BLACKSTONE LABORATORIES

The Oil Report
March 2020

Oil the News that's Fit to Print!

Slick Talk is here! Blackstone's podcast unpacks the questions, comments, and concerns you have about engines. Join senior analyst Joe for an in-depth look at topics like bearings, antifreeze, extended oil use, and more. You can subscribe on your favorte podcast platform. If you like what you're hearing, don't forget to rate/review!

How Big is this Problem?

The numbers are off. How concerned should you be?

by Ryan Stark

One of the main purposes of oil analysis it to find problems that might be developing in an engine, and after working at this for a lot of years, I can say without a doubt that it works. However, some problems are more urgent than others, and part of our job is to determine if a problem is a major one or not. Most engine problems start out minor, though if left unchecked can lead to major issues, which eventually result in the engine's demise.

Minor problems

Fuel dilution
This generally includes any fuel level between 2.0% and 5.0% that keeps showing up again and again. This is not a normal situation, but it doesn't necessarily cause an engine problem in the short term. Still, since fuel is a contaminant, it will cause the oil to oxidize faster that it normally would. That typically causes problems like stuck oil control rings, which then leads us to our next minor issue.

Oil consumption
This one isn't really a problem at low levels because all engines are designed to use some oil. Still, modern engines generally do a great job in keeping oil consumption so low that some owners (me included) don't even bother to check the oil level. That complacency can come back to bite you if the engine suddenly decides to start burning oil at an accelerated rate. When that happens, it's quite possible for an engine to suffer oil starvation which ranks high on the list of engine killers, though typically the engine will let you know it's getting low on oil, either in the form of a check engine light, or a knocking sound.

Abrasive contamination
Dirt getting past the air filter will cause a lot of problems in an engine, and piston scuffing is the primary

concern. Fortunately, most air filters do a really good job even when they are dirty. If you change your air filter on a regular basis, then this type of problem is pretty easy to avoid. Remember, it's also important to check the whole air induction system down-stream of the air filter to make sure no cracks or other problems exist that could be letting dirt into the system.

Major problems

Antifreeze contamination

This could actually fit into the minor problem category as well because at low levels, it is really something you can live with for a while. We've seen engines go years with a minor antifreeze seep. As long as you keep the oil changes short and the coolant level topped off, then this problem can usually be put on the back burner until you can get around to fixing it. However, when we start to see antifreeze, it's a safe bet that the engine is going to need some attention at some point. Problems of this nature can get out of hand quickly, especially if the antifreeze is coming from a blown head gasket. Antifreeze normally affects bearings first and if those start to wear heavily it can lead to loss of oil pressure, excess oil consumption, and then engine death.

Detonation

This issue develops in an engine when the combustion process is not completed correctly. Detonation can easily burn a hole right through the top of a piston. A ticking or pinging noise is a good indication this issue is at hand, usually when an engine is under a heavy load and producing a lot of heat. Modern engines will have a sensor that can pick up this pinging and will automatically make adjustments to help keep the engine cool. Often times detonation problems are a sign that the engine timing is off. Running a fuel with a higher octane will usually help the problem. Problems of this nature generally lead to a loss of power, a blown head gasket, and a trip to the repair shop.

Instant Death

Oil starvation

Whether it's caused by oil consumption left unchecked, or severely worn bearings not letting any oil get into the upper-end of the engine, this type of problem will cause an engine to fail in short order and it's usually accompanied by the worst sound you've ever heard your engine make.

Spun bearings

When the babbit is worn off your bearings, either due to hard use, abrasive oil, or lack of oil, you will start to lose oil pressure. If the problem gets severe enough, the spinning shaft will actually weld to the bearing itself and everything spins in place. Once this happens, the engine will be shot, though amazingly enough it might still run (but not for long).

Outside causes

Of course there are lots of other things that can cause instant engine death — see this link for an example, or this picture of my flooded MINI. Unfortunately, outside factors probably take more engines down than anything else. It's a dangerous world out there.

Conclusion

It's pretty rare for engines to fail suddenly due to minor issues, so when we see them in oil analysis, that doesn't necessarily mean you need to get out the wrenches or head straight to the dealer and demand a new engine. Usually, you'll have some time to see if the problem persists or is getting worse. Once that has been established, then some action is usually required and the cost should be minor compared to the hassle and expense of having to replace the whole engine. So check your oil level every now and then and test your oil. Chances are good your engine will look perfect, but if it doesn't, you're better off knowing about it sooner rather than later.

Report of the Month

Lots of metal showed up in this 1994 F150's oil. What's going on?

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

UNIT

MAKE/MODEL: Ford 5.8L 351 CID V-8
FUEL TYPE: Gasoline (Unleaded)
ADDITIONAL INFO:

OIL TYPE & GRADE: Gasoline Engine Oil
OIL USE INTERVAL: Miles

COMMENTS

This engine looks rough. Universal averages for the 351 CID show typical wear after about 2,800 miles of oil use, and all of the metals here are high in comparison. Lead stands out the most, and unless most of it is leaded fuel blow by, this is a cautionary amount of bearing wear. Iron shows excess steel wear. The oil is contaminated too, with fuel dilution at an elevated 2.5%. Silicon could be from dirt or sealers, and sodium may be from coolant. The TBN's okay at 2.1. The viscosity is fairly thick, reading like a 10W/60. A closer look is warranted before using this V-8.

ELEMENTS IN PARTS PER MILLION

		UNIT / LOCATION AVERAGES	UNIVERSAL AVERAGES
MI/HR on Oil			
MI/HR on Unit	116,000		
Sample Date	1/1/2020		
Make Up Oil Added			
ALUMINUM	**18**	12	4
CHROMIUM	**10**	6	1
IRON	**173**	114	22
COPPER	**99**	61	7
LEAD	**750**	387	11
TIN	**18**	11	1
MOLYBDENUM	33	80	53
NICKEL	**6**	4	1
MANGANESE	2	2	1
SILVER	0	0	0
TITANIUM	1	1	0
POTASSIUM	10	9	4
BORON	33	35	46
SILICON	**54**	33	13
SODIUM	**152**	95	62
CALCIUM	2023	2130	1832
MAGNESIUM	227	122	236
PHOSPHORUS	845	805	806
ZINC	1085	969	964
BARIUM	0	0	1

Bearings are made up of layers of metal. Often the outer layer is lead babbit, with a bronze layer beneath that. In these three pictures you can see how the bearings have worn through the first layer and into the bronze underneath.

PROPERTIES

		Values Should Be*
SUS Viscosity @ 210°	89.2	
cSt Viscosity @ 100°C	17.78	
Flashpoint in °F	**325**	>375
Fuel %	**2.5**	<2.0
Antifreeze %	0.0	0.0
Water %	0.0	0.0
Insolubles %	0.4	<0.6
TBN	2.1	>1.0
TAN		
ISO Code		

*** THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE**

The owner of this F150 wanted to put this engine into an older vehicle -- it ran smooth and was quiet -- but reconsidered after seeing the analysis. Oil pressure was okay but after pulling a couple of bearing caps, they decided the engine needed to be rebuilt. Although aluminum and chrome are elevated, the cylinder walls and pistons looked okay. But the main and rod bearings had major wear (lead, copper, and tin). Iron is probably largely from the crankshaft.

Report of the Month

Check out this 1959 Porsche with the deluxe chrome package.
Unfortunately that probably doesn't explain lead…
To learn more about where the elements are coming from, click here.

UNIT

MAKE/MODEL: Porsche 1.6L H-4 (Air-Cooled) OIL TYPE & GRADE: Valvoline VR1 20W/50
FUEL TYPE: Gasoline (Unleaded) OIL USE INTERVAL: 1,394 Miles
ADDITIONAL INFO: 1959 356A Super, no full-flow oil filter

COMMENTS

In addition to high chrome (which is even higher than it was last time), we now get to talk about high lead. Lead can show bearing wear, though if you've used any leaded fuel or octane boosters, that may be where it's from. Chrome is still high, but we're hoping that this is due to the deluxe "chrome package" your car has. It's hard to be sure, and the fact that chrome increased is suspicious, but let's see how the trends look, assuming all is well on your end. Watch for low oil pressure/listen for engine noises. The TBN's good, but use this interval for now.

ELEMENTS IN PARTS PER MILLION

	MI/HR on Oil	1,394	UNIT / LOCATION AVERAGES	1,328					UNIVERSAL AVERAGES
	MI/HR on Unit	36,454		35,060					
	Sample Date	9/30/2019		12/17/2018					
	Make Up Oil Added	0 qts		0 qts					
	ALUMINUM	2	2	2					3
	CHROMIUM	**27**	22	**17**					1
	IRON	6	6	6					13
	COPPER	12	11	10					17
	LEAD	**142**	91	40					24
	TIN	2	1	0					0
	MOLYBDENUM	1	1	0					41
	NICKEL	0	0	0					0
	MANGANESE	0	0	0					2
	SILVER	0	0	0					0
	TITANIUM	1	1	0					3
	POTASSIUM	10	15	19					7
	BORON	4	3	2					42
	SILICON	4	4	4					7
	SODIUM	385	376	367					159
	CALCIUM	2183	2163	2142					1919
	MAGNESIUM	23	18	13					239
	PHOSPHORUS	1320	1294	1268					971
	ZINC	1435	1434	1433					1127
	BARIUM	1	1	0					0

PROPERTIES

			Values Should Be*					
	SUS Viscosity @ 210°	86.9	77-94	84.9				
	cSt Viscosity @ 100°C	17.24	14.8-19.2	16.74				
	Flashpoint in °F	390	>385	**375**				
	Fuel %	<0.5	<2.0	0.5				
	Antifreeze %	-	0.0	-				
	Water %	0.0	0.0	0.0				
	Insolubles %	0.3	<0.6	0.3				
	TBN	7.3	>1.0					
	TAN							
	ISO Code							

*** THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE**

After his first sample, the owner writes of chrome: The previous owner, a Buick dealer in Terre Haute, Indiana, seemingly chromed everything removable on the car! This included the following, which may have a bearing on the chromium level: gas tank cap; air filter canisters; valve covers; oil filter canister top and bolt; and the oil filler assembly, top, and overflow tube. It might even have chrome cylinders, based on how low iron is. Fortunately he missed the oil dipstick! Lead is another story; if it's not from leaded fuel, then that metal shows bearing wear.

Report of the Month

Check out this 2009 Ford Focus! Do you see any problems?

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

UNIT

MAKE/MODEL: Ford 2.0L 4-cyl Duratec
FUEL TYPE: Gasoline (Unleaded)
ADDITIONAL INFO:

OIL TYPE & GRADE: Mobil 1 High Mileage 5W/20
OIL USE INTERVAL: 7,863 Miles

COMMENTS

Congrats on getting half a million miles on your Focus. That's pretty darn impressive and the engine is showing no signs of slowing down that we can see. The metals are still low, steady, and properly balanced compared to past samples and universal averages. There is no fuel or coolant contamination to worry about and the air and oil filters had no trouble keeping silicon and insolubles under control. The TBN is 4.9, showing active additive left for a longer run. Try 10,000 miles on the next oil and just keep driving!

ELEMENTS IN PARTS PER MILLION

MI/HR on Oil	7,863	UNIT / LOCATION AVERAGES	8,200	7,720	5,000			UNIVERSAL AVERAGES
MI/HR on Unit	500,649		452,280	365,280	350,000			
Sample Date	1/31/2020		7/29/2019	4/27/2018	3/9/2018			
Make Up Oil Added			0 qts		0 qts			
ALUMINUM	2	2	2	1	3			3
CHROMIUM	0	0	0	0	1			1
IRON	8	8	7	7	8			9
COPPER	0	0	0	0	0			3
LEAD	0	0	1	0	0			0
TIN	0	0	0	0	0			0
MOLYBDENUM	70	73	70	78	72			88
NICKEL	0	0	0	0	0			0
MANGANESE	0	1	0	2	0			1
SILVER	0	0	0	0	0			0
TITANIUM	0	0	0	0	0			2
POTASSIUM	2	2	2	2	2			1
BORON	47	55	45	61	66			68
SILICON	4	23	7	13	**67**			18
SODIUM	5	6	7	6	4			25
CALCIUM	1022	1042	1050	1159	935			1837
MAGNESIUM	700	703	685	788	639			297
PHOSPHORUS	653	677	655	739	661			720
ZINC	727	745	734	837	682			826
BARIUM	0	0	0	0	0			1

PROPERTIES

		Values Should Be*					
SUS Viscosity @ 210°	56.7	46-57	56.3	55.7	56.5		
cSt Viscosity @ 100°C	9.28	6.0-9.7	9.15	8.98	9.20		
Flashpoint in °F	435	>385	425	440	420		
Fuel %	<0.5	<2.0	<0.5	<0.5	<0.5		
Antifreeze %	0.0	0.0	0.0	0.0	0.0		
Water %	0.0	0.0	0.0	0.0	0.0		
Insolubles %	0.2	<0.6	0.2	0.3	0.2		
TBN	4.9	>1.0					
TAN							
ISO Code							

*** THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE**

This engine is still going strong! We don't limit our extended oil use recommendations to young cars. This sturdy little Ford Focus is still wearing nicely at 500K miles, and since the TBN is strong, metals look good, the filters are functioning well, and no significant contamiation is present, we're suggesting the owner go on up to 10,000 miles for the next oil change. We see a fair number of high-mileage engines these days. They don't necessarily require special oil, or anything other than routine maintenance. If yours is getting up there and the doors haven't fallen off, send us a sample to see how the engine looks!