

Valve Adjustment Seminar BMW K75 through K1200LT

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BMW K75 through K1200LT (Longitudinally mounted engines)

4-Cycle Engine Basics

Currently, all BMW motorcycle engines are 4 cycle engines. This is a brief explanation of what happens inside that block of aluminum every time you use it.

The term “4-cycle” (sometimes called “4-stroke”) describes the engine operations that make it function. The cycles are normally called “intake”, “compression”, “power”, and “exhaust”.

Like the chicken and the egg, it is debatable which of these cycles happens first, as at least two will be happening on our multi-cylinder engines when you hit the starter button. I like to start with the intake cycle because until you get something in the cylinder to burn, there will be no power and since power is what we all are really interested in, we’ll begin there.

I am going to over-simplify the engine cycles by telling what would be happening if the engine was designed to be operated at extremely low rpm. Also, I will assume you know that there is a piston that goes back and forth in a cylinder, and there are at least 2 valves for each cylinder, one for intake of fuel & air, and one for exhaust.

The gasses have considerable mass and are reluctant to be moved. The operation of the valves is to allow the movement of those gasses either into or out of the cylinder. So, the actual valve timing for your BMW will be advanced from what we will discuss to allow for the time to accelerate the gasses. Also, the spark timing is advanced to allow time for the mixture to be burned more thoroughly.

Intake Cycle

The piston is at Top Dead Center or TDC (could really be “side dead center” on the airhead engine!). The exhaust valve is closed, the intake valve is opened. As the piston goes down to the bottom of the cylinder it will allow a mixture of air and fuel to fill the cylinder.

Compression Cycle

The intake valve is now closed, exhaust valve is still closed. As the piston moves back up to the top of the cylinder, the air and fuel mix is compressed. This compression raises the temperature of the fuel-air mix, making it more combustible.

Power Cycle

The piston is back at top dead center. All valves are closed. The sparkplug sparks, a big bang happens. The burning fuel air mix is expanded and pushes the piston down. Yahoo!! Power!

Exhaust Cycle

The exhaust valve is opened. The intake valve remains closed. As the piston goes back up to the top, what is left of the burned air fuel mixture is expelled through the exhaust valves and out through the exhaust system. As an interesting note, the exhaust sound that you hear through the muffler is the release of these dead gasses—well after the power has been made—so never confuse a loud exhaust with power!

Basic Valve clearance checking procedure

Nomenclature

Camshaft lobe nose: the “point” on the cam at highest valve opening

Camshaft base circle: the base of the cam, directly opposite the lobe nose

Cam follower: sometimes called cam bucket, the solid round piece that contacts the cam lobe and pushes on the valve

stem

Intake cam: the cam that operates the intake valves, on the K motor it is on the top

Exhaust cam: the cam that operates the exhaust valves, on the K motor it is on the bottom

General notes

The early 2-valve per cylinder K engines (K75 and early K100) had a “shim over bucket” adjustment mechanism. The shims are available in 0.05mm increments. On these engines, the bucket can be compressed and the shim can be changed (using special BMW tooling) to correct the valve clearance. The 4-valve per cylinder models (late K100, all K1100 and K1200 models) had buckets that are available in 0.05mm increments, but to change the buckets requires camshaft renewal. There are several special tools required to remove and re-install the cams. There are about 75 ways to screw up the reinstallation and timing of the cams once they are removed. Incorrect reassembly could result in bent valves upon start-up and the repair costs would be similar to simply buying a new Honda. There is no rocket science involved, but due to the time constraints of this seminar, we will not discuss the procedure at length. If you wish to attempt this procedure, we would be glad to help you through it, as long as it is snowing outside.

General procedure

Valves must be adjusted with the engine COLD. On this cold January morning, that might only take a couple of hours. During a typical Utah June day, allow 12 hours since the engine was last started.

Remove bodywork as necessary to get to the valve cover. On a K75 standard, it will take about 10 seconds. On a K1200LT it will take about 45 minutes if you are fast.

Remove the spark plug cover plate if your engine has one.

DO NOT remove the spark plugs! There is a possibility that some carbon in the combustion chamber around the spark plug could fall into the open exhaust valve and give you incorrect clearance measurements because the carbon would not allow the valve to close fully when you check the clearance.

Spotlessly clean around the valve cover area. Any dirt that might fall into the engine could be fatal to it. Clean it again; you did not get it clean enough the first time.

Stuff a rag into the area around the sparkplugs. Some oil will drip into that area when you remove the valve cover. It is easier to have a rag there to soak up the oil than to clean it out later.

Place a pan under the valve cover to catch the oil that will come out when you remove the cover. The oil volume will only be a few cc's, but it will drip out the entire length of the cover. A shallow baking pan about 12" long and 1/2 inch deep works well. Do not use the pan later for cookies; they will taste odd.

Loosen the valve cover bolts $\frac{1}{2}$ turn each, starting with the ones in the center top and center bottom of the valve cover. Continue to loosen each bolt $\frac{1}{2}$ turn, moving out from the center in an “X” pattern. Most of the bolts are threaded into the cam bearing tops. The bearing tops are not available separately from a complete cylinder head. The bearing tops are line bored at the factory, so each one is a unique part. If you damage one of the tops you might have to purchase a cylinder head. Good for us, really bad for you!

Repeat loosening the bolts $\frac{1}{2}$ turn each in an “X” pattern until all are less than finger tight. This is done to avoid putting excessive strain on any particular bolt. Once they are all less than finger tight, fully remove the bolts and pull the valve cover off.

Each cam has a hexagonal surface on it. Use an open-end wrench on the hexagonal head to turn the cam.

We suggest that you use a valve adjustment sheet to document which valves you have checked. There are many valves and if you do not keep written track of which you have checked you will probably miss some and check others twice or more.

Turn a cam (it does not make any difference which one, when one turns the other will too) until the cam base is directly over the cam follower on any valve. Measure the clearance between the cam base and the cam follower with a feeler gage. Document the clearance on your valve adjustment sheet.

Repeat above until you have checked every valve clearance for the engine.

The correct clearance for the intake valves is 0.15mm to 0.20mm. The correct clearance for the exhaust valves is 0.25mm to 0.30mm. If any valve clearance is outside of those tolerances a valve adjustment will be required. If all valve clearances are correct (and usually they are), continue as below. If adjustment is needed, please call us!

Each valve cover bolt has a sealing grommet on it. Renew all the grommets.

Clean the valve cover gasket surface on the head thoroughly. Remove all oil and residual gasket materials from the surface. This surface must be spotlessly clean or it will leak when you reinstall the valve cover.

Replace the valve cover gaskets(s). The 2-valve per cylinder engines have an inner valve cover gasket, an outer valve cover gasket, and two $\frac{1}{2}$ moon seals. The 4-valve K100 and K1100 engines have a one piece gasket. These gaskets press into the valve covers. The K1200 engine gasket is also a one piece, but it fits into the cylinder head. Install the gaskets as appropriate for your engine.

Apply a very light wipe of 3 bond sealant to the $\frac{1}{2}$ moon surfaces and another very light wipe of 3 bond sealant to the joint where the cam chain cover joins the cylinder head.

Note which of the valve cover bolt holes are threaded into the main cylinder head casting, and which are threaded into the cam bearing tops. Position the valve cover onto the cylinder head. Start the bolts that go into the head casting first to avoid damage to the cam bearing tops. Install all of those bolts until just finger tight. Look carefully at the gasket(s) to assure that they are still in the correct position. Next install the remaining bolts until just finger tight. Turn each bolt $\frac{1}{2}$ turn in an "X" pattern until they bottom out on their stop. Use an accurate torque wrench and finalize the torque on each bolt to 9 NM (6.3 lb/ft for General Motors folks).

Remove the rag from the spark plug area. Wipe all oil out of that area. Wipe off all the oil from around the valve cover outside areas.

If you are performing the rest of a BMW Inspection II, renew the spark plugs. K100 and K1100 engines should have the throttle bodies synchronized after the valve adjustment is completed. Ride the bike until the engine is fully warmed up before you do the synchronization. If you have a 2-valve per cylinder model or a very early K100 4-valve per cylinder without the O2 sensor, the idle air/fuel mixture should be adjusted after the synchronization is completed. The K1200 models do not have adjustment capacity for either throttle synchronization or idle air/fuel mixture.

Start the engine in a well ventilated area. Let it run for 3 minutes and 15 seconds. Turn it off and check for leaks. Correct if needed.

Reinstall the spark plug cover if you removed one.

Reinstall the body work previously removed.

Go riding!