

Maintenance Misdiagnosis

by Stu Simpson

Back in October it was looking like my Cavalier's engine was leaking oil from somewhere, specifically, the front crank seal... again. I've had an inordinate amount of trouble with the seal leaking, but I thought I'd traced the problem and whooped it.

Since I installed the Lycoming O-320 in the spring of 2015 I've redone the front crank seal three times. I finally realized the reason for the leak was because I was adding Marvel Mystery Oil to the sump at each oil change. Since MMO is a proprietary recipe of mineral oil, solvents (some say turpentine) and other stuff, it seemed pretty clear it was eating the crank seal sealant.

Thus, I stopped using Marvel and the crank seal has held since then. So, I was really surprised, and more than a little frustrated, when I started smelling burning oil in my cabin heat muff and seeing way too much of it in the engine bay; both being telltale signs of a leak at the front of the 320. The crankcase breather hose position means there's usually some oil in the engine compartment, but what I was noticing was way more than normal.

Lycoming front crank seals come in two types; a solid rubber piece that stretches over the prop flange with enormous difficulty, and a type that is split to fit over the crank behind the flange with minimal fuss. There are pros and cons to each. The split style, which I've always used, goes on much, much more easily, but is said to be not as long lasting. The solid style is apparently more durable in the long term, but can be really tough to install over the prop flange. It requires a special tool that is used ONLY for that one task, and which costs about \$140 dollars.



The Lycoming one-piece crank seal and the special tool that stretches it over the prop flange. The curved part of the lever is grooved to slide around the flange. Courtesy www.glasair-owners.com

There's also a specifically recommended sealant for the job, which holds the seal in its journal. It's also ridiculously expensive for a toothpaste-sized tube of the stuff. If you're an aircraft engineer, you'll buy the tool likely only once in your career, and use the sealant on other items, as well, so it's probably not as big a deal as it is for a private aircraft owner doing their own maintenance.

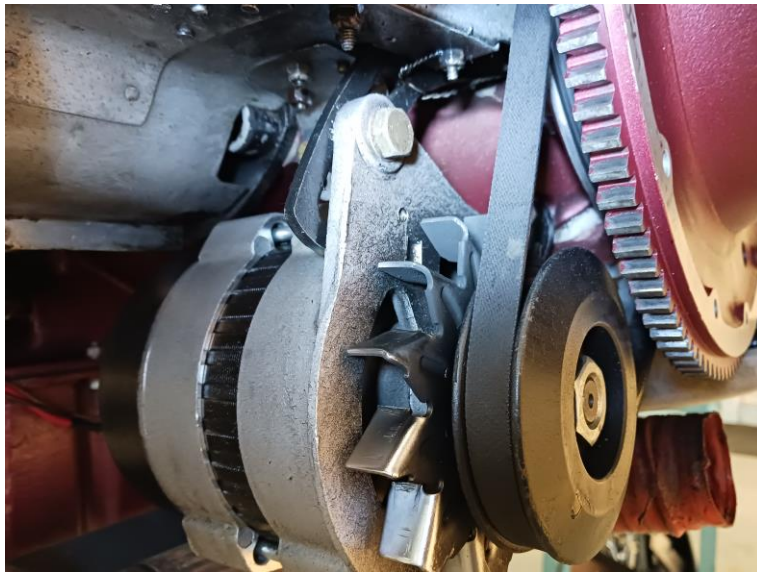
After all my frustrations with the crank seal over the years, I decided to bite the bullet and get the one-piece seal, the proper tool, and the sealant. This time, there wouldn't be any more leaks!

In early November I had all the tools and parts in hand, and due to Bob Kirkby's generosity, a warm hangar to work in for a couple of days. As I tied into the job and pulled more and more pieces off the front of the Cav, like the cowling, the spinner and the prop, I was finding more and more evidence of a cranky crank seal.

The interior of the cowling was more oily than normal, especially at the front. A residue mixture of splashed oil and alternator belt dust coated the front of the alternator. A shallow puddle of oil pooled in the SCAT tubing that feeds the cabin heat muff and sits directly beneath the crank. And the front of the engine case displayed a thin sheen of oil, too.

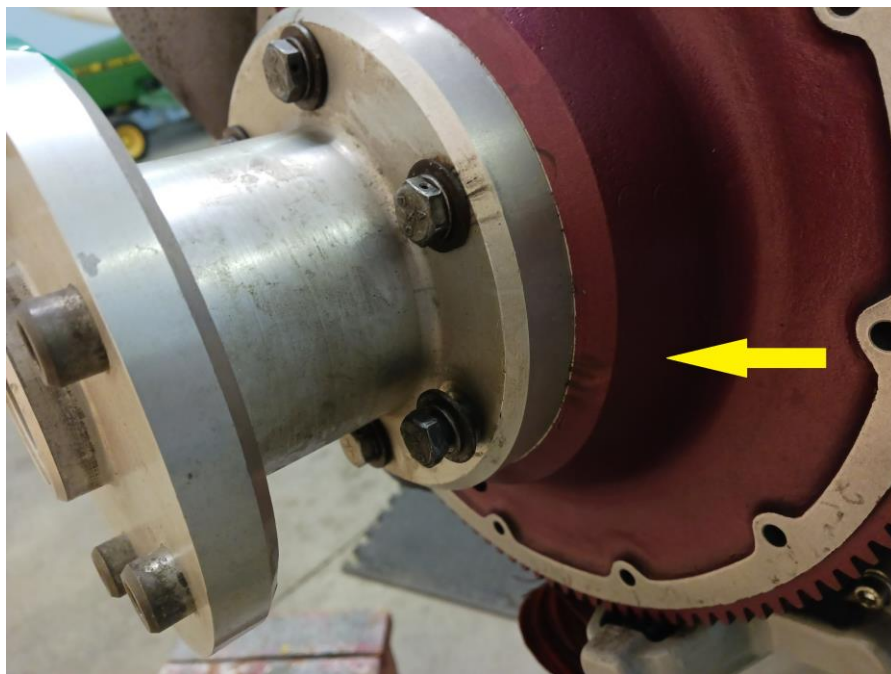


The cabin heat muff intake tube sits beneath the front crank seal. Arrow shows oil in the tube, which then gets into the heat muff and stinks up the cabin.



The front of the alternator showing a mixture of oil residue with normally occurring 'dust' from the belt as it wears.

Finally, after I wrestled the prop extension off the flange, Bob slipped the starter ring off and we examined the inside of it. Here was the first clue that maybe something else was amiss. The inside of the starter ring was dry. When the crank seal leaks, there's naturally some oil inside of it since it surrounds the crank seal.



The starter ring assembly and prop extension. There's some oil residue on the extension, but the bowl-shaped inside of the ring assembly, which surrounds the crank seal where the arrow points, was dry.

In fact, the crank seal itself was absolutely dry. The seal was tight and there was no evidence at all of any leakage. Bob and I quickly concluded the crank seal was not the problem.

On one hand I was relieved and thrilled at not having to replace it, even though I'd dropped nearly two hundred dollars preparing to do so. I guess I'll be saving all that stuff for the next time, which I hope never comes.

On the other hand, I was mystified as to where the oil was actually coming from. This obviously needed a wider scan.

Upon further examination I discovered there was noticeably more oil residue on the left side of the engine than on the right. The oil also seemed to be heaviest atop the flange where the oil sump bolts to the bottom of the engine case. And then I noticed the oil return lines on cylinders #2 and #4, especially #2, were heavily covered in oil.

Suddenly, the cause of the oil leak became glaringly obvious and had nothing to do with a cranky seal.

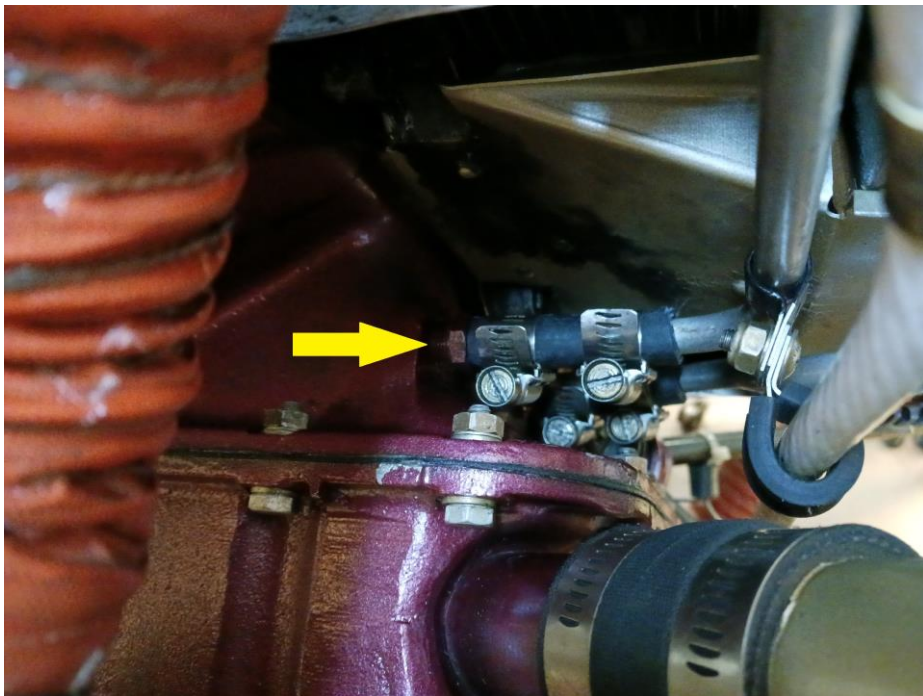
On the Lycoming O-320 each cylinder has a 3/8" metal line that drains excess oil from the cylinder heads back to the crank case and sump. The line joins to the case via a 2.5" length of rubber hose slipped over a barb threaded into the case itself. Hose clamps secure the rubber in place.



Arrows point to the cylinder head oil drain lines on cylinders #2 and #4.



A closer look past the exhaust and intake tubes at how the oil drain lines route into rubber connection hoses beneath the cylinders.



View looking aft at how the oil drain line and the rubber hose sections clamp to the barb fitting (at the arrow) threaded into the case. Photo shows the new hose sections.

The rubber hose on cylinders' #2 and #4 drain lines had deteriorated to the point where at least one of them was leaking, either from the hose clamp joint, or from a crack in the rubber. In any case, I replaced both pieces of hose from stock in my hangar. Then Bob and I commenced re-assembling the front end of the Cav.

It was all an interesting case of compelling but still circumstantial evidence leading to an understandable but entirely wrong conclusion. To be fair, though, it was one I reached based on previous experience. It's worth noting that the oil return lines have also leaked in the past due to loose clamps, but I forgot about that.

The factor that biased me toward a crank seal leak was how oil was getting into the cabin heat muff right under the seal. Of course, with the way air squirrels around in the bottom half of the cowling, it's easy to see how that could happen with the leaking return lines, especially with the significant amount of oil that had leaked.



The Cavalier's all ready to get fully dressed again with no more leaks. Kirkby's Starduster and Cherokee 235 are in the background.

I take this a good lesson in troubleshooting, though it was more expensive than it needed to be. And I'm cynical enough to think that I'll likely be using those newly purchased crank seal replacement items at some point in the future. Hopefully, it'll be a long time in the future.