

Aircraft Engine Oil Changes: How Often?

No surprise that the companies who sell the oil say frequent changes are better. Here are our recommendations.

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It's accepted wisdom that your engine will last longer if you change the oil frequently. If that's true—and we're as guilty as anyone for supporting whatever mythology applies—isn't changing it more frequently even better? And what the heck does "frequently" really mean? Engine manufacturers have their own recommendations, which are sometimes hard to find and even harder to follow. But as far as we can tell, these are determined less by actual research-based findings than they are textbook recommendations from engineering manuals. So for this report, we set out to find out what the piston-engine aviation oil professionals who manufacture and sell the oil and the people who analyze the dirty stuff have to say. What do they recommend for the typical aircraft owner?

Why Change Oil?

Does the oil actually wear out? No, it doesn't, at least not appreciably during a typical interval between changes. Instead, we change oil to remove potentially damaging contaminants. After sitting for hours, days or weeks, your engine's oil is heated up, pressurized and circulated past pistons, crankshafts, camshafts and cylinders. As it circulates, oil is collecting tiny bits of metal as, inevitably, your fresh overhaul wears and turns itself into a high-time engine. Those tiny metal particles suspended in the oil are normal and, when analysis is performed, their characteristics help us determine if any components are wearing abnormally. Some are caught by the filter, fewer by a screen and those small enough to escape both wind up at the bottom of the crankcase or are too small to cause any damage, according to Conoco-Phillips' Harold Tucker, who is director of product technical information and training. As long as you don't fly in a sandstorm, or you aren't an ag operator flying at low level, internal abrasion from those particles isn't a problem to get overly concerned about, Tucker says.



But that's not the end of it. While the oil is collecting various bits of expensive metal, it's also picking up the byproducts of combustion. Dating to the 1930s, technology in air-cooled powerplants has been designed for looser clearances when compared to modern automotive engines. "A tremendous amount of stuff gets by pistons into the crankcase," says Ed Kollin, technical director of Aircraft Specialties Lubricants, which makes CamGuard oil additive.

After a few hours of operation, the oil in the crankcase entrains a wide range of contaminants. For example, in addition to partially burned hydrocarbons, there's raw fuel from overpriming and rich mixtures, plus the biggest problem of all: water, itself a combustion byproduct. That water, combined with the chemical stew from thousands of tiny explosions in the cylinders, forms acids. Those acids promote corrosion and, at least anecdotally, we believe this is the single most significant wear item for aircraft engines. "Corrosion, as a result of infrequent use, is by far the greatest problem in those engines I've examined that have problems," Kollin says.

Between Changes

Instead of worrying about the tiny bits of metal in the oil, which show up at analysis—your engine is on analysis, right?—we really should be worried about corrosion. While modern aviation oils do a good job of lubricating and are good at minimizing corrosion, combustion byproducts eventually overcome even the best oil chemistry. And corrosive acids, according to Kollin, can start showing up in as little as 20 hours of operation: "After 20 hours, the oil's chemical equilibrium shifts to a corrosive environment," he says.

Short of changing the oil, the presence of contaminating chemicals and water is the main reason piston aircraft engine gurus urge pilots to make sure their oil is heated up when flown. An ideal oil temperature is 180 to 190 degrees F,

which helps drive off water and minimizes its ability to react with contaminants and form the acids causing corrosion.

How often should the airplane fly to heat up the oil? Once or twice a week is ideal and the flight should be an hour or so in duration, according to Paul Royko, Shell's technical manager for piston-engine oils. "Shorter flights—a half hour, for example—don't get the oil's temperature high enough and do more harm than good," he says, since you're just circulating the contaminated oil throughout the engine and warming it enough to accelerate acid formation and corrosion.

Conoco-Phillips' Tucker agrees: "Shorter flights—like for the \$100 hamburger each weekend—actually result in more moisture in the engine. That's contrary to what people might think," he admits. If that's your typical flight, Tucker strongly recommends changing oil more frequently than either TCM or Lycoming recommend.



The cam destruction shown here begins with micro-pitting caused by corrosion, as shown on the lifters in bottom photo. Engine oil's role is to prevent the corrosion in the first place and fresh oil does that better than dirty oil.

Variations

If you went strictly by what the engine manufacturers say, you'd change your oil every 50 hours or four months, whichever comes first. If your engine lacks a filter and uses only a screen, make that 25 hours or four months. The table on page 17 breaks down recommendations from Continental and Lycoming, including each company's reference document.

Of course, owners are free to shorten those recommended intervals and they frequently do, according to Ryan Stark at Blackstone Laboratories, our favorite oil analysis lab. He tells us 30 to 35 hours seems to be the average between changes for the engines on which his company performs oil analysis.

What if you fly 50 hours in a relatively short time—two months or so—then change the oil but your utilization rate sinks to almost nothing? That's when you switch to the calendar instead of the tach. Another example might be finding the engine oil at 40 hours (in far less than four months), but the airplane is scheduled for a trip of 20 or so hours over the next two or three weeks. Should you change the oil before the trip or, knowing the engine isn't going to be sitting long enough for corrosion to take hold until you return, change it once the trip is concluded? The answers were consistent: change the oil before the trip.

The reason for leaving on that trip with fresh oil is the same as our experts' unanimous recommendation to fly the airplane briefly after the oil change: Allow that fresh oil to circulate and replace the contaminated oil. "Merely changing the oil doesn't do anything," Conoco-Phillips' Tucker told us: "You're missing the benefits of fresh, clean oil by not running it to replace old oil throughout the engine."

One Size Doesn't Fit All

Everyone we spoke with agrees: If you don't fly very much, you should change your oil more frequently than manufacturers recommend. For example, if you struggle to reach 100 hours each year—or an average of fewer than 10 hours each month—you definitely should be changing oil more often. "I'd be more concerned with the calendar than the number of hours," Shell's Royko says when considering low-activity engines.

What's low activity? Royko and others with whom we spoke generally agreed 25 hours, or every three months, should be your target if your aircraft engine isn't used much. "If you only fly 30 hours a year," says Tucker, "then change your oil by the calendar, not the tach." Blackstone's Stark agrees: "Less than five hours a month definitely qualifies as infrequent," and you should go by the calendar.

The converse is true, but there are limits. If you fly, say, 20 hours a month, you can get by with going slightly beyond engine manufacturers' recommendations, but not very far. Think of 60 to 65 hours between changes as an upper limit, presuming you're doing all this flying in no less than three months. After that, according to Tucker, the lead build-up alone is high enough to start causing problems.

Blackstone's Stark says his company works with flight schools and other fleet operators to monitor engines.

"Engines that fly more often look good and have fewer metal accumulations. Some operators can go 100 hours between changes in 30 to 60 days. There's no hard and fast rule, though," he adds.

That's a little extreme for us. Besides, somewhere in the middle, say flying 100 to 200 hours a year, is where many owners seem to be. In that situation, the experts say to change the oil more frequently; don't wait until reaching the magic 50-hour number the engine makers recommend. The 30 to 35-hour interval noted by Stark for most operators using Blackstone's analysis magically works out to a minimum of three or four changes per year at the low end of the 100 to 200 hours/year average.

Put another way, if most filter-equipped operators waited until accumulating 50 hours, they'd likely be past even the engine manufacturers' calendar recommendations. Changing oil at 30 to 40 hours—four or five times a year—is probably the sweet spot. Conoco-Phillips' Tucker agrees: "What matters is how long it took to get to 40 hours."

Aviation Specialties Lubricants' Ed Kollin agrees. An owner flying 100 or fewer hours each year should be changing oil at least four times a year, he believes. Further, filters don't remove the acids and water which cause corrosion, even though they catch the metal particles circulating. Flying the engine or changing the oil is the only way to address the presence of contaminants, he says.

Blackstone's Stark summed it up: "If people are flying their engines on a regular basis, changes can be less frequent." If not, you know what to do. After all, a few quarts of oil and some filters are a lot cheaper than a new engine. Worth noting is that all of the players we talked to here have an interest in owners changing oil more frequently rather than less. Phillips sells more oil, labs do more analysis and so on.

Nonetheless, our review of oil analysis records and our numerous corrosion tests over the years leads us to say that these recommendations pass the smell test. There are better ways to save money in aircraft ownership than skipping oil changes.