

CDX Handout Activity: HA1019

Student/Intern information:

Name Date Class

Piston to valve clearance check

Summary

If the camshaft has been changed in the rebuild its essential to check the piston to valve clearance. The objective of this procedure is to show you how to check piston to valve clearance.

Part 1. Preparation and safety

Objective

- Check piston to valve clearance.



Personal safety

Whenever you perform a task in the workshop you must use personal protective clothing and equipment that is appropriate for the task and which conforms to your local safety regulations and policies. Among other items, this may include:

- Work clothing - such as coveralls and steel-capped footwear
- Eye protection - such as safety glasses and face masks
- Ear protection - such as earmuffs and earplugs
- Hand protection - such as rubber gloves and barrier cream
- Respiratory equipment - such as face masks and valved respirators

If you are not certain what is appropriate or required, ask your supervisor.

Safety check

- Make sure that you understand and observe all legislative and personal safety procedures when carrying out the following tasks. If you are unsure of what these are, ask your supervisor.

Points to note

- If the camshaft has been changed in the rebuild its essential to check the piston to valve clearance.
- If the engine has hydraulic lifters you will need to get a set of solid lifters to perform this operation.
- Put the gaskets on dry with no sealer for this test.

Part 2: Step-by-step instruction

1. Determine the use of solid or hydraulic lifters

If the camshaft has been changed in the rebuild, it is essential to perform a piston to valve clearance check. To do this, you need to assemble the valve train for the number one cylinder, so that you can check to make sure that the camshaft isn't opening the valves too far. If the valves are pushed open too far, they'd be in danger of coming in contact with the piston.

If the machine shop has already assembled the heads you won't need to take it apart again to check the valve clearance if you can get a pair of solid lifters from a parts store. If you cannot get some solid lifters, you will need some light weight checking springs from a performance or hot rod supplier to use with the regular hydraulic lifters.

When rotating an engine by hand there's no oil pressure. Stock valve springs are very strong and when the cam starts to push up on the lifter, the plunger in a hydraulic lifter would push down inside the lifter body. This is because there's no oil pressure built up inside the lifter. A solid lifter won't allow the pushrod to sink into the lifter body. As the solid lifter begins to come up, even with no oil pressure, it will overcome the strength of the stock valve spring and make the valve in the head open all the way to perform a proper piston to valve clearance check. The hydraulic lifters can be used for this test, but only if the valve springs being used are light weight springs that won't cause the lifter plunger to push down inside the lifter body.

2. Preparation using solid lifters

If your valve train is not pre-assembled you need to build one of your heads with stock springs for the test. Take the correct intake and exhaust valves out of the organizer tray for the number one cylinder head. Make sure these have some lubricant on the stems. Put on any spring shims, if you have them, then the spring and retainer. With new springs or shims, squeezing the valve spring compressor by hand may be more difficult, but you need to compress the spring far enough to be able to install the keepers. Be careful not to let the compressor slip off. The spring could shoot across the room or take your own eye out. Always wear safety glasses when you look at the valve tip to fit the keepers in. If you can, leave your hand on the keepers to prevent them from falling while you release tension on the compressor.

This cylinder head is now ready for the test. Have the pair of solid lifters nearby.

3. Preparation using hydraulic lifters

If your heads are pre-assembled, you need to remove the stock springs for the number one cylinder.

Put a little piece of wood or something similar under the valve to keep it in the closed position while you install the light weight springs. Place a spring on one of the heads and use the retainer to push the spring down far enough to slip in the keepers that hold the retainer in place. When both of the valves are in place for this cylinder, the head is ready for the test. Have the right pair of hydraulic lifters for that cylinder nearby.

4. Check piston clearance

Check your repair manual for the cylinder numbering of your block. On this particular engine the number one cylinder is here, so our piston to valve clearance check will be with the head on this side of the engine.

Rotate the block right side up and put in the safety pin to keep it from shifting under the weight of one cylinder head.

Check that the pistons aren't protruding above the deck. They should be fractionally below the deck. Verify that by sliding a feeler gauge under the straight edge.

Clean the entire surface of both decks. When you install the head gaskets for the test they should not get any dirt or oil on them. Also, clean the deck surface of both of the cylinder heads.

5. Install test material under valves

Make two balls of modeling clay, one for each valve. Stick them to the piston in the upper valve reliefs that are cut into the top of the piston. Cover them with a little oil to keep the valves from sticking to the clay when they make an imprint in it. Wipe off any oil drips before you put on the head gasket.

6. Install head

Pay close attention to any labels that might be on one of the sides of the head gasket. If the gasket has a 'front' or 'this side up' label, follow the directions as you place the gasket on the block. For this check, put the metal head gaskets on dry, with no sealer.

Lay the head in place and install a few bolts in the number one cylinder area and tighten them hand tight with a wrench. Don't tighten the bolts very much. You can't re-use a head gasket that's been torqued even once before.

Part 2: Step-by-step instruction continued**7. Install valves and position crank**

Lubricate the sides and bottoms of the lifters and slide both of them in. Install both pushrods and rocker arms with their pivots and nuts, but don't tighten the nuts yet.

Turn the engine over in the direction of its normal rotation. In most engines this is clockwise. For the remainder of the rebuild, have a crank turning socket or some other method to roll the crank over by hand. If you need to, re-install the balancer and center bolt to rotate the crank with. It doesn't need to be pressed all the way on, just a few taps with a mallet and the centerbolt will hold it in place.

Identify which valve is which. Look at the number one piston area of the cylinder head. The exhaust valve will be closest inline with the exhaust port and the intake valve will line up with the intake port. As you rotate the engine by hand, watch the intake lifter or pushrod and when it moves all the way up and back down again, give the crank another 1/8 to 1/4 turn and stop. Now the piston is on the compression stroke and both of the lifters will be down all the way while the valves are in their closed positions.

8. Adjust valves to 'zero lash'

For the piston to valve clearance check, tighten the rockers to the point of "zero lash". Start tightening the intake rocker nut. Spin the push rod in your fingers as you are tightening the nut. Feel for the precise moment when the pushrod tightens up and stops spinning easily between your fingers. Sometimes it's very hard to determine this exact point, and you may need to loosen the nut and try again. When you feel the point where the pushrod tightens up, you'll be at zero lash which means that all the slack has been taken out. Now adjust the exhaust rocker arm in the same way.

9. Perform test and disassemble

Rotate the crank until you see the exhaust and intake valves open and close two times each. The exhaust valve first and then the intake valve, twice. Now, take the valve train apart again, removing everything you just installed, the rockers, pushrods and the head bolts. Don't forget to pull out the pair of lifters, especially if you used solid lifters that won't be in the final assembly.

10. Check test results

When you remove the head and the gasket the two balls of clay now have valve imprints pressed in them. Cut each piece of clay and remove half. Measure the distance from the piston to the top of the valve imprint with a ruler or the depth end of a dial caliper. Compare this with the specification in the service manual. If this measurement is greater than the minimum allowed, there is no danger of your valves contacting the piston once the engine is heated up and running. Clean any leftover clay off the piston.

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1. Put the gaskets on dry with no for this test.
 2. If the engine has hydraulic lifters you will need to get a set of lifters to perform this operation.
 3. Now adjust the rocker arm in the same way.
 4. To do this, you need to assemble the valve train for the number one cylinder, so that you can check to make sure that the isn't opening the valves too far.
 5. Cover them with a little oil to keep the from sticking to the clay when they make an imprint in it.
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Score / 5

Supervisor/Instructor information:

Name Signature Date