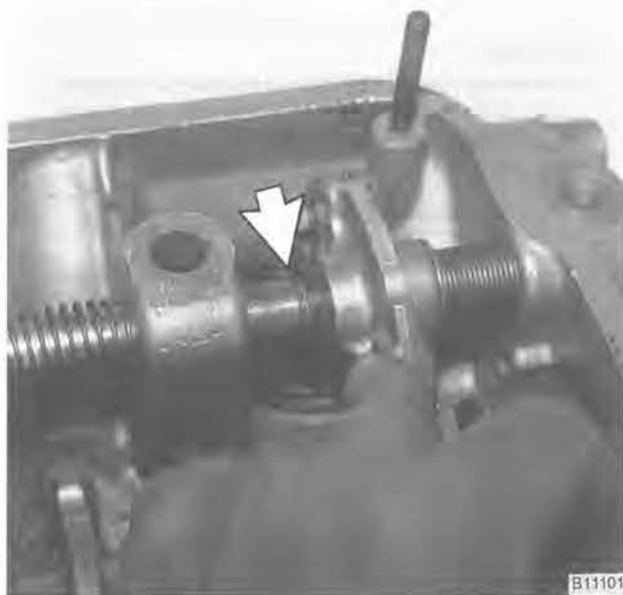
NOTE—

If the shaft turns while trying to remove the plug, place a cylinder head bolt in a cylinder head bolt hole.

- Remove rocker arm shafts by either driving them out using a long drift or pulling them out using a slide hammer that threads into threaded end of rocker arm shaft. Catch springs as shafts are removed.

CAUTION—

If drifting the shaft out, strike the drift using firm, hard blows while holding the head steady. Tapping on the drift will cause the end of the shaft to mushroom, making it difficult to remove and possibly damaging the head. If the end of the shaft does become mushroomed, use a small grinding stone or equivalent to redress the end of the shaft.



CAMSHAFT REPLACEMENT

116-8 CYLINDER HEAD AND VALVETRAIN

NOTE—

Label all parts as they are removed so they can be reinstalled in their original positions. The M30 cylinder head uses a two-piece rocker arm shaft. The intake-side shafts are different from the exhaust side shafts as are the front and rear sections of each shaft.

- Remove valves using a standard C-type valve spring compressor. Label each valve assembly as it is removed. Remove and discard valve stem oil seals from valve guides.
- Reassembly is reverse of disassembly.
 - Prior to installation, check all components for wear as described below under **Cylinder Head and Valvetrain Reconditioning**.
 - Be sure all parts are installed in their original positions. When installing rocker arm shafts, the longer of two shafts goes toward front of cylinder head, with plugged ends facing out.
 - Make sure cutouts for head bolts are correctly aligned and oil holes for rocker arms face valve stems.
 - Use Loctite® 270 or equivalent when installing rocker shaft end plugs.
 - Lubricate camshaft prior to installation. If camshaft is being replaced, transfer camshaft flange parts from old shaft to new shaft.

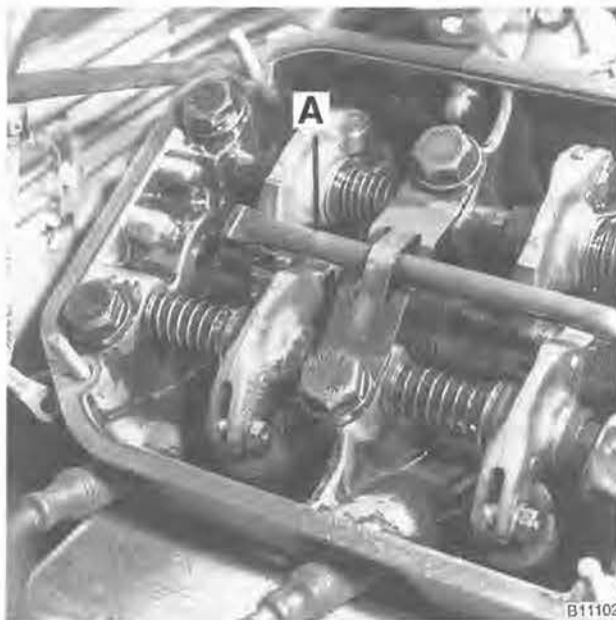
- ◀ When installing oil sprayer bar, make sure arrow (A) on tube faces front of cylinder head and new center mounting bolt has a new crush-type washer on either side of tube.

NOTE—

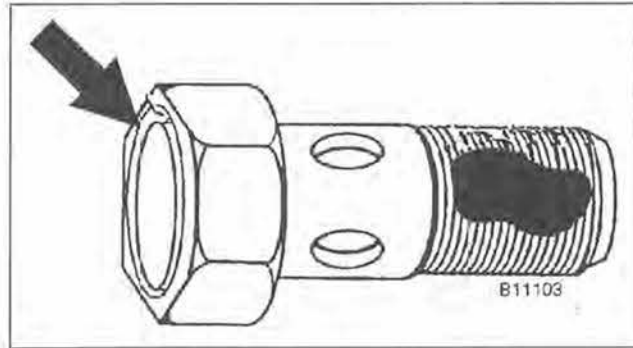
If the arrow is not visible, turn the tube upside down and position it on the cylinder head. The oil holes should be directly above the cam lobes.

CAUTION—

- An incorrectly installed or loose oil sprayer bar will cause accelerated camshaft wear. Be sure to use a new center bolt and new washers. If the old bolt is reinstalled, there is danger of it loosening.
- Hollow bolt has to be installed in bearing cap #3.



CYLINDER HEAD AND VALVETRAIN 116-9



Use new sprayer bar hollow bolt with machined groove (arrow) in bolt head.

- Bolt is pre-coated with a locking compound and should not be reused once torqued.

Tightening Torques

- Flange to camshaft (large nut) 145 Nm (107 ft-lb)
- Ignition rotor adaptor (install with Loctite® 270 or equivalent) 23 ± 1 Nm (16.5 ± 0.5 ft-lb)
- Oil sprayer bar to cylinder head (new hollow bolt and washers) 11 to 13 Nm (8 to 10 ft-lb)

Camshafts, removing and installing (M60 engine)

NOTE—

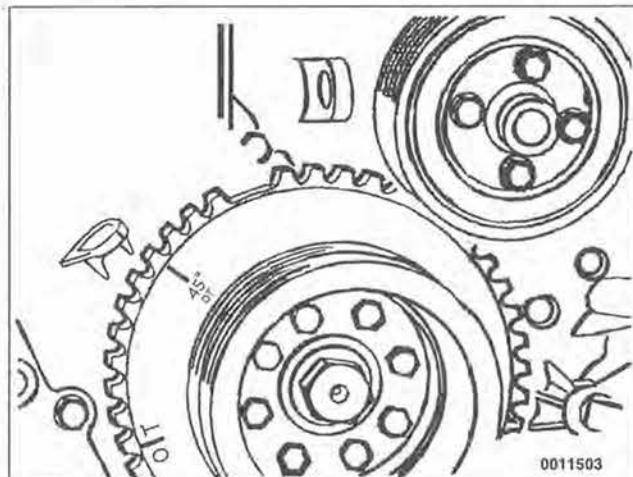
- Be sure all used parts are reinstalled in their original positions.
- Cylinder no. 1 is at the front right (passenger) side of the engine. The right cylinder head is for cylinders 1 through 4. The left cylinder head is for cylinders 5 through 8.

Remove camshaft timing chain and sprockets from camshaft. See 117 **Camshaft Timing Chain**.

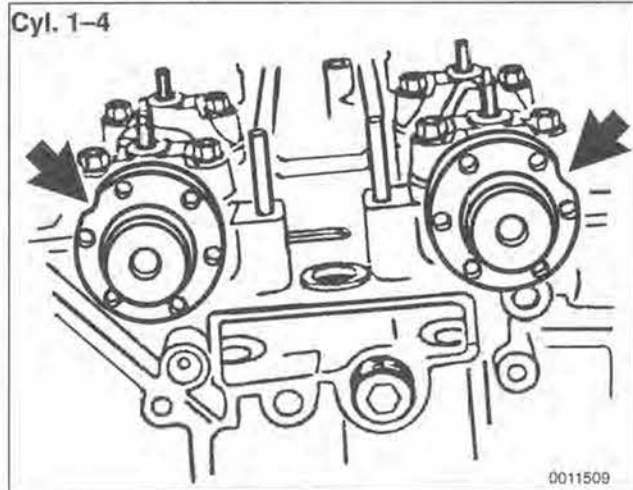
Rotate engine to 45° before TDC setting.

CAUTION—

Rotate engine in opposite direction of normal rotation.



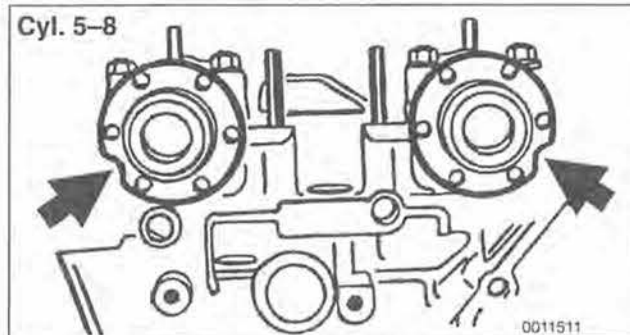
Cyl. 1-4



Right Cylinder Head (passenger side): Carefully turn camshafts so that cutouts (arrows) in camshaft flanges are pointing up approximately 30° - 40° from horizontal plane.

CAMSHAFT REPLACEMENT

116-10 CYLINDER HEAD AND VALVETRAIN



➤ **Left Cylinder Head** (driver side): Carefully turn camshafts so that cutouts (**arrows**) in camshaft flanges are pointing **down** approximately 30° - 40° from horizontal plane.

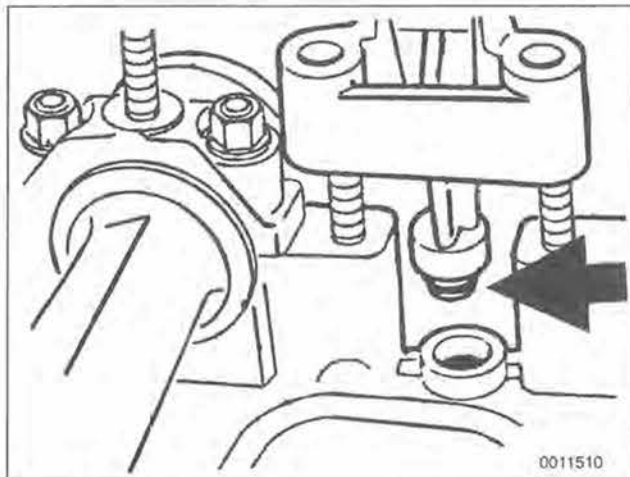
NOTE—

A special jig (BMW special tool no. 11 2 430) is available to check the removal and installation positions of the camshafts.

- Loosen camshaft bearing cap mounting nuts in stages (½ turn per stage), working from outside to inside until valve spring pressure is relieved.
- Remove camshaft bearing caps. Remove camshafts.
- Carefully remove hydraulic cam followers. Label each follower as it is removed.

CAUTION—

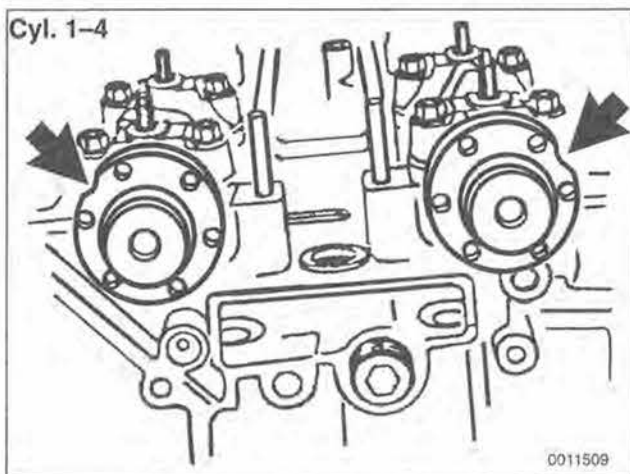
- Use care not to damage the cam follower bores when removing the cam followers. Special suction cups are available from BMW (special tool no. 11 3 250) to remove the followers from the cylinder head.
- The removed cam followers should be stored in an upright position.



- Check all components for wear as described below under **Cylinder Head and Valvetrain Reconditioning**.

➤ When reinstalling hydraulic timing chain tensioner, be sure to use correctly positioned new O-ring (**arrow**).

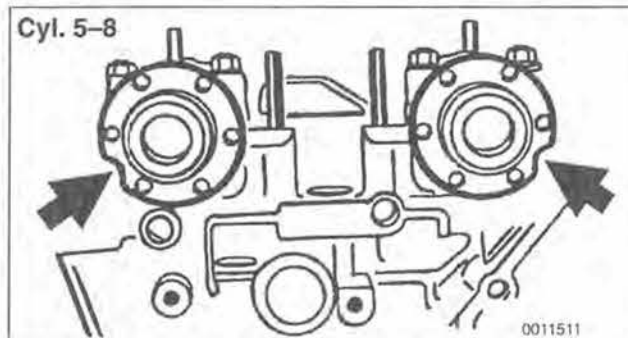
- Lubricate camshafts prior to installation.



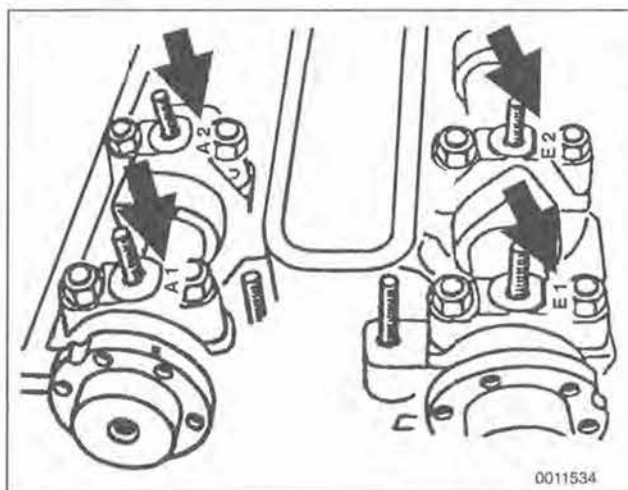
➤ **Right Cylinder Head** (passenger side): Before reinstalling timing chain, carefully turn camshafts so that cutouts (**arrows**) in camshaft flanges are pointing **up** approximately 30° - 40° from horizontal plane.

CAMSHAFT REPLACEMENT

CYLINDER HEAD AND VALVETRAIN 116-11



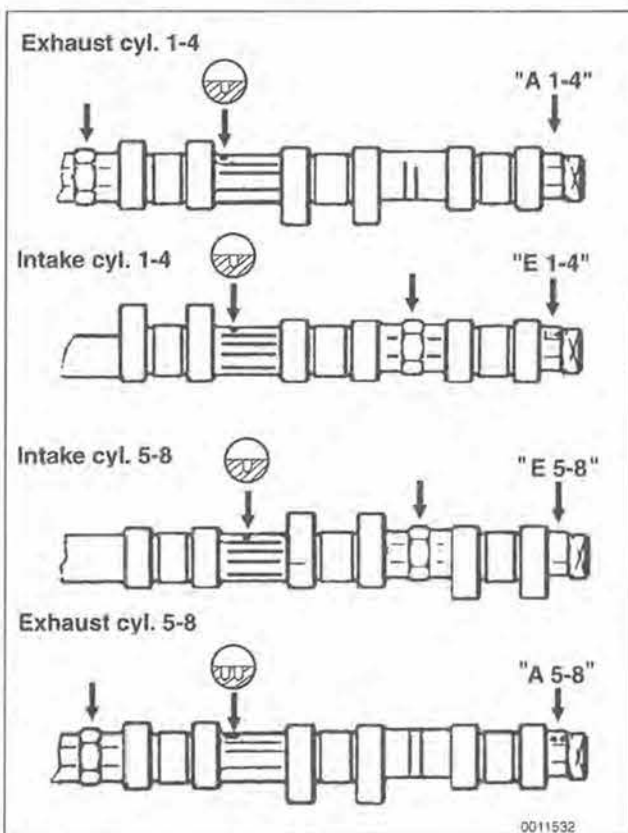
➤ **Left Cylinder Head (driver side):** Before reinstalling timing chain, carefully turn camshafts so that cutouts (**arrows**) in camshaft flanges are pointing **down** approximately 30° - 40° from horizontal plane.



➤ Camshaft bearing caps (**arrows**) are coded with a letter and a cylinder number. For example, "A1" is the exhaust camshaft bearing cap for cylinder no. 1 and "E1" is the intake camshaft bearing cap for cylinder no. 1.

CAUTION—

Bearing caps A1 to A4 are for exhaust camshaft.
Bearing caps E1 to E4 are for intake camshaft.



➤ Similarly, camshafts are marked with a code letter and cylinder number. For example, "E1-4" is the intake camshaft for cylinders 1 through 4. Refer to **Table c** for a listing of camshaft identification markings.

Table c. Camshaft Identification (M60 engine)

Identification/ markings	Right cylinder head (cylinders 1-4)	Left cylinder head (cylinders 5-8)
Installed position		
Intake	E1-4	E5-8
Exhaust	A1-4	A5-8
Hexagon location		
Intake	between cyl. 3/4	between cyl. 7/8
Exhaust	between cyl. 1/2	between cyl. 5/6
Hole marking		
Intake	one hole	one hole
Exhaust	one hole	two holes

- Reset camshaft timing as described in **117 Camshaft Timing Chain**.
- Remainder of reassembly is reverse of disassembly.

CAMSHAFT REPLACEMENT

116-12 CYLINDER HEAD AND VALVETRAIN

Tightening Torques (M60 engine)

- Camshaft bearing caps to cylinder head 15 Nm (11 ft-lb)
- Camshaft sprocket to camshaft 15 Nm (11 ft-lb)

Camshafts, removing and installing (M70 engine)

The procedures used to remove either the left or the right camshaft in the M70 engine are similar. A camshaft can be removed with the cylinder head installed on the engine or removed and mounted on a work bench.

- Remove both cylinder head covers as described in **113 Cylinder Head Removal and Installation**.
- If a valve job or other cylinder head work is necessary, remove cylinder head as described in **113 Cylinder Head Removal and Installation**.
- Remove all spark plugs.
- Remove camshaft oil sprayer bar.

- Turn camshaft over until camshaft lobe points straight up. Using BMW special tool no. 11 5 180 (arrow), depress valve spring and remove rocker arm from under camshaft.

CAUTION—

Removed rocker arms must be reinstalled in the same locations.

- Remove distributor housings, top timing case cover and camshaft timing chain sprockets as described in **117 Camshaft Timing Chain**.
- Remove camshaft position sensor, if necessary.
- Remove camshaft bearing caps and lift out camshaft.

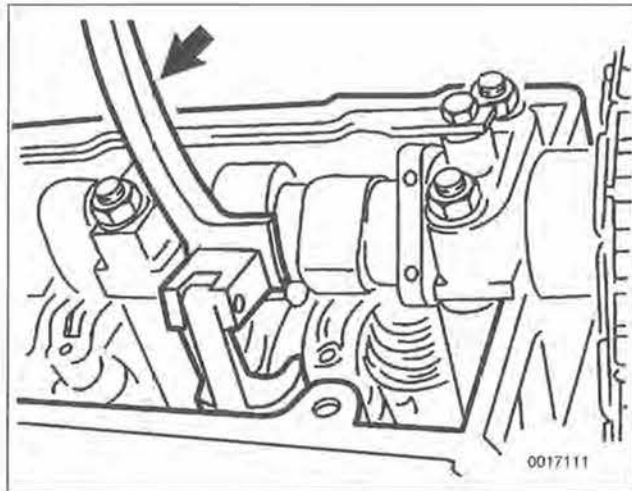
CAUTION—

Camshaft bearing caps must be reinstalled in the same locations. Note the factory numbering on the castings.

- Carefully remove hydraulic valve adjusters (HVA) as described earlier. Label each HVA as it is removed.

CAUTION—

- Use care not to damage the HVA bores when removing the HVAs.
- The HVAs should be stored in an upright position.



CYLINDER HEAD AND VALVETRAIN 116-13

- Reassembly is reverse of disassembly.
- Check all components for wear as described below under **Cylinder Head and Valvetrain Reconditioning**.
- Be sure all parts are installed in their original positions.
- Lubricate camshafts and HVAs prior to installation.
- Install camshaft oil sprayer bar with oil injector bores pointing toward camshaft.
- Use new copper sealing gaskets when installing camshaft oil sprayer bar.

Tightening Torques (M70 engine)

- Camshaft bearing caps to cylinder head (M7) 15 Nm (11 ft-lb)
- Camshaft oil sprayer bar (M8) 12 Nm (98 in-lb)
- Camshaft sprocket to camshaft (M6) . 10 Nm (89 in-lb)

CYLINDER HEAD AND VALVETRAIN RECONDITIONING

This section provides the specifications and special reconditioning information necessary to repair the cylinder heads covered by this manual.

NOTE —

All procedures in this repair group require removal of cylinder head(s) and camshaft(s).

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.

Cylinder head

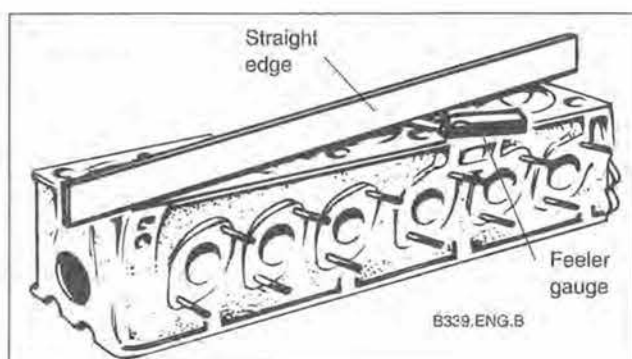
- ◀ Straight edge and feeler gauge used to check straightness of cylinder head gasket surface.

The disassembled cylinder head should be inspected for warpage and cracks. Check the valve guides and valve seats for wear before machining a warped head. Always decarbonize and clean the head before inspecting it. A high-quality straight edge can be used to check for warpage.

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.

NOTE —

BMW does not give cylinder head warpage specifications for the engines in the 7 Series cars.



CYLINDER HEAD AND VALVETRAIN RECONDITIONING

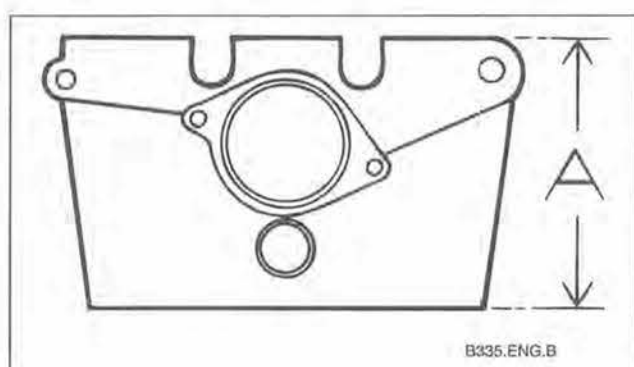
116-14 CYLINDER HEAD AND VALVETRAIN

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. A 0.3 mm thicker gasket is available from an authorized BMW parts department.

Before machining the head to correct for warpage, measure the total height of the cylinder head. Minimum resurfacing height specifications are given below. 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 M30 and M60 engines, the upper camshaft timing chain cover and the rear cover (M30 only) should be bolted to the cylinder head before machining.



Front view of cylinder head showing minimum resurfacing dimension (A). (Single cam cylinder head shown. Dual cam head similar.)

Table d. Cylinder Head Height

Engine	New	Minimum permissible height (dimension A)
M30	129.0 ± 0.1 mm (5.079 ± 0.004 in)	128.6 mm (5.063 in)
M60	140.0 ± 0.05 mm (5.512 ± 0.002 in)	139.7 ± 0.05 mm (5.500 ± 0.002 in)
M70	140.0 ± 0.05 mm (5.512 ± 0.002 in)	139.8 ± 0.05 mm (5.504 ± 0.002 in)

Camshaft

Camshaft wear is usually caused by insufficient lubrication. On M30 and M70 engines the installation of the oil sprayer bar is critical. A clogged sprayer bar or a loose sprayer bar mounting bolt will reduce oil flow to the camshaft. Visually inspect the removed camshaft lobes and journals for wear. Camshaft wear specifications are given in Table e.

Table e. Camshaft Specifications

Axial play	
M30 engine	0.03-0.18 mm (0.0012 to 0.0071 in)
M60 engine	0.10-0.28 mm (0.004-0.011 in)
M70 engine	0.15-0.33 mm (0.006-0.013 in)
Radial play (Plastigage)	
M30 engine	N/A
M60 engine	0.040-0.074 mm (0.0016-0.0029 in)
M70 engine	0.040-0.074 mm (0.0016-0.0029 in)
Camshaft lobe height	
1994- M60 engine	
Intake	47.7 ± 0.06 mm (1.8780 ± 0.0024 in)
Exhaust	47.4 ± 0.06 mm (1.8661 ± 0.0024 in)

NOTE—

- If the camshaft is being replaced due to cam lobe wear, the corresponding rocker arms or cam followers should also be replaced to avoid damaging the new camshaft.
- On an M30 engine experiencing camshaft wear, a special hardened camshaft may be available from BMW. Check with an authorized BMW dealer parts department for the latest parts information. (BMW Service-Information Bulletin 11 07 88-1767.)

Rocker arms and rocker arm shafts (M30 engine)

Rocker arms and rocker arm shafts are components that wear and are usually the cause of valve train noise. Although valve train noise may indicate worn rocker arms or rocker arm shafts, valve train noise may also be caused by incorrect valve clearances or other engine wear. Valve clearance adjustment is described above under **Valve clearance, adjusting (M30 engine)**.

NOTE—

To replace rocker arms or rocker arm shafts, the cylinder head must be removed. See 113 **Cylinder Head Removal and Installation**.

- First check the rocker arm bushings for wear. If the lower part of the bushing is shiny and rough, the rocker arm is worn. A good rocker arm bushing surface will have a dull, smooth finish all around. Continue checking the rocker arms by installing them on a known good rocker arm shaft. There should be no noticeable play in any direction. The exhaust-side rocker arms are the most susceptible to wear. If the rocker arm or shafts show any visible signs of wear, they should be replaced.



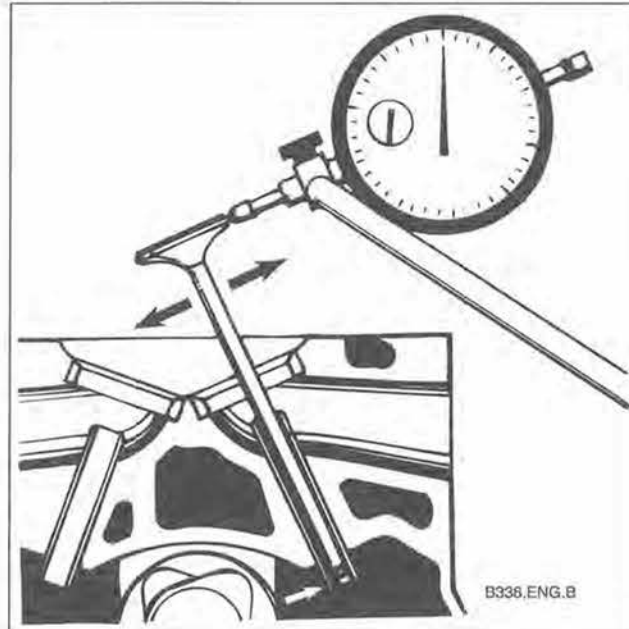
B11108

CAUTION—

Some M30 engines produced between September 1992 and April 1993 may have faulty rocker arms installed. On vehicles so equipped, the rocker arm bushings can slide out of the rocker arms, causing the valves to jam at the rocker arm eccentrics and result in engine damage. Contact an authorized BMW dealer for vehicle chassis ranges and additional information on this problem.

Rocker Arm Specifications

- Radial play . . . 0.016 to 0.052 mm (0.0006 to 0.002 in)



Valve guides

BMW does not supply valve guides as replacement parts. If a valve guide is excessively worn, the valve guides should be reamed to accept oversized valve stems. Valve guide specifications are listed in **Table f**.

- ▶ Valve guide wear being checked with dial indicator. Insert new valve until stem end is flush with end of guide (**white arrow**). See **Table f** for wear limits.

Valve guides must be checked for wear using a new valve. Be sure to inspect the valve seats to ensure that the cylinder head can be reconditioned before reworking the valve guides.

NOTE—

- International Organization for Standardization (ISO) tolerance classes are listed in **Table f**. ISO allowances are based on nominal sizes and should be used to determine proper fits. Most machine shops should have this information readily available.
- BMW supplies oversize valves. See **Valves** for additional information.
- Replacement valve guides may be available through after-market suppliers. Valve guide replacement requires special tools and a press. It is also necessary to heat the cylinder head and chill the valve guides when replacing the guides.

Table f. Valve Guide Specifications

Specification	M30 Engine	M60 Engine	M70 Engine
Valve guide wear, maximum (valve tilt clearance measured with new valve)	0.8 mm (0.031 in)	0.5 mm (0.020 in)	0.5 mm (0.020 in)
Valve guide inside diameter, installed (tolerance per ISO allowance H7)			
Standard	8.0 mm (0.315 in)	6.0 mm (0.236 in)	7.0 mm (0.275 in)
Oversize 1	8.1 mm (0.319 in)	6.1 mm (0.240 in)	7.1 mm (0.280 in)
Oversize 2	8.2 mm (0.323 in)	6.2 mm (0.244 in)	7.2 mm (0.283 in)

CYLINDER HEAD AND VALVETRAIN 116-17

Valves

Valve specifications are listed below in **Table g**. Remove carbon deposits from the valves using a wire brush or wire wheel.

CAUTION—

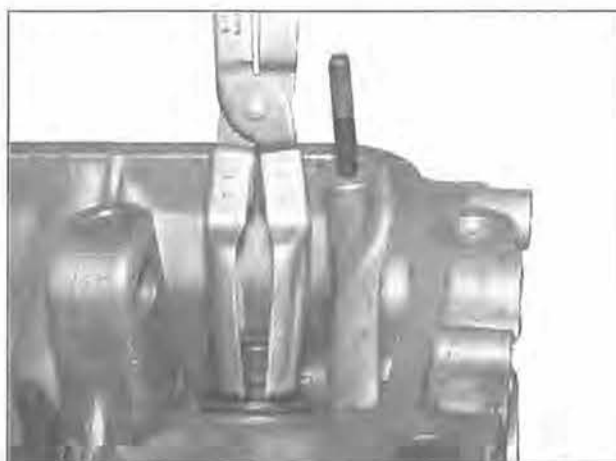
Special procedures are required when disposing of sodium filled exhaust valves.

Table g. Valve Specifications

Specification	M30 Engine	M60 Engine	M70 Engine (to 4/90)	M70 Engine (from 4/90)
Valve head diameter				
Intake	47 mm (1.850 in)	35.0 mm (1.378 in)	42.0 mm (1.654 in)	42.0 mm (1.654 in)
Exhaust	38 mm (1.496 in)	30.5 mm (1.201 in)	35.0 mm (1.378 in)	36.0 mm (1.417 in) (sodium filled exhaust)
Min. valve head thickness				
Intake	1.3 mm (0.051 in)	N/A	N/A	N/A
Exhaust	2.0 mm (0.079 in)	N/A	N/A	N/A
Valve stem diameter				
Standard				
Intake	8.0 mm (0.315 in)	5.975–0.015 mm (0.235–0.0006 in)	6.975–0.015 mm (0.2746–0.0006 in)	6.975–0.015 mm (0.2746–0.0006 in)
Exhaust	8.0 mm (0.315 in)	5.960–0.015 mm (0.2346–0.0006 in)	6.960–0.015 mm (0.2740–0.0006 in)	6.960–0.015 mm (0.2740–0.0006 in)
Oversize 1				
Intake	8.1 mm (0.319 in)	6.075–0.015 mm (0.239–0.0006 in)	7.075–0.015 mm (0.2785–0.0006 in)	7.075–0.015 mm (0.2785–0.0006 in)
Exhaust	8.1 mm (0.319 in)	6.060–0.015 mm (0.239–0.0006 in)	7.060–0.015 mm (0.2779–0.0006 in)	7.060–0.015 mm (0.2779–0.0006 in)
Oversize 2				
Intake	8.2 mm (0.323 in)	6.175–0.015 mm (0.243–0.0006 in)	7.175–0.015 mm (0.2824–0.0006 in)	7.175–0.015 mm (0.2824–0.0006 in)
Exhaust	8.2 mm (0.323 in)	6.160–0.015 mm (0.243–0.0006 in)	7.160–0.015 mm (0.2818–0.0006 in)	7.160–0.015 mm (0.2818–0.0006 in)

Testing valves for leakage

To test the valves for leakage, the camshaft and rocker arm assemblies (where applicable) should first be removed. Install the valve assemblies and the spark plugs in each cylinder. Place the cylinder head on a workbench with the combustion chamber facing upward. Fill each combustion chamber with a thin non-flammable liquid, such as a parts cleaning fluid. After fifteen minutes, check the level of the fluid. If the fluid level in any cylinder drops, that cylinder is not sealing properly.



B11109

Valve stem oil seals

The purpose of the valve stem oil seal is to prevent excess oil from entering the combustion chamber. The sign of faulty valve stem oil seals is excessive oil consumption and smoke from the exhaust immediately after starting and during deceleration.

NOTE—

Valve stem oil seals should not be reused. If the valves are removed, new valve stem oil seals should be installed.

- Using BMW special tool no. 11 1 250, remove the valve stem oil seals on M30 valves. As an alternative, standard valve seal removal tools are available from most automotive parts stores.

When installing the valve stem oil seals, the use of BMW special tool 11 1 200 is recommended. Lubricate the new seals and install them using hand pressure only. Be sure to install the valve spring seat before installing the seal.

Valve seats

The valve seats should be resurfaced whenever new valves or valve guides are installed. Cutters are required to resurface the seats. Always check the valves for leaks after reconditioning a valve seat as described above.

NOTE—

Standard size replacement valve seats are not available from BMW. Replacement valve seats are only available from BMW in 0.4 mm oversize (oversized in both height and diameter).

Replacing the valve seats requires heating the cylinder head and chilling the valve seats to a specific temperature as listed in **Table h**. When installing new valve seats, they should be installed flush to the cylinder head surface.

Table h lists valve seat dimensions. **Table i** lists valve seat replacement specifications, including correct installation temperatures.

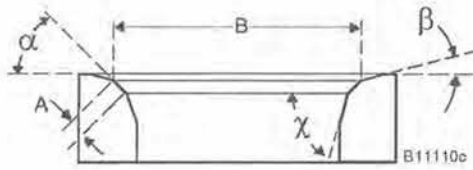
Valve springs

Valve springs should be checked for squareness and fatigue. To quickly check the springs, line them up in a row. Place a straight edge across the top of the springs. Any spring that is significantly shorter than the others is significantly worn and should be replaced. Use a high quality square to check spring out of squareness. Any spring that is out of square should be replaced.

NOTE—

Valve spring specifications and wear limits are not available from BMW.

Table h. Valve Seat Dimensions

			
Specification	M30 Engine	M60 Engine	M70 Engine
Valve seat angle (α)	45°	45°	45°
Correction angle, outside (β)	15°	15°	15°
Correction angle, inside (γ)	60°	60°	60°
Valve seat width (A)			
Intake	1.4 ± 0.4 mm (0.055 ± 0.016 in)	1.25 ± 0.25 mm (0.049 ± 0.014 in)	1.65 ± 0.25 mm (0.065 ± 0.014 in)
Exhaust	1.7 ± 0.4 mm (0.067 ± 0.016 in)	1.65 ± 0.25 (0.065 ± 0.014 in)	2.00 ± 0.25 mm (0.079 ± 0.014 in)
Valve seat outside dia.(B)			
Intake	46.4 mm (1.827 in)	34.5 mm (1.358 in)	41.5 mm (1.634 in)
Exhaust	37.6 mm (1.480 in)	30.0 mm (1.181 in)	Non-sodium: 34.6 mm (1.362 in) Sodium: 35.6 mm (1.402 in)

116-20 CYLINDER HEAD AND VALVETRAIN

Table i. Valve Seat Replacement Specifications

Specification	M30 Engine	M60 Engine	M70 Engine
Valve seat insert outside diameter tolerance per ISO allowance: G6 for M30 and M70 engines K6 for M60 engine			
Intake			
Standard	48.15 mm (1.8957 in)	—	43.15 mm (1.699 in)
+ 0.4 mm	48.55 mm (1.9114 in)	36.5 mm (1.437 in)	43.55 mm (1.715 in)
Exhaust			
Standard	40.15 mm (1.5807 in)	—	37.65 mm (1.482 in)
+ 0.2 mm			37.85 mm (1.490 in)
+ 0.4 mm	40.55 mm (1.5965 in)	32.0 mm (1.260 in)	38.05 mm (1.498 in)
Valve seat bore diameter (tolerance per ISO allowance H7)			
Intake			
Standard	48.00 mm (1.8898 in)	—	43.00 mm (1.693 in)
+ 0.4 mm	48.40 mm (1.9055 in)	36.4 mm (1.433 in)	43.40 mm (1.709 in)
Exhaust			
Standard	40.00 mm (1.5748 in)	—	37.50 mm (1.476 in)
+ 0.2 mm	—	—	37.70 mm (1.484 in)
+ 0.4 mm	40.40 mm (1.5905 in)	31.9 mm (1.256 in)	37.90 mm (1.494 in)
Valve seat insert height (tolerance per ISO allowance H11)			
Intake and exhaust			
Standard	7.5 +0.1 mm (0.295 +0.004 in)	—	7.3 -0.1 mm (0.287 -0.004 in)
+ 0.2 mm	—	—	7.5 -0.1 mm (0.295 -0.004 in)
+ 0.4 mm	7.9 +0.1 mm (0.311 + 0.004 in)	7.7 -0.1 mm (0.303 -0.004 in)	7.7 -0.1 mm (0.303 -0.004 in)
Valve seat bore depth			
Intake and exhaust			
Standard	—	—	7.5 ± 0.1 mm (0.295 ± 0.004 in)
+ 0.2 mm	—	—	7.7 ± 0.1 mm (0.303 ± 0.004 in)
+ 0.4 mm	—	—	7.9 ± 0.1 mm (0.311 ± 0.004 in)
Valve seat installation temperatures			
Cylinder head	+50°C (+120°F)	+20°C (+68°F)	+20°C (+68°F)
Valve seat insert	-150°C (-240°F)	-150°C (-240°F)	-150°C (-240°F)

