BLACKSTONE LABORATORIES

The Oil Report
July 2018

Oil the News that's Fit to Print!

Have you ever sent in a sample and didn't hear back from us? You might be surprised to learn we get five to ten samples each month with no information – either there's nothing in the container but oil, or the information slip is completely blank. We save all of the information we can with these samples (where it was sent from and when we received it) and then we actually test those samples so we can store the data in our database. When someone calls wondering where their sample is, we can often do a bit of sleuthing and find the wayward oil. If you think this might have happened with your sample, just let us know!

How Often Should I Sample?

by Ryan Stark

One of the most common questions I get asked is, "How often should I send in a sample?" and this is one that I tend to struggle with answering. The businessman in me says at every oil change regardless, and while you're at it, check your transmission fluid, differential fluid, and your wife's/husband's car. And don't forget any air compressors, lawn mowers, wood splitters, etc. you may own. And your neighbor's car was smoking a bit last time you saw it drive past, better check that too. Unfortunately, before I start talking, my "realist" side kicks in and I usually say something like once a year, after you have some good trends established. But even that answer doesn't always apply. What if you don't drive your vehicle very often, or at all? Is it really necessary to test the oil once a year? The answer to that is once again, not really. Though if you think you might have a problem developing, then it could be a good idea to sample more often than you normally would.

We recently had a customer send in a sample of oil that had been in an engine since 2008 and had not been run in over 5 years -- amazingly enough the oil really didn't change at all. Wear metals were virtually identical to what we were seeing in 2008 and the only significant difference was at insolubles. These had gone from 0.2% to 0.0% after the 5 years of sitting. We figured the reason for this was gravity. All normal engine oils contain dispersant additives, and their function is to hold dirt and solids in suspension so they can be filtered out. Do they work? Absolutely, but asking them to work for a full five years is a little much. The good news is that the additives are still in the oil, so once the engine starts up and sees some use, those solids should be picked up and dispersed again.

So, if we can say with good certainty that the oil itself won't go bad just sitting in an engine, you might wonder why it needs to be changed at all? The answer to that is contamination. Engine oil has maybe the hardest life of any oil application out there. Not only does it see frequent temperature swings of 150° to 200°F (65° to 93°C), but it will also get contaminated with fuel blow-by and a little atmospheric water as well. Ideally the fuel and water will boil out once the oil gets up to operating temperature, but that contamination will add up over time and eventually cause the oil to start to oxidize. If you can pinpoint exactly when the oil will oxidize enough that it will start to affect wear or cause the oil's viscosity to change, that's the point at which you want to change the oil. If you test your oil on a regular basis, you can start to identify that point, and that's one of the reasons why we're here. But, this article isn't about long you can run your oil; we already wrote that one -- twice (see https://www.blackstone-labs.com/Newsletters/Gas-Diesel/March-1-2009.php and https://www.blackstone-labs.com/Newsletters/Gas-Diesel/July-1-2013.php).

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So when is the best time to get a sample? The answer to that is: it depends. If you just bought a brand-new car, the first oil is factory oil and while that oil will sometimes have an unusual additive package, it's not that useful for finding a problem, or developing a normal wear trend. Factory oil is typically loaded with excess metal from wear-in of new parts as well and some silicon from sealers used when the engine was assembled, and this stuff normally takes two or three oil changes to wash out. So, while these samples aren't useful as far as trends go, they are useful in finding problems in engines that have been recently rebuilt or had other major work done, and we always recommend testing those from the beginning. This is because if wear metals don't drop from that initial oil fill, it can be the early indication of a problem. Still, for factory-new engines, you can skip sampling them right off the bat and not lose much information.

The Key to Longevity

A few years ago I wrote an article about how trends in blood tests were just as important as trends in oil analysis (see our newsletter from August 2015). This medical talk spurred a lot of comments and advice which I greatly appreciate, though surprisingly enough, not too many of you seemed concerned about my suicidal-scorn for statin drugs. Still, I'd like to thank all of those was responded and I'd like to pass on one bit of great advice from a doctor/pilot. His best advice for living a long healthy life: Stay off ladders.

What is a very good idea is to get a trend going while the engine is running well. A trend consists of three samples. Once we have that established and the engine is running perfectly, then it's not really necessary to get a sample at each oil change and at that point it's okay in most cases to go to a once-a-year sampling routine. You might be wondering why once a year? The reason for that is two-fold. One: A lot of people (including myself) only change their oil once a year. It's also the only time I crawl under my car and have the hood open. I consider it like an annual inspection and there are been numerous times that I have been on my back waiting for the oil to drain when I noticed another problem like a seeping freeze-plug or a torn CV boot. Two: It's easy to remember.

However, the once-a-year rule doesn't always apply. There are many vehicles out there that only see light use (maybe less than 500 miles a year), so not only can they typically skip changing oil on a yearly basis, then you don't need to sample every year. Another factor is how important the vehicle is to you. If you rely on it for your business, or it's the only vehicle you have and it's getting up there in mileage, then sampling at every oil change might be a very good idea. We can see problems developing in your engine long before they actually cause a failure, so you normally have some time to do something about any trouble we might spot. Like a lot of things in life, the earlier you know about problems the better. We get a lot of samples from engines that have a known problem, so we test the oil and usually see poor wear, but telling how bad the problem is or how/when it started is hard without trends from when the engine was normal. We do have averages that give us a good idea how an engine should look overall, but they aren't as valuable as trends when it comes to saying exactly what's normal for a particular engine and the use it sees.

Another reason you might want to sample more than once a year is to have a complete record. A lot of people use oil analysis as a selling point when it comes time to sell their old car and buy another one. We also frequently hear from people who say the engine data helped them convince the dealer that something was not right when the problem wasn't immediately obvious. In the end, whether you sample often or rarely really depends on your goals and the reasons you're sampling in the first place.

So there you have it, in this newsletter, I'm actually saying you may not need our services as much as you might think. Some of the other business owners out there might call me crazy and I guess they're right. But please, feel free to sample anytime you like. As you well know, there is nothing better than getting a glowing oil report on your pride and joy.

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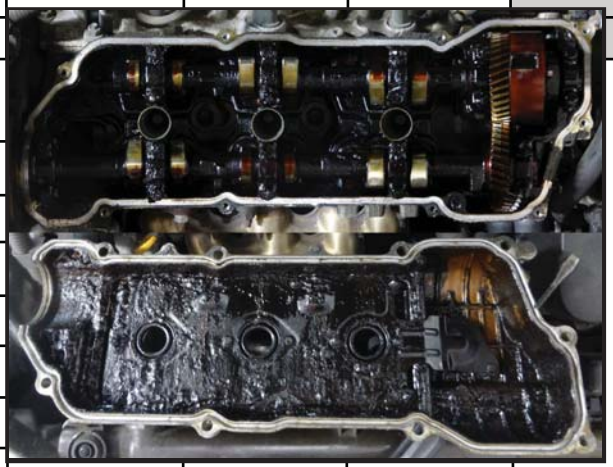
Report of the Month

This 2002 Toyota Avalon had a problem repaired between the first and second samples. So why is wear higher in the second?

To learn more about where the elements are coming from, click here.

ELEMENTS IN PARTS PER MILLION			UNIT/ LOCATION AVERAGES					UNIVERSAL AVERAGES
	MI/HR on Oil	3,247		3,077				
	MI/HR on Unit	151,884		146,847				
	Make-up Oil	0 qts.		14 qts.				
	ALUMINUM	2	4	5				3
	CHROME	2	1	1				0
	IRON	12	9	12				7
	COPPER	1	1	1				2
	LEAD	10	4	2				3
	TIN	12	5	4				1
	MOLYBDENUM	6	60	103				69
	NICKEL	0	0	0				0
	POTASSIUM	2	1	0				2
	BORON	13	115	110				47
	SILICON	162	75	50				17
	SODIUM	14	11	11				36
	CALCIUM	1025	1947	2853				1982
	MAGNESIUM	381	133	11				185
	PHOSPHORUS	674	721	789				706
	ZINC	698	772	858				818
	BARIUM	0	0	0				0



Toyota's infamous sludge problem.

PROPERTIES			Values Should Be*	
	SUS Viscosity @210°F	55.9	54-63	60.7
	cSt Viscosity @ 100°C	9.04	8.5-11.3	10.41
	Flashpoint in °F	390	>375	380
	Fuel %	<0.5	<2.0	<0.5
	Antifreeze %	0.0	0.0	0.0
	Water %	0.0	0.0	0.0
	Insolubles %	0.8	<0.6	0.2
	TBN	1.8	>1.0	12.3

The owner had had good luck with two similarly old Avalons in the past. He bought this one for his son and was surprised to find that it not only smoked on start-up (unless parked uphill), but the engine was using a ton of oil, especially on the highway - in that first sample the engine blew through 14 quarts in 3,000 miles. So the first sample's metals were severely diluted. (All that make-up oil is also the reason the TBN read so high.) He suspected the problem was the valve guides, but when he looked at the spark plugs, #2 was clearly worse than the others, with ash deposits bridging the plug gap. However, the plug was iridium and was still able to fire under the terrible conditions. It only generated an error code under hard highway acceleration. According to the owner's research, cylinder #2 is the sludge canary in the coal mine for this type of Toyota. The rear valve cover was so sludged up that sludge was preventing internal engine air from getting to the PCV valve. The pressure was forcing oil out every place it could, mostly through the valve stem seal. Replacing the valve cover fixed the oil consumption problem. So why is wear so high in the second sample? It turns out that fixing the first problem may have unvcovered a second issue. Lead and tin typically indicate bearing wear; those metals were being masked by the excessive oil being added in the first sample. Silicon is from sealers used in the fix.

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Report of the Month

This 2004 Porsche Boxster's engine blew at Laguna Seca.
What went wrong?

To learn more about where the elements are coming from, click here.

ELEMENTS IN PARTS PER MILLION								
	MI/HR on Oil	7,000	UNIT/ LOCATION AVERAGES					UNIVERSAL AVERAGES
	MI/HR on Unit	116,000		110,000				
	Sample Date	1/28/2018		3/14/2015	5/24/2014			
	ALUMINUM	17	8	9	6			4
	CHROME	4	2	2	1			0
	IRON	51	23	30	16			9
	COPPER	24	16	19	12			7
	LEAD	91	5	7	3			2
	TIN	6	2	0	3			1
	MO LYBDENUM	2	12	6	17			61
	NICKEL	3	3	3	2			0
	PO TASSIUM	3	1	2	0			2
	BORON	47	53	49	56			114
	SILICON	28	21	16	26			7
	SODIUM	11	11	13	8			12
	CALCIUM	2429	2656	2844	2468			2546
	MAGNESIUM	19	33	27	39			105
	PHOSPHORUS	914	851	878	824			891
	ZINC	1024	1035	1110	960			1030
	BARIUM	0	0	0	0			0

PROPERTIES			Values Should Be*				
	SUS Viscosity @210°F	64.1	56-63	63.3	67.4		
	cSt Viscosity @ 100°C	11.35	9.1-11.3	11.14	12.27		
	Flashpoint in °F	395	>375	385	410		
	Fuel %	<0.5	<2.0	<0.5	<0.5		
	Antifreeze %	0.0	0.0	0.0	0.0		
	Water %	0.0	<0.1	0.0	0.0		
	Insolubles %	0.2	<0.6	<0.3	<0.2		
	TBN						

We had emailed with the owner back in February when metals were increasing. Considering the high lead, we were leaning toward the problem being with a main or rod bearing. Then, at Laguna Seca this summer, the engine blew. The owner believes the high-G situations on the track coupled with too-high tolerances in the rod bearings caused oil starvation, which led to a rod bearing failure.

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