How to Adjust Your Chevy Valve Lash

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This tech paper will discuss the adjustment of Chevrolet hydraulic lifters ("valve lash").

The procedure outlined here differs slightly from the Service Manual, and is based on my years of experience doing this work in the quickest, least painful, most economical way while keeping the level of quality high. It is recognized that other people will have different methods of doing things, and may disagree with specific methods and procedures that I use.

Overview, Theory and my Thoughts on Lash Settings

Hydraulic lifters are wonderful little innovations which reduce valve train wear and virtually eliminate required valve train maintenance.

Without the use of hydraulic lifters (mechanical lifters), the valve train must be adjusted with a certain amount of "slop" in it ("lash"). This lash is necessary, since the various components in the valve train tend to "grow" and expand as they heat up from normal engine operation. As the components "grow," they take up a large portion of the lash, but some lash must still be retained as a safety margin. If there were no lash, there would be a risk of the valves not closing fully, resulting in poor engine performance and burnt valves. This lash, however, results in a bit of valve train noise as parts "clank" together, and this clanking induces wear of the valvetrain components. This wear, in turn, requires that the lash be re-adjusted at regular intervals. If only there were a way to eliminate the lash…. hmmmmm….

Enter the hydraulic lifter. Believe it or not, but the internal components of a hydraulic lifter are the most precise, close-tolerance parts on a vehicle. The basic operation and principle of the hydraulic lifter is as follows:

When the hydraulic lifter is at the "low" point in its bore (the valve is closed), the body of the lifter is exposed to pressurized oil in the lifter oil galley. The lifter body has a little hole in it, and this hole allows oil to enter and/or exit the lifter body. The pressurized oil in the galley thus enters the body of the lifter, and pushes lightly on a plunger in the roof of the lifter body. This plunger is about a half inch in diameter, giving it a total area of approximately 0.12 square inches. If you're running 60 pounds of oil pressure, that means that the oil is pushing upwards on the plunger with a force of about 11 pounds max. This 11 pound force is not enough to open the valve, but it will remove all slack out of the valve train.

As soon as the lifter starts moving upwards in its bore (the cam is opening the valve), the oil hole in the lifter body moves out of alignment with the oil galley. The lifter body is sealed off, and oil can't get in or **<u>out</u>** of the body. The lifter, thus, goes into "hydraulic lock," and suddenly acts like a solid lifter. The oil under the plunger is not compressible, so the lifter now opens the valve.

As the lifter comes down the bore after completing its valve opening chore, it is once again exposed to the oil pressure in the lifter galley, and the pressurized oil once again assures that all lash is taken out of the valvetrain before repeating the opening cycle. As the valvetrain wears, the oil pressure simply constantly pushes the plunger upwards to remove any slack caused by the wear. The plunger can be pushed upwards in the lifter bore within the design limitations of the lifter, and will eventually be stopped by a snap ring retainer in the top of the lifter body. Once the plunger reaches the retainer, it can no longer provide effective valve train adjustment, and the valvetrain will start making noise.

The distance the plunger is compressed into the lifter body when the lifter is at the low point in its bore is referred to as "lifter preload." This is the "valve lash" or "valve adjustment" on a hydraulic lifter. The further the plunger is depressed, the more wear the lifter can "absorb" before reaching the snap ring retainer. However, the more the plunger is depressed, the more prone the engine becomes to "lifter float" or "valve float."

As we noted earlier, the oil in the lifter is not compressible. If, somehow, the lifter body were filled with just a few drops of oil too many, and the lifter were moving so fast in its bore that the oil did not have a chance to bleed out and re-stabilize the valvetrain lash at the bottom of the lifter travel, the lifter would keep the valve open when the valve should be closed. Further, if aggravated, this condition could cause the lifter to open the valve beyond its design limitations, out of time with the intended valve cycle. This is what is known as "lifter float" or "valve float." It can have disastrous consequences if the valve were to hit the piston. We, therefore, adjust hydraulic lifters with some pre-load, but not too much. So what's the right spec…?

Obviously, we can eliminate valve float completely by simply adjusting our lifter pre-load such that the plunger is right at the top of the lifter body; right up against the snap ring retainer. The problem with this approach is that there is the possibility of the same hydraulic lock conditions exerting so much force on the snap ring that the snap ring is forced out. With nothing retaining the plunger, we would have the same disastrous ending to our engine… Also, with no plunger travel available, the non-maintenance feature of our hydraulic valvetrain is defeated, and we must now constantly adjust the valves as if they were mechanical.

The factory setting on a Chevy lifter pre-load is ¾ to 1 turn lifter preload with the lifter on the low side of the cam (valve closed). This eliminates valvetrain maintenance for at least 100,000 miles, and is a good compromise setting. However, it can allow the valves to float at rpms as low as 5700. This, effectively, becomes a factory-installed rev limiter: if they can make the valves float lightly around 6000 rpm, GM can reduce warranty claims from customers over-revving their engines. Hey… these boys and girls designing this stuff in Detroit aren't dummies, are they?

So for a performance application, we split the difference. A ½ turn lifter pre-load will raise the rpm limit of the engine, yet it will still provide quite a bit of plunger travel so the lifter can do its valvetrain wear adjustment thing.. It will also keep the plunger away from the snap ring retainer, and it will keep our operation safe. Safe, reliable, improved performance and good durability/life: what more could you ask for?

Procedure

This procedure typically takes me about 30 minutes from start to finish on a Chevy without air conditioning, but I've done it a few times. Allow yourself an hour or two for a leisurely pace of wrenching and beer drinking.

General tips:
Keep your work area clean and organized. It'll make the job seem much easier. I like to lay a clean towel out on the ground by the car or on an adjacent workbench. As each bolt, screw, nut and component is removed, I lay the parts out carefully on the towel. Whenever possible, I put screws back into the holes that they came out of after the component is removed. Wipe up spills and sweep the area as you progress to keep things clean and pleasant. You will be leaning across the fenders on pre-C4 cars, so use a fender apron.

Step-by-Step:

- Park the car on a level surface. Set the parking brake and block the tires. On manual cars, put the trans in neutral. Pull the coil wire that goes from the distributor cap to the ignition coil (on HEI cars, disconnect the connector out of the distributor) and ground it.
- Turn the engine over until you can see the timing mark on the harmonic balancer. Using a piece of chalk or other visible marker, place three more timing marks on the balancer: one mark every

90 degrees around the balancer (one exactly opposite the factory mark, and two in between these marks: just get it pretty darned eye-ball close, it doesn't have to be ***exact***.)

- Remove the valve covers. You may have to remove some accessory brackets in order to do this.
- Rotate the engine over (either by "bumping" the starter or by inserting a socket and breaker bar onto the harmonic balancer bolt) until the factory timing mark lines up with "0." Observe the pushrod for the exhaust valve on the #1 cylinder: if the pushrod moves as you come up on Top Dead Center, you're on the exhaust stroke, and you need to rotate the crank one more time. If neither pushrod moves as you come up on the timing mark, you're on the compression stroke and ready to go.
- Loosen the adjustment nuts on both the rocker arms for cylinder #1 using a deep socket and a ½" drive ratchet. One at a time, adjust them as follows:
- Place the pushrod between you thumb and forefinger of your left hand (or right hand if you're left handed…). Rotate, or "twirl," the pushrod back and forth between your fingers and notice how lightly and easily it spins. As you do this, slowly tighten the rocker arm nut. The instant you feel the "twirl" friction change between your fingers, you are at "0" lash. STOP. Now, notice the position of your ratchet handle. Tighten the nut exactly ½ turn from your current position. Do the same to the other rocker arm for #1 (when doing this, make sure that the friction you feel as you swirl the pushrod is not caused by your ratchet and socket pushing or binding on the rocker arm – keep things straight and aligned, and watch for false indications caused by your tools). That's it for #1.
- Now, here's the trick:
  What's the firing order for a GM V8?
  1-8-4-3-6-5-7-2
  How often does a cylinder fire in a V8?
  Every 90 degrees
  That means we can now rotate the crankshaft 90 degrees at a time, and go right to the next cylinder in the firing order for the valve adjustment, with confidence that both of the valves for that cylinder will be closed and ready to adjust.. So rotate to your next chalk line, and adjust #8 as described above. Rotate to the next line and adjust #4. After you've rotated the crankshaft twice over (using the starter and "bumping" is the easiest way), you've finished your valve adjustment! No oily mess, no worrying about if you missed a valve. Just a nice, simple, structured procedure!
- Pop your valve covers back on with a fresh set of gaskets, re-install any accessory brackets you've removed, and start it up with confidence. You now have a correctly adjusted valvetrain that will operate quietly and with outstanding performance and reliability.:

Questions, Comments & Technical Assistance

If you have questions or comments regarding this article, or if you notice any errors that need to be corrected (which is quite possible since I'm writing this from memory…), please feel free to drop me an e-mail. Also, if you need any technical assistance or advice regarding this process, or other maintenance issues, feel free to contact me:

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