BLACKSTONE LABORATORIES

The Oil Report
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Oil the News that's Fit to Print!

What does make-up oil mean? We ask for it on the oil slip and people are often confused. What we want to know is how much oil you've added between oil changes. Did you add 1 quart? Two? None? We don't want to know how much oil the pan holds, or how much you added after you drained the pan. Just how much you added in between oil changes.

FAQ Roundup

by Kristin Huff

Today I spent an hour talking with an AT&T "expert" online. ("No worries on that, Christine!" she said. "You got an expert here!") Unfortunately, Desirae was neither an expert nor actually helpful in any way. We at Blackstone really strive to provide excellent customer service. We get emails and phone calls every day from people who have follow-up questions about their reports and about analysis in general. We've gathered some of the most common questions here, but if there's something you've been wondering about that we didn't cover, feel free to let us know!

Why did (moly, boron, calcium, phosphorus, zinc) go up/down since last time?
Those elements are just additives in the oil itself, and their levels will vary depending on what type of oil you use. You can't really compare them to universal averages, because universal averages are going to be a mix of all different types of oil. What you really want to use averages for is comparing your wear metals: aluminum, chrome, iron, copper, lead, tin, and nickel. And silicon, which isn't a wear metal but is an indication of the effectiveness of air filtration.

How concerned should I be about ABC metal?
As you probably know, we take a lot of things into account when we're trying to determine whether an engine has a problem or not. Our first guideline for when to mark something is when it gets to twice the average level. Usually we'll highlight it at that point, though sometimes we don't, if we know there's a good reason for it reading high. Some engines, for example, make more metal than others, and if the trend is steady we'll call it normal even if it's above average. Or maybe you reported towing or racing, or you're running much longer on the oil than normal -- those things can all cause extra wear and we might call it okay. But if we do think there's a possibility of a problem, we'll spell it out in the comments. We try hard not to worry you unnecessarily, but we also don't want to overlook something that's not normal.

Where does fuel come from?
Blow-by past the rings is usually the source of fuel in the oil for both gasoline and diesel engines. Some engines are worse than others, and older carburetor-style engines are probably the worst about leaving fuel in the oil. It happens more on start-up than any other time, though that doesn't mean we always see right after an engine starts up. That was proven by Amanda's testing on her Kia. Less often, fuel comes from things like injector problems or an issue with a fuel pump.

Can/should I switch from XYZ viscosity to ABC viscosity?
As long as you're under warranty, we advise going with whatever the manufacturer recommends. After that, feel free to play around with different viscosities. As a rule, we really don't see any problems from changing grades.

I just bought a new car/truck, and I don't know the oil/mileage. Does it still make sense to send a sample?
It's really up to you. If you suspect the last owner just changed the oil, then you might want to wait until your first full oil change to see how the engine is wearing (more miles/hours on the oil is better for getting a true picture of engine wear). But if you're worried about something, or you just want some peace of mind, then absolutely, go ahead and sample right away. If there is a serious problem, we can often see it, even if the oil hasn't been run very long.

I noticed a question mark in the coolant spot. How come you couldn't give me a %?
Antifreeze is a glycol, so we don't test for it directly. Instead, when antifreeze is or has been present in the oil, it tends to leave behind potassium and sodium as a sort of footprint, even if any actual moisture has cooked out. Sometimes, if there's just a little of one or both of those elements, it's hard to say for sure if they're from a very slight coolant leak, or if they're from some-

thing else. Sodium, for example, could be left over oil additive from an oil you used in the past. When the potassium and sodium levels are present but very low, there may be a slight enough leak that you won't be able to see any loss of coolant, and it's usually not hurting wear much at all, so we'll typically put a question mark in the antifreeze category and just recommend monitoring it. If more does turn up in subsequent samples, then we usually quantify it.

I drove my car on the highway for 20 minutes and then let it sit for half an hour before I took the sample. This oil was the first oil to come out of the engine. Is that the reason for the extra metal in my sample?
Probably not. The oil has a lot of additives in it that hold most of the dirt and metal in suspension, so the first oil should be very similar in composition to the middle and last oil that comes out of the pan. We recommend a mid-drain sample simply because there might be dirt around the drain that leaves with the first oil, and if you wait till the last oil you might run out and not have enough to fill up the sample bottle. If you take the first or last oil out of the pan, feel free to let us know but it's really not a big deal at all in most cases.

I sampled through a quick-drain release valve. Is that why metals are so high?
Maybe, depending on the type of drain and what's reading high. Some of them are brass, and new ones leach oxides that can throw copper off. But most of them don't affect analysis at all.

I don't really understand the viscosity. I thought the oil got thinner as it heats up, but you're saying a 5W is a 5W upon start-up and 30W after reaching operating temps. Is this because of oil additives?
In a general sense, the viscosity of the oil does decrease (i.e., gets thinner) as the temperature increases. In other words, oil will flow more freely when it's hot than when it's cold. The same is true for a lot of viscous liquids, like honey or syrup. However, there's a little bit more to today's automotive engines than that.

When we call an oil a 5W/30 or 15W/40 (or whatever), those numbers are classifications to help easily categorize the viscosity of different types of oil. Back in the old days, you didn't have multi-weight oils like that -- you had straight 30W, 40W, or whatever. A 30W oil is defined as an oil whose kinetic viscosity is between 9.5 and 12.5 centiStokes (cSt) when measured at 100°C. That same oil will have a cSt reading of ~80-110 cSt when measured at 40°C (these numbers are rounded off for simplicity). The higher the cSt reading, the thicker the oil, so a straight 30W oil is much thicker at 40°C (a bit warmer than room temperature) than it is at 100°C (the boiling point of water).

The problem for automotive engines is that you want the oil to flow at a consistent rate over a wide variety of temperatures. For example, if you were in Indiana this morning, the outside ambient temperature when you started your car was about 8°F, but after 30 minutes of driving, the engine temps are up around 200°F. If you're using a straight-weight oil, that's a huge temperature differential, and the oil would behave much differently on start-up than it does once the engine is warm. This is why, back in the old days, people had to use one viscosity oil in the summer, and then switch to a lighter viscosity in the winter. The lighter viscosity oils were actually marked with a W, for "winter," so that's where "5W" and "10W" come in.

So you see the issue; we want to use a 5W oil when the engine is cold, because it will flow more freely, but that's not suitable when the engine is hot, because it will become too thin and won't protect the engine's parts well enough. A 30W, on the other hand, would be good enough to protect parts, but it won't flow freely enough at cold temperatures, leading to oil starvation.

To remedy this, the oil companies came up with multi-viscosity, or multi-weight oil, which is mostly what we use today. Basically, they've taken a bunch of viscosity modifying molecules and added them to a straight-weight oil. As the oil warms up, these Viscosity Index Improvers (VII) additives will activate, causing the viscosity to thicken up. The idea is to make an oil that behaves like a 5W when it's cold, but a 30W once it warms up. In fact, to be designated a "5W/30," the oil has to pass the test for a 5W when it's cold, and it has to pass the test for a 30W when it's hot. In our standard analysis we test the oil at the hot temperature, since that's the most critical to your engine. We want to know whether the oil is maintaining the proper thickness when you're driving and the engine is hot. (We can do a low-temp viscosity if you ask for it; it's a separate test that costs extra.) Interestingly, the oil often shears down (thins out) quite a bit from its virgin state once you start using it. This is a natural property of oil and doesn't seem to hurt engine wear at all.

If we tested a 5W/30 oil at 100°C, the reading should be around 9.3-12.2 cSt, pretty close to the expected range for a straight 30W. However, if we test it at 40°C, we'd expect a reading of maybe 15-20 cSt, which is what a 5W oil should look like. That's much lower than the 80-110 cSt we'd get if we tested a straight 30W at the same temperature. In effect, the VII's stabilize the viscosity, so there's much less variation over a wide range of temperatures. The oil behaves like a 5W oil when cold, and like a 30-weight when hot. Nifty, huh?

Report of the Month

This S2000 engine is no longer running. What happened?

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

ELEMENTS IN PARTS PER MILLION								
	MI/HR on Oil	1,718	UNIT/ LOCATION AVERAGES					UNIVERSAL AVERAGES
	MI/HR on Unit	109,068						
	Sample Date	07/27/2011						
	ALUMINUM	20	20					5
	CHROME	2	2					0
	IRON	51	51					8
	COPPER	35	35					4
	LEAD	24	24					1
	TIN	1	1					1
	MO LYBDENUM	101	101					95
	NICKEL	1	1					1
	PO TASSIUM	0	0					2
	BORON	70	70					69
	SILICON	42	42					9
	SODIUM	6	6					25
	CALCIUM	2630	2630					2317
	MAGNESIUM	17	17					249
	PHOSPHORUS	760	760					745
	ZINC	901	901					870
	BARIUM	0	0					0

PROPERTIES		Values Should Be*				
SUS Viscosity @210°F	55.2	58-68				
cSt Viscosity @ 100°C	8.83	9.7-12.7				
Flashpoint in °F	355	>365				
Fuel %	0.5	<2.0				
Antifreeze %	0.0	0.0				
Water %	0.0	0.0				
Insolubles %	0.2	<0.6				
TBN						
TAN						
ISO Code						

*THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

If you're thinking "bearing failure," you're right on. Not 3,000 miles after this sample was taken, the bearings failed. The S2000, like a lot of modern engines, has a system that sprays the bottom of the piston with oil. In some (not all) older S2000s, the sprayer was not spraying enough oil. The owner said the pistons weren't being lubricated properly, which led to scoring, and that in turn caused excessive bearing wear on the steel crank. In essence, according to the owner, a lack of lubrication on two cylinders caused excessive piston scoring, which caused the bearing failure. This problem was apparently corrected in later S2000 engines.