

The Lives of Lifters – What You Need to Know

By John Carollo

It's like any other mechanical part in an engine. It has a simple yet specifically designed function, it's not overly complicated and it's definitely not the proverbial rocket science, tricked-out part. But there's more to know about the valve lifter than you may think.

First off, there are two distinct styles of lifters used in vehicles: hydraulic and mechanical. The mechanical versions are often called solid lifters as they do not have the hydraulic cushioning function. From there, how they meet the cam lobe surface determines the style, either flat tappet or roller.

The majority of lifters built are hydraulic flat tappet used in street vehicles. Flat tappet lifters have a crown face that meets the cam lobe while a roller is self-explanatory with a roller contacting the cam. Again, both styles can be mechanical or hydraulic.

In contrast, an overhead cam engine uses variations of the hydraulic lifter with followers and lash adjusters but no pushrods. The performance market prefers mechanical and mostly roller styles. OEM builders typically prefer the hydraulic versions because they require less service for the vehicle's owner and need virtually no adjustment yet they can be used with both flat tappets or rollers. The performance market prefers mechanical and mostly roller styles.

Applications

Hydraulic roller lifters are suitable for pretty much anything, including street performance vehicles. And that includes the benefit of being able to follow a more aggressive cam design. That explains their popularity in the truck and even boat market where they can be an easy "drop in" cam kit for owners and builders. The simple nature of these "retrofit kits" can offer an easy option to customers.

They are not without their limitations, however, as hydraulic lifters usually cannot handle too much in the way of higher rpms and performance. You must consider their extra weight for both the reciprocating weight of the lifter and its effect on the cam. This added weight actually ends up working against the hydraulic lifter in those situations, adding yet another weak spot to an already vulnerable valve train. Another factor to consider is functional geometry and how a lifter can or cannot be controlled. The OEMs want the most they can get from a lifter so they use them to run up to their service envelope and not beyond, as in high performance conditions.

The transition of a lifter from street design to racing includes many facets. One of the biggest is internal hydraulic valving via the lifter's bleed rates. While the specifics are closely guarded secrets by manufacturers, the principal idea is that valving helps to be able to withstand the spring load rates, offer less preload and be of a beefier construction. For racing parts, less bleed is usually used.

Another difference can be seen in the method used to hold the lifter together. While the materials and the heat treats used are similar, it's not unusual to see a stamped steel ring used on an OE version; for racing versions, a dedicated snap ring is used so the lifters can be taken apart more easily. The critical area is lash: OE lifters are set up with zero lash then turned one turn. Racing lifters use only a quarter-turn.

Lifter Troubleshooting And What To Look For

Logically, the wear surface is the first place to look to see just what wear a lifter has accumulated. Is the crown correct? Unless you can precisely match that crown with the proper hardness and no soft spots - which is unlikely - you could be creating a bigger problem by reusing lifters. Most builders and manufacturers strongly recommend using new components. Another factor here is the nature of today's more advanced materials and heat treating, which can give you a "false read" on the old parts. By far the best practice is to use all new contacting pieces when installing a new cam or rebuilding an engine.

Watching out for lifter trouble is relatively simple. For flat tappet lifters - hydraulic or solid - the break-in period is absolutely critical. More aggressive cam designs and valve spring pressures may "amplify" the problems. True, with more pressure on the valves and cam grinds moving the lifter in a more dramatic gesture, the use of a good break-in lube becomes even more critical. Likewise for the contents of engine oils as additives have had to change to suit environmental requirements. Although break-in failures are easy to sidestep thanks to the vast array of extremely high quality break-in lubes available today some experts say the preventable failures actually seem to be increasing.

Another area that can be the site of trouble is the lifter bore in the block. As an example, some older engines that may have cycled around for their third, fourth and even fifth rebuild. The odds are that the lifter bores haven't received much attention and may now be out of round from excessive or premature wear. Much like a piston's bore, improper sizing in the lifter bore can contribute to a quicker and catastrophic failure.

Higher end race engines typically use bronze bearing sleeves in their lifter bores which can be checked often for any out-of-tolerance problems. When one is found, the sleeve can be easily replaced saving not only the valve train but the expensive block that has now become more of a parts holder. An engine builder's only option for a car owner who wants to keep his "numbers-correct" engine is to fix the problem correctly and maybe prevent future problems that would be bigger and more disastrous.

Another lifter problem is often revealed by the familiar sound of lifter clicking or ticking. It's called lash tick by most people in the business and can be caused by something as simple as a few small pieces of dirt in the lifter that collapse the hydraulic mechanism. Ninety-nine out of 100 times, the problem is caused by dirt that got in there, and unfortunately, that contamination can cause wear to the metal-to-metal contacts. This wear can also go into the body of the lifter, giving the needle bearings more room to dislodge from their cage.

If you're looking for problems in racing applications, normally, it's the needles. Probably the weakest link of a solid lifter are the needle bearings themselves. The tallest needle bearing always carries the load. By sizing all of their needles right down to the microns, the load is distributed more evenly so needle bearings will live a longer life.

In a more extreme engine valve train environment, lifter bounce can occur. Called "loft" or "launch," the lifter actually jumps off the cam. This not only increases the wear on the lifter's roller and supporting areas such as the roller's axle and bearings but often establishes a "divot" on the back side of the cam where the lifter comes back into contact much like an airplane's wheels upon landing. Sometimes the lifter will actually skid on the cam, too. The preferred method of operation for a lifter is to work smoothly in transmitting the motion. In racing applications, a simple over rev can create the perfect conditions for this to happen. Again, with the aggressive cam grinds and stronger valve springs, it's only a matter of time until the weaker component gives up after the abuse reaches the breaking point.

The Future

Just what is the future of lifters? With the widespread use of overhead cam versions—complete with hydraulic lash adjusters—are OHV engines and simple lifters ready to fade from the scene? That pushrod lifters are going to go away? Hardly. They are less expensive and more reliable for OEs to use. General Motors is a prime example of a company that sees the value of OHV technology.

In fact, there's already talk about the next generation of lifters coming out of Detroit. They will sport a lower profile to match up with an engine that sits lower in the chassis to present less upper engine mass to the car or truck's hood. And it's not just the engine's location, the engine itself is being made with less upper profile, mass and weight. The lower profile means the length of the lifter will be reduced, as will the pushrod length and upper parts of the block and heads. It's a challenging concept and entirely doable.

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