

116 Cylinder Head and Valvetrain

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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 timing chain and VANOS repair information, see **117 Camshaft Timing Chain**.
- 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.

The information given in this repair group is organized according to engine code. For engine application information, see **100 Engine—General**.

CYLINDER HEAD, DISASSEMBLY AND ASSEMBLY

BMW special tools are required for most cylinder head service described in this repair group. Many of these tools are expensive and 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.

Camshafts, removing and installing (M42 engine)

The camshafts can be removed with the cylinder head mounted on the engine. The first step is to remove the cylinder head cover. See **113 Cylinder Head Removal and Installation**.

Special BMW service tools should always be used to remove and install the camshafts. Removal and installation of the camshafts without the special tools can result in camshaft and valve train damage.

WARNING —

The process of evenly loosening the camshaft bearing cap nuts is **NOT** an acceptable method of removing the camshafts. Be sure to read the procedure through before starting the job.

1. Disconnect negative (–) battery cable.

CAUTION —

Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page vii.

2. Remove radiator cooling fan shroud and cooling fan. See **170 Radiator and Cooling System**.

CAUTION —

Radiator fan has left hand threads.

CYLINDER HEAD, DISASSEMBLY AND ASSEMBLY

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3. Remove timing chain sprockets and timing chains from camshafts. Remove upper timing chain guide from cylinder head. See **117 Camshaft Timing Chain**.

NOTE —

It is not necessary to remove the lower timing chain cover.

4. Remove spark plugs and install BMW special tool 11 3 260 to cylinder head. Tighten tool retaining bolts in spark plug holes. Do not over-tighten bolts. See Fig. 1.

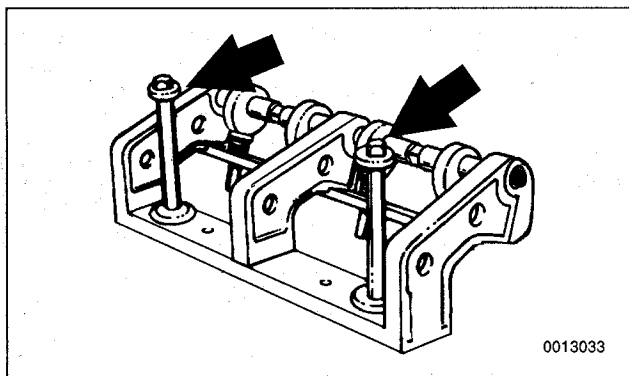


Fig. 1. Special BMW tool no. 11 3 260. Tool mounting bolts (arrows) thread into spark plug holes.

Tightening Torque

- BMW special tool 11 1 260 to cylinder head 23 Nm (17 ft-lb)

5. Turn eccentric shaft on special tool until pressure is applied to camshaft bearing caps. See Fig. 2.

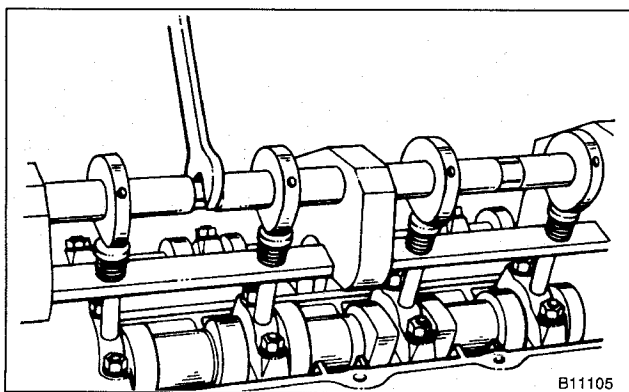


Fig. 2. Special tool (eccentric shaft) being turned to apply pressure to camshaft bearing caps.

6. Remove bearing cap mounting nuts.

7. Slowly release pressure on camshaft bearing caps by turning eccentric shaft. Remove bearing caps and camshaft. Repeat procedure on remaining camshaft.

CAUTION —

Camshaft bearing caps must be reinstalled in their original locations.

NOTE —

- The camshaft bearing caps are coded with a letter and a number. For example, "A1" is the exhaust camshaft bearing cap at the front of the engine, and "E1" is the intake camshaft bearing cap at the front of the engine.
 - Camshafts are stamped with a code letter—"E" for the intake side and "A" for the exhaust side.
 - "E" is for Einlaß, (German for intake) and "A" is for Auspuff, (German for exhaust).
 - The front of the engine is at the front of the car.
8. Camshaft installation is reverse of removal, noting the following:
 - Prior to installation, check all components for wear as described below under **Cylinder Head and Valvetrain, Reconditioning**.
 - Crankshaft must be at least 45° away from TDC before installing camshafts to cylinder head.
 - Lubricate camshafts prior to installation.
 - Install camshafts into cylinder head with lobes for cylinder no. 1 pointing up and towards each other.
 - After installing camshaft(s), observe specified waiting time for hydraulic cam followers to fully compress before bringing crankshaft back to TDC.

Camshaft installation waiting times

- At or above 68°F (20°C) 10 minutes
- 50-68°F (10-20°C) 30 minutes
- 32-50°F (0-10°C) 75 minutes

- Reinstall timing chain sprockets and tensioner as specifically described in **117 Camshaft Timing Chain**.
- Wait at least 10 minutes before cranking engine over with starter motor for the first time.

Tightening Torques

- Camshaft bearing caps to cylinder head (M7) 15 Nm (11 ft-lb)
- Cylinder head cover to cylinder head (M6) 10 Nm (89 in-lb)
- Primary timing chain tensioner plug to cylinder head 40 Nm (30 ft-lb) (see **117 Camshaft Timing Chain**)
- Spark plugs (M12) 23 Nm (17 ft-lb)
- Timing chain cover (upper) to cylinder head 10 Nm (89 in-lb)
- Timing chain sprockets to camshaft
M6 10 Nm (7.5 ft-lb)
M7 15 Nm (11 ft-lb) (see **117 Camshaft Timing Chain**)

Camshafts, removing and installing (M44 engine)

The camshafts can be removed with the cylinder head mounted on the engine. The first step is to remove the cylinder head cover. See **113 Cylinder Head Removal and Installation**.

Special BMW service tools should always be used to remove and install the camshafts. Removal and installation of the camshafts without the special tools can result in camshaft and valvetrain damage.

WARNING —

The process of evenly loosening the camshaft bearing cap nuts is NOT an acceptable method of removing the camshafts. Be sure to read the procedure through before starting the job.

1. Disconnect negative (–) battery cable.

CAUTION —

Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.

2. Remove spark plugs. See **120 Ignition System**.
3. Rotate engine until a pair of camshaft lobes are pointing up. Using BMW special tool 11 5 130, depress each valve and valve spring enough to remove rocker arms. Rotate engine for the next pair of rocker arms. See Fig. 3.

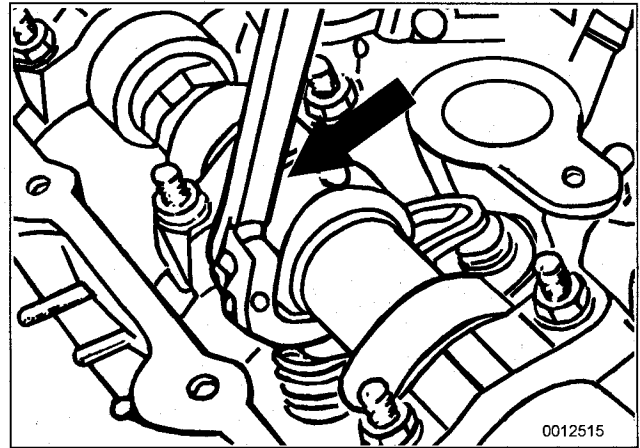


Fig. 3. BMW special tool no. 11 5 130 (arrow) being used to depress valve stem to remove rocker arm.

WARNING —

Removed rocker arms must be reinstalled in the same locations.

4. Remove primary timing chain tensioner from right side of cylinder head.
5. Remove upper timing chain cover.

NOTE —

It is not necessary to remove the lower timing chain cover.

6. Remove timing chain sprockets with timing chains from front of camshafts. See **117 Camshaft Timing Chain**. Remove upper timing chain guide from cylinder head.
7. Remove camshaft bearing caps and remove camshafts.

CAUTION —

Camshaft bearing caps must be reinstalled in their original locations.

NOTE —

- The camshaft bearing caps are coded with a letter and a number. For example, "A1" is the exhaust camshaft bearing cap at the front of the engine, and "E1" is the intake camshaft bearing cap at the front of the engine.

- Camshafts are stamped with a code letter—"E" for the intake side and "A" for the exhaust side.

- "E" is for Einlaß, (German for intake) and "A" is for Auspuff, (German for exhaust).

- The front of the engine is at the front of the car.

8. Camshaft installation is reverse of removal, noting the following:

- Prior to installation, check all components for wear as described below under **Cylinder Head and Valvetrain Reconditioning**.
- Lubricate camshafts prior to installation.
- Reinstall timing chain sprockets and tensioner and set valve timing **before** reinstalling rocker arms, as specifically described in **117 Camshaft Timing Chain**.
- Be sure corresponding camshaft lobe is pointing up before installing rocker arms. Note that each rocker arm angles away from corresponding spark plug hole. See Fig. 4.
- Wait at least 10 minutes for hydraulic cam followers to fully compress before cranking engine over with starter for the first time.

Tightening Torques

- Camshaft bearing caps to cylinder head (M7) 15 Nm (11 ft-lb)
- Cylinder head cover to cylinder head (M6) 10 Nm (89 in-lb)
- Primary timing chain tensioner plug to cylinder head 40 Nm (30 ft-lb) (see **117 Camshaft Timing Chain**)
- Spark plugs (M12) 23 Nm (17 ft-lb)
- Timing chain cover (upper) to cylinder head M6 10 Nm (7.5 ft-lb) M7 15 Nm (11 ft-lb)
- Timing chain sprockets to camshaft M6 10 Nm (7.5 ft-lb) M7 15 Nm (11 ft-lb) (see **117 Camshaft Timing Chain**)

Camshafts, removing and installing (6-cylinder engine)

Camshafts on 6-cylinder engines can be removed with the cylinder head mounted on the engine. The first step is to remove the cylinder head cover. See **113 Cylinder Head Removal and Installation**.

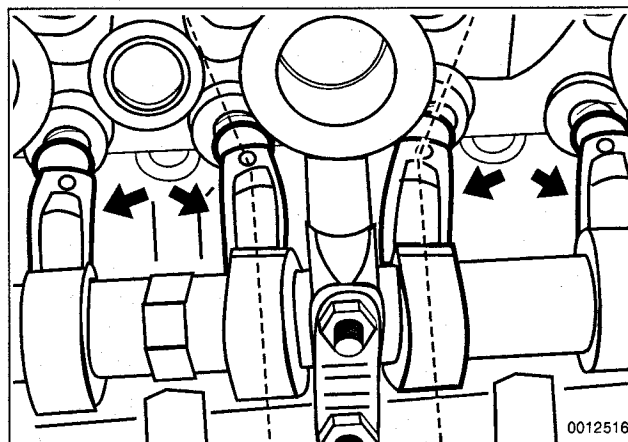


Fig. 4. Correct installation position of rocker arms (arrows) on M44 engine.

Special BMW service tools should always be used to remove and install the camshafts. Removal of camshafts without the special tools can result in personal injury and/or cylinder head damage.

WARNING —

The process of evenly loosening the camshaft bearing cap nuts is **NOT** an acceptable method of removing the camshafts. Special tools should always be used to remove the camshafts. Be sure to read the procedure through before starting a job.

1. Disconnect negative (–) battery cable.

CAUTION —

Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.

2. Set engine to TDC and lock into position by installing BMW special tool 11 2 300 through transmission bellhousing and into hole in flywheel or drive plate. See Fig. 5.

NOTE —

Arrows on camshaft sprockets should be pointing up. See **117 Camshaft Timing Chain**.

3. Remove VANOS control unit from cylinder head. Remove timing chain sprockets from camshafts. See **117 Camshaft Timing Chain**.
4. Remove spark plugs and install BMW special tool 11 3 260/11 3 270 to cylinder head. Tighten tool retaining bolts in spark plug holes. Do not over-tighten bolts. See Fig. 6.

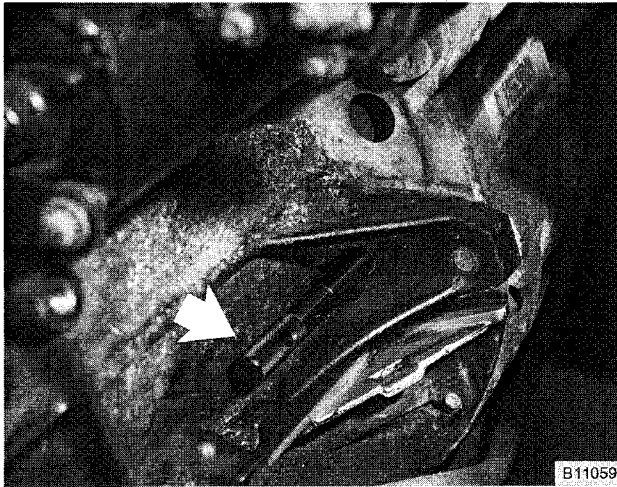


Fig. 5. BMW special tool 11 2 300 (arrow) inserted through bell-housing hole and into flywheel.

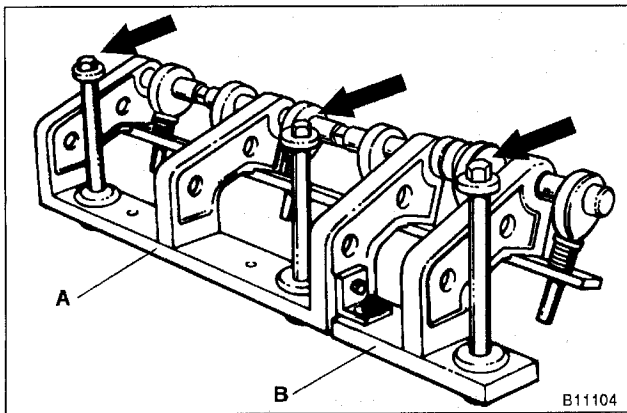


Fig. 6. Special BMW tool no. 11 3 260 (A) with adapter 11 3 270 (B). Tool mounting bolts (arrows) thread into spark plug holes.

Tightening Torque

- BMW special tool 11 1 260/11 3 270 to cylinder head 23 Nm (17 ft-lb)

5. Remove intake camshaft bearing cap no. 1.
6. Turn eccentric shaft on special tool until pressure is applied to camshaft bearing caps. See Fig. 7.
7. Remove remaining bearing cap mounting nuts.

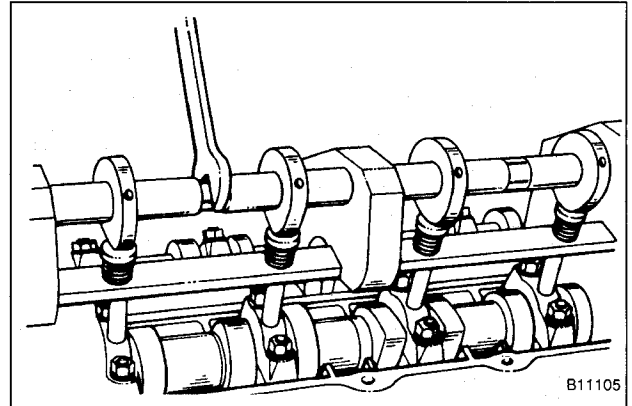


Fig. 7. Special tool (eccentric shaft) being turned to apply pressure to camshaft bearing caps.

8. Slowly release pressure on camshaft bearing caps by turning eccentric shaft. Remove bearing caps and camshaft. Repeat procedure on remaining camshaft.

CAUTION —

Camshaft bearing caps must be reinstalled in their original locations.

NOTE —

- The camshaft bearing caps are coded with a letter and a number. For example, "A1" is the exhaust camshaft bearing cap at the front of the engine, and "E1" is the intake camshaft bearing cap at the front of the engine.
- The camshafts are stamped with a code letter—"E" for the intake side and "A" for the exhaust side.
- "E" is for Einlaß, (German for intake) and "A" is for Auspuff, (German for exhaust).
- The front of the engine is at the front of the car.

9. Camshaft installation is reverse of removal, noting the following:

- Prior to installation, check all components for wear as described below under **Cylinder Head and Valvetrain Reconditioning**.
- Crankshaft must be at least 45° away from TDC before installing camshafts to cylinder head.
- Lubricate camshafts prior to installation.
- Install camshafts into cylinder head with lobes for cylinder no. 1 pointing up and towards each other. See Fig. 8.
- After installing camshaft(s), observe specified waiting time for hydraulic cam followers to fully compress before bringing crankshaft back to TDC.

Camshaft installation waiting times

- at or above 68°F (20°C) 10 minutes
- 50-68°F (10-20°C) 30 minutes
- 32-50°F (0-10°C) 75 minutes

- Reinstall timing chain sprockets and tensioner as specifically described in **117 Camshaft Timing Chain**.
- Wait at least 10 minutes before cranking engine over with starter motor for the first time.

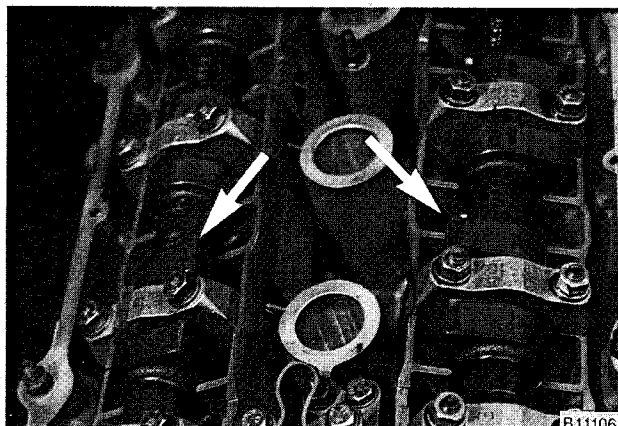


Fig. 8. Camshaft correctly positioned for reassembly so that cylinder no. 1 lobes (arrows) face each other.

Tightening Torques

- Camshaft bearing caps to cylinder head (M7) 15 Nm (11 ft-lb)
- Cylinder head cover to cylinder head (M6) 10 Nm (89 in-lb)
- Primary timing chain tensioner to cylinder head—see **117 Camshaft Timing Chain**
- Spark plugs (M12) 23 Nm (17 ft-lb)
- Timing chain sprocket to camshaft flange (M6)—see **117 Camshaft Timing Chain**

Valves, removing and installing

1. Remove cylinder head as described in **113 Cylinder Head Removal and Installation**. Remove exhaust manifold(s).
2. Remove camshafts using special tools as described earlier.
3. On M42 and all 6-cylinder engines: Remove camshaft carriers by pulling them straight up off mounting studs.

CAUTION —

- Do not let the hydraulic cam followers fall out as the camshaft carrier is removed. Special suction cups are available from BMW to hold the hydraulic cam followers in place during carrier removal.
- Hydraulic cam followers should be stored in an upright position.

4. On M44 engines: Remove all hydraulic valve adjusters. See **Hydraulic valve adjusters, checking and replacing (M44 engine)**, later in this section.

CAUTION —

- Hydraulic valve adjusters should be stored in an upright position. If necessary, use a magnetic tool to aid in removal of the adjusters.

5. Remove valves using a valve spring compressor.

NOTE —

- The M44 cylinder head has recessed valve stems. This requires the use of a special valve spring compressor tool.
- Label each valve assembly as it is removed so it can be installed in its original position.

6. Remove and discard valve stem oil seals from valve guides. See **Valve stem oil seals** later in this section.
7. Valve installation is reverse of removal.
 - Reinstall exhaust manifold(s) with new gaskets. Use Molycote HSC® or equivalent anti-seize thread compound on fasteners.

Tightening Torque

- Exhaust manifold to cylinder head M7 20 Nm (15 ft-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.

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

Cylinder head

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 must be replaced.

NOTE —

When replacing the cylinder head on engines with removable camshaft carriers, be sure to check the camshaft carrier bearing surfaces for warpage.

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 for machined heads.

Before machining the head to correct for warpage, measure the total height (thickness of the cylinder head). See Fig. 9. Minimum height specifications are given in Table a.

Table a. Cylinder Head Height

Engine	New	Minimum height (dimension A)
4-cylinder	140.0 mm (5.512 in)	139.55 mm (5.494 in)
6-cylinder	140.0 mm (5.512 in)	139.7 mm (5.500 in)

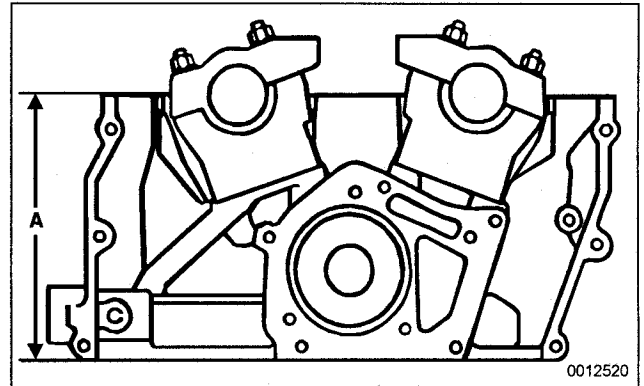


Fig. 9. Front view of cylinder head showing minimum resurfacing dimension (A).

Camshaft

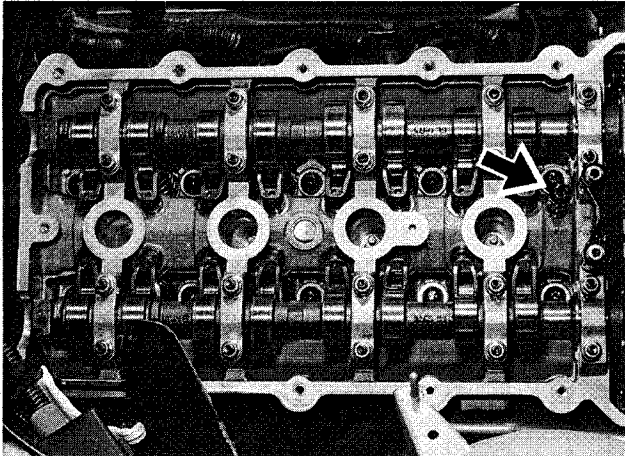
Camshaft wear is usually caused by insufficient lubrication. Visually inspect the camshaft lobes and journals for wear. Camshaft wear specifications are given in Table b.

Table b. Camshaft Specifications

4-cylinder engines	
Axial play	0.065-0.150 mm (0.0025-0.0059 in)
M42 engine	0.065-0.150 mm (0.0025-0.0059 in)
M44 engine	
Radial play (Plastigage)	0.020-0.061 mm (0.0008-0.0024 in)
M42 engine	0.040-0.082 mm (0.0016-0.0032 in)
M44 engine	
6-cylinder engines	
Axial play	0.020-0.054 mm (0.0008-0.0021 in)
All	
Radial play (Plastigage)	0.150-0.330 mm (0.006-0.013 in)
All	

NOTE —

- On M44 engines, check the oil sprayer tube in the top of the cylinder head cover and the tube seal in the cylinder head. A clogged sprayer tube or a defective seal will reduce oil flow to the camshaft. See Fig. 10.
- 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.



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Fig. 10. Location of camshaft oil sprayer tube seal in M44 cylinder head (arrow).

Hydraulic valve adjusters, checking and replacing (M44 engine)

The M44 engine uses hydraulic valve adjusters (HVA) to keep valve clearances within a limited working range. See Fig. 11. HVAs are sealed units and require no maintenance.

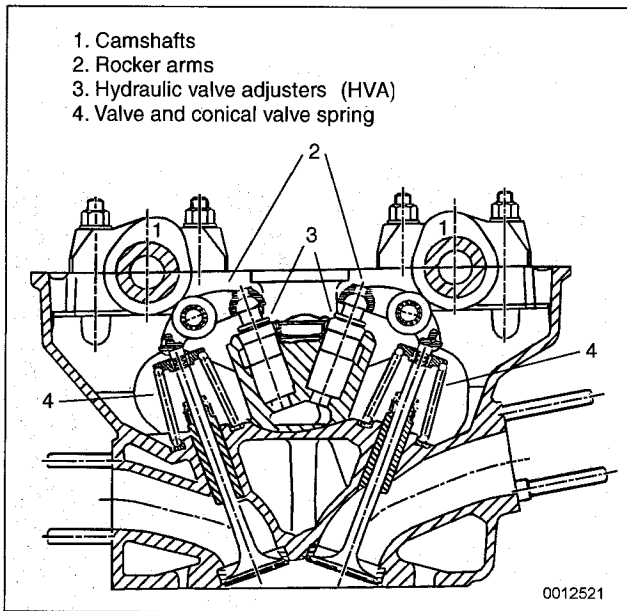


Fig. 11. Cutaway view of M44 cylinder head.

Under some circumstances, such as a cold start, the hydraulic units may become noisy. Hydraulic valve adjuster 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 hydraulic unit is faulty or the oil pressure to the adjuster(s) is low.

NOTE —

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

1. Run engine until it reaches normal operating temperature.
2. Turn engine off and remove top engine cover, spark plugs, and cylinder head cover. See **113 Cylinder Head Removal and Installation**.
3. 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.

4. To remove an HVA, turn engine over until camshaft lobe points straight up. Using BMW special tool no. 11 5 130, depress valve spring and remove rocker arm from under camshaft. See Fig. 12.

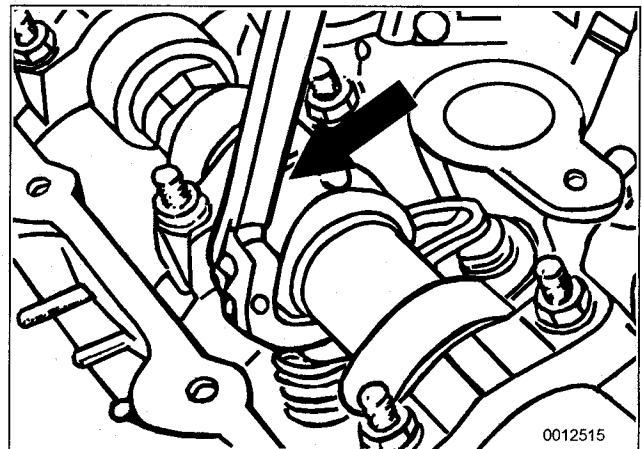


Fig. 12. BMW special tool no. 11 5 130 (arrow) being used to depress valve stem to remove rocker arm.

WARNING —

Removed rocker arms must be reinstalled in the same locations.

5. Pull hydraulic valve adjuster straight out of cylinder head. See Fig. 13.

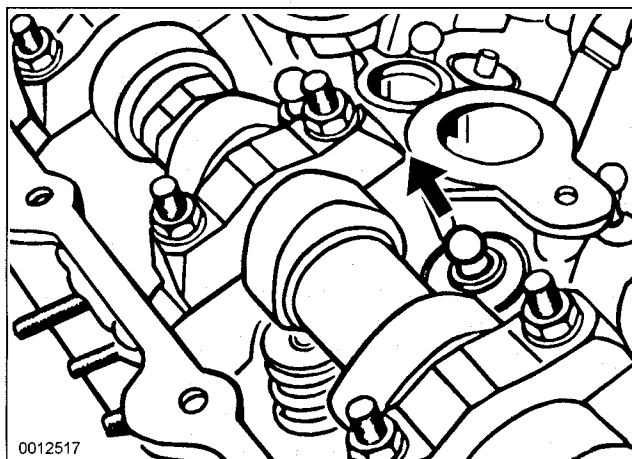


Fig. 13. Remove hydraulic valve adjuster by pulling straight out of cylinder head (arrow).

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

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)

Hydraulic cam followers, checking and replacing (M42 and all 6-cylinder engines)

The M42 engine and all 6-cylinder engines use 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. See Fig. 14..

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.

NOTE —

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

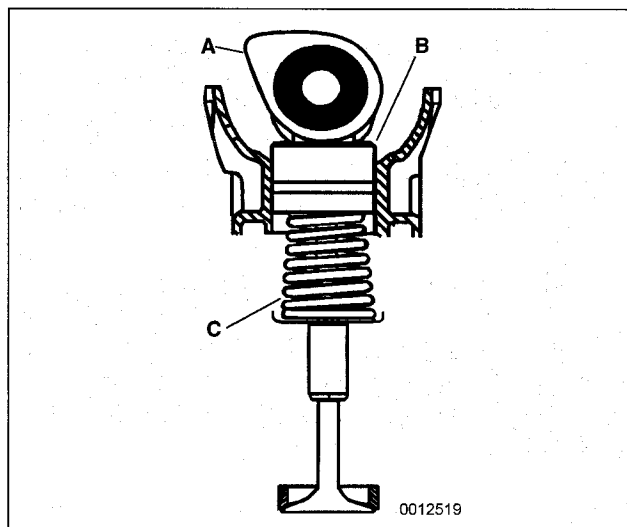


Fig. 14. Section view of camshaft (A), hydraulic cam follower (B), and valve with conical valve spring (C) used on M52 engine.

1. Run engine until it reaches normal operating temperature.
2. Turn engine off and remove top engine covers, ignition coils, and cylinder head covers. See **113 Cylinder Head Removal and Installation**.
3. Use a plastic or wooden stick to press down on top of cam follower. See Fig. 15. If there is any noticeable clearance, the follower is faulty and should be replaced.

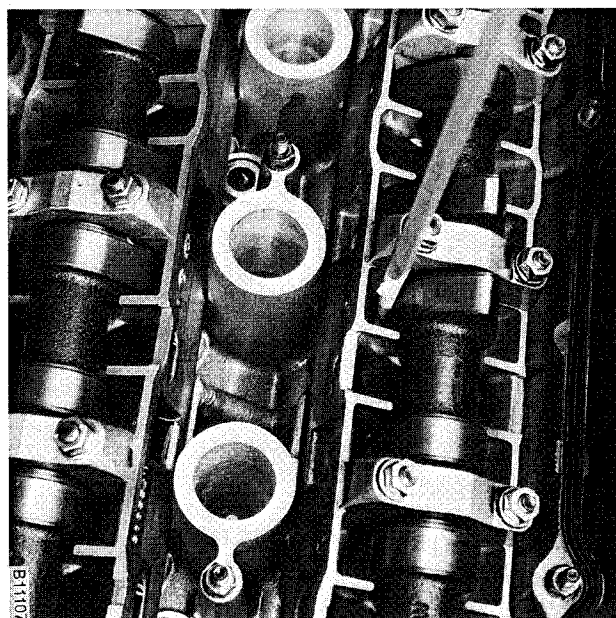


Fig. 15. Hydraulic cam follower in M52 engine being checked. Note that camshaft lobe is pointing up.

NOTE —

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

4. To replace a cam follower, remove appropriate camshaft. Refer to camshaft removal procedures given earlier.
5. Once camshaft is out of way, withdraw faulty cam follower and replace with new one. Inspect cam follower bores for wear and scoring.
6. Camshaft, timing chain and cylinder head cover reassembly is reverse of disassembly.

Tightening Torques

- Camshaft bearing caps to cylinder head
M7 15 Nm (11 ft-lb)
- Cylinder head cover to cylinder head/timing chain cover
M6 10 Nm (89 in-lb)
- Timing chain hydraulic tensioner to cylinder head—see **117 Camshaft Timing Chain**
- Timing chain sprocket to camshaft flange (M6)—see **117 Camshaft Timing Chain**

Valve guides

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

Valve guides should be checked for wear using a new valve. See Fig. 16. Be sure to thoroughly inspect the cylinder head to ensure that it can be reused before reworking the guides.

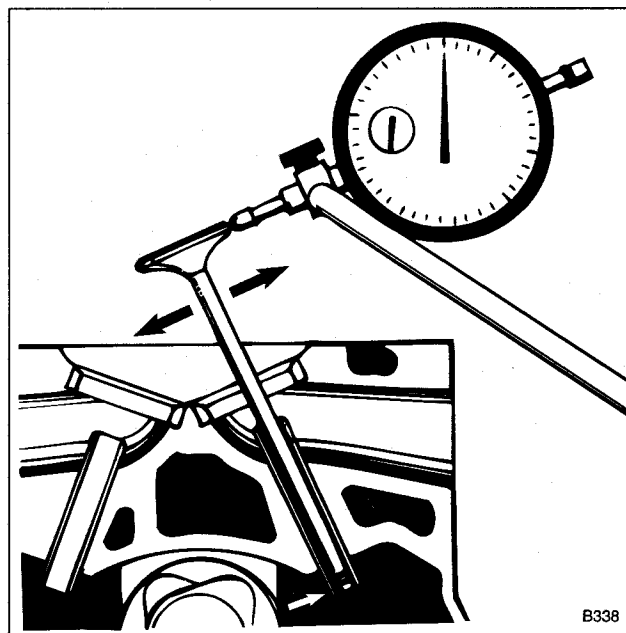


Fig. 16. Valve guide wear being checked with dial indicator. Insert new valve until stem end is flush with end of guide (white arrow). See **Table c** for wear limits.

NOTE —

- International Organization for Standardization (ISO) tolerance classes are listed in **Table c**. ISO allowances are based on nominal sizes and should be used to determine proper fit. Most machine shops should have this information available
- Replacement valve guides may be available through aftermarket 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.
- BMW supplies oversize valves. See **Valves** for additional information.

Table c. Valve Guide Specifications

Specifications	M42 engine (1992)	M42/M44 engines (1993-1998)	M50 engine (1992)	M50, M52, S50 US, S52 US engines (1993-1998)
Valve guide wear, maximum (valve tilt clearance measured with new valve)	0.5 mm (0.020 in)	0.5 mm (0.020 in)	0.5 mm (0.020 in)	0.5 mm (0.020 in)
Valve guide inside diameter, installed (tolerance per ISO allowance H7)				
Standard	7.0 mm (0.276 in)	6.0 mm (0.236 in)	7.0 mm (0.276 in)	6.0 mm (0.236 in)
Oversize 1	7.1 mm (0.279 in)	6.1 mm (0.240 in)	7.1 mm (0.279 in)	6.1 mm (0.240 in)
Oversize 2	7.2 mm (0.283 in)	6.2 mm (0.244 in)	7.2 mm (0.283 in)	6.2 mm (0.244 in)

Valves

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

Table d. Valve Specifications

Specification	M42 engine (1992)	M42/M44 engines (1993-1998)	M50 engine (1992)	M50, M52 engines (1993-1998)	S50 US/S52 US engine (1995-1998)
Valve head dia. Intake Exhaust	33.0 mm (1.299 in) 30.5 mm (1.201 in)	33.0 mm (1.299 in) 30.5 mm (1.201 in)	33.0 mm (1.299 in) 30.5 mm (1.201 in)	33.0 mm (1.299 in) 30.5 mm (1.201 in)	30.0 mm (1.181 in) 27.0 mm (1.063 in)
Valve stem dia. Standard Intake Exhaust	6.975 -0.015 mm (0.2746-0.0006 in) 6.960 -0.015 mm (0.2740-0.0006 in)	5.975 -0.015 mm (0.2352-0.0006 in) 5.960 -0.015 mm (0.2345-0.0006 in)	6.975 -0.015 mm (0.2746-0.0006 in) 6.960 -0.015 mm (0.2740-0.0006 in)	5.975 -0.015 mm (0.2352-0.0006 in) 5.960 -0.015 mm (0.2345-0.0006 in)	5.975 -0.015 mm (0.2352-0.0006 in) 5.960 -0.015 mm (0.2345-0.0006 in)
Oversize 1 Intake Exhaust	7.075 -0.015 mm (0.2785-0.0006 in) 7.060 -0.015 mm (0.2779-0.0006 in)	6.075 -0.015 mm (0.2392-0.0006 in) 6.060 -0.015 mm (0.2386-0.0006 in)	7.075 -0.015 mm (0.2785-0.0006 in) 7.060 -0.015 mm (0.2779-0.0006 in)	6.075 -0.015 mm (0.2392-0.0006 in) 6.060 -0.015 mm (0.2386-0.0006 in)	6.075 -0.015 mm (0.2392-0.0006 in) 6.060 -0.015 mm (0.2386-0.0006 in)
Oversize 2 Intake Exhaust	7.175 -0.015 mm (0.2825-0.0006 in) 7.160 -0.015 mm (0.2819-0.0006 in)	6.175 -0.015 mm (0.2431-0.0006 in) 6.160 -0.015 mm (0.2425-0.0006 in)	7.175 -0.015 mm (0.2825-0.0006 in) 7.160 -0.015 mm (0.2819-0.0006 in)	6.175 -0.015 mm (0.2431-0.0006 in) 6.160 -0.015 mm (0.2425-0.0006 in)	6.175 -0.015 mm (0.2431-0.0006 in) 6.160 -0.015 mm (0.2425-0.0006 in)

Valves, leak test

To test the valves for leakage, the camshafts and camshaft carriers (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.

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 valves are removed, new valve stem oil seals should be installed.

Valve stem oil seal replacement requires that the cylinder head be disassembled and the valves removed as described above under **Valves, removing and installing.**

NOTE —

BMW special tools are available to remove the valve stem oil seals. As an alternative, standard valve seal removal tools are available from most automotive parts stores. See Fig. 17.

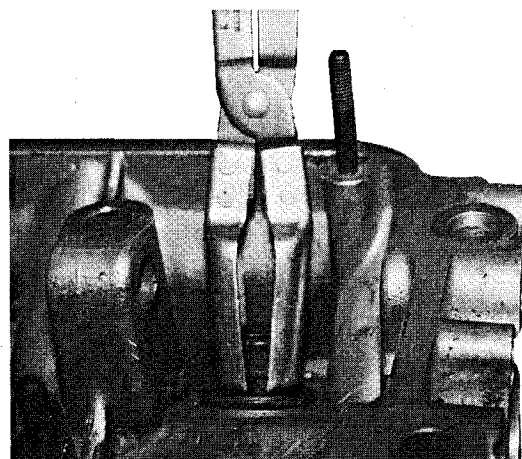


Fig. 17. Valve stem oil seal being removed from valve guide.

Lubricate the new seals and install them using hand pressure only. Be sure to install the valve spring seat(s) 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. **Table e** lists valve seat dimensions.

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). The manufacturer does not provide specifications for valve seat replacement for the engines covered by this manual.

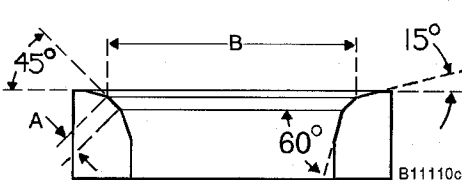
Valve Springs

The valve springs should be checked for 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 worn and should be replaced.

NOTE —

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

Table e. Valve Seat Dimensions

						
Specification	M42 engine (1992)	M42 engine (1993-1995)	M44 engine (1996-1998)	M50 engine (1992)	M50/M52 engines (1993-1998)	S50US/S52US engines (1995-1998)
Valve seat angle	45°	45°	45°	45°	45°	45°
Correction angle, outside	15°	15°	15°	15°	15°	15°
Correction angle, inside	60°	60°	60°	60°	60°	60°
Valve seat width (A)						
intake	1.65 ± 0.25 mm (0.065 ± 0.014 in)	1.65 ± 0.25 mm (0.065 ± 0.014 in)	1.65 ± 0.25 mm (0.065 ± 0.014 in)	1.4 - 1.9 mm (0.055-0.075 in)	1.65 ± 0.25 mm (0.065 ± 0.014 in)	1.65 ± 0.25 mm (0.065 ± 0.014 in)
exhaust	2.0 ± 0.25 mm (0.079 ± 0.014 in)	2.0 ± 0.25 mm (0.079 ± 0.014 in)	1.65 ± 0.25 mm (0.065 ± 0.014 in)	1.4 - 1.9 mm (0.055-0.075 in)	1.65 ± 0.25 mm (0.065 ± 0.014 in)	1.65 ± 0.25 mm (0.065 ± 0.014 in)
Valve seat outside dia. (B)						
intake	32.4 mm (1.276 in)	32.4 mm (1.276 in)	32.4 mm (1.276 in)	32.4 mm (1.276 in)	32.4 mm (1.276 in)	29.4 mm (1.157 in)
exhaust	30.1 mm (1.185 in)	30.1 mm (1.185 in)	30.1 mm (1.185 in)	30.1 mm (1.185 in)	29.4 mm (1.157 in)	26.4 mm (1.039 in)

