
Translating an
Oil Analysis
Report

Translating an Oil Analysis Report

By Mike Jones

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My maintenance logbook is fat with Blackstone oil analyses I have collected over the years. But I was interested in the thought-processes report writers use when a lab report appears on their screen. I perched on Brian's shoulder for fifteen minutes as he reviewed my latest submission.

Before he looks at the lab results, he double-checks to make sure he's got all the facts straight. He looks at the address, the tail number, the engine type, and so on. He also reads any notes the owner has added.

"You're good about giving us notes [on the sample slip]," he complimented me. "They're always useful. I see you added a quart every seven to eight hours, that's awesome." He went on to add that more notes are generally better; even just a few headlines are helpful.

He then considered the metals reported in the latest sample, comparing those outcomes to previous samples and the "universal average" results. The universal average is computed from decades of oil samples from engines of exactly the same make and model.

"For some engines, like the Lycoming 360s, we've got thousands in there," Brian explained. "But there are other ones, rare ones, like automotive engines

converted for aircraft use, there might only be a handful." The same goes for other types of machinery, such as marine engines or industrial compressors.

In my case, Blackstone has about 200 samples from Continental TSIO-520R9 engines, which is sufficient to provide a good baseline. Blackstone's customized software flags any score if it is greater than two times the universal average. Brian pondered the results, judging if the higher readings were an issue (red boxes on the attached report). He looked at the trend from earlier samples and looked for patterns between the different metals. Studying my report, he paused for a minute.

"I'd consider this one a significant increase over the last one. I'm gonna flag that as a potential sign of excess wear, maybe a developing problem," he said. "Only potentially though. It's not like it was ten times higher than the last one. In that case I would be a lot more concerned."

Stark joined the conversation and they gently debated the numbers. Aluminum usually is from pistons, I learned, so the increase may have been caused by a little corrosion due to inactivity (this was a winter sample, and I was flying five hours/month or less).

"It [the aluminum reading] doesn't look like piston scuffing because the molybdenum didn't increase," Stark opined. Molybdenum is used in anti-scuff coatings applied to Continental pistons.

The elevated iron score is from steel parts like cylinders and rotating shafts. "That improvement is nice, and the current reading wasn't too far off earlier scores, so I don't think we need to highlight it," Stark added.

Brian noted that nickel usually is from exhaust valve guides and my engine has been trending higher as of late. The big concern might be a burned exhaust valve, so he thought a borescope inspection would be useful the next time I put the plane in the shop. Old '91N is equipped with a digital engine monitor but it

BLACKSTONE LABORATORIES

OIL REPORT

LAB NUMBER: Q91082 **UNIT ID:** N7591N
REPORT DATE: 3/30/2023 **CLIENT ID:** 49279
CODE: 20/88 **PAYMENT:** CC: AmEx

UNIT

MAKE/MODEL: Continental TSIO-520-R9
FUEL TYPE: Gasoline (Leaded)
ADDITIONAL INFO: Cessna T210N, Eng S/N 289551-R
OIL TYPE & GRADE: Aeroshell W100 (AD)
OIL USE INTERVAL: 41 Hours

CLIENT

MIKE JONES
PHONE:
FAX:
ALT PHONE:
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COMMENTS

MIKE: Over TBO -- I can relate; we're closing in on TBO in our 172's engine and watching things like a hawk. Make sure you're cutting the oil filter open with each oil change and looking for the bigger metals than will turn up here; we only test the microscopic stuff. Aluminum and nickel are the metals to watch. Aluminum can show piston wear and nickel comes from exhaust valve guides. Do regular compression checks and borescope tests to keep an eye out for trouble in those areas. Aluminum could show a bit of corrosion too, since you haven't flown a lot. ~Amanda

ELEMENTS IN PARTS PER MILLION

		UNIT / LOCATION AVERAGES						UNIVERSAL AVERAGES
MI/HR on Oil	41		41	33	40	22	35	
MI/HR on Unit	1,668		1,629	1,598	1,568	1,528	1,508	
Sample Date	1/18/2023		5/17/2022	9/15/2021	4/18/2021	11/20/2020	4/15/2020	
Make Up Oil Added	5 qts		5 qts	4 qts	3 qts	1 qt	2 qts	
ALUMINUM	**27**	11	16	9	12	14	8	11
CHROMIUM	17	12	24	15	**21**	12	15	14
IRON	117	90	146	77	**161**	94	95	75
COPPER	12	6	**14**	11	11	8	6	7
LEAD	5655	5906	5960	4811	5651	5992	7366	5215
TIN	3	1	3	2	3	3	3	1
MOLYBDENUM	6	7	8	5	9	6	7	6
NICKEL	**46**	23	**55**	34	**48**	31	39	22
MANGANESE	1	1	2	1	2	1	1	1
SILVER	0	0	0	0	0	0	0	0
TITANIUM	1	1	2	1	1	1	1	0
POTASSIUM	0	0	0	0	0	0	1	0
BORON	2	1	1	2	1	4	1	1
SILICON	7	6	8	6	8	11	6	8
SODIUM	2	1	3	2	2	4	1	1
CALCIUM	92	2	71	2	2	2	3	29
MAGNESIUM	1	1	1	1	0	0	1	1
PHOSPHORUS	1371	189	1005	827	797			
ZINC	6	2	6	4	4			
BARIUM	0	0	0	0	0			

PROPERTIES

	Values Should Be*						
SUS Viscosity @ 210°F	94.0	86-105	94.9	92.0	95.9		
cSt Viscosity @ 100°C	18.93	17.0-21.8	19.15	18.45	19.39		
Flashpoint in °F	470	>460	475	470	490		
Fuel %	<0.5	<1.0	<0.5	<0.5	<0.5		
Antifreeze %	-		-	-	-		
Water %	0.0	0.0	0.0	0.0	0.0		
Insolubles %	0.3	<0.6	0.4	0.3	0.3		
TBN							
TAN							
ISO Code							

Here's a typical Blackstone oil analysis report. Notice the highly personalized commentary offered in the notes by Amanda, one of the report writers who also is a private pilot. Three metals are showing up a little high.

* THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

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is an older design without a data collection option. “That’s too bad,” Stark said. “Otherwise I’d look at the graphs of EGTs and CHTs from your last flight. If you see any unusual spikes or dips, that could confirm a valve issue.”

I asked about two other numbers that looked weird to me (green boxes), but they were unconcerned. Calcium is just from the use of CamGuard while phosphorus often is an additive in the oil itself.

“Aeroshell W100 doesn't use phosphorus,” Stark said, “so the chances are good you were actually using Aeroshell W100 Plus.” These people are really smart about aircraft engines and oils!

Brianna joined our conversation, sharing a more alarming report. This was from a new customer who had just bought the plane. The aluminum was 50ppm and the iron was high, too, even though there was just eight hours on the oil.

“These readings look bad,” Brianna said grimly. “Iron means corrosion. You wouldn't necessarily get that level in just six months, even sitting on the ramp. But [the owner] wrote that the airplane had not flown from 2017 to October ’22. That’s five years, going on six.”

Brian agreed. “I would pick up the phone on that one.”

About the Author

Mike Jones is a 4,000 hour commercial-rated pilot who has more than 50 aircraft types in his logbook. His pride and joy is a Cessna T210, which has carried him to every corner of the U.S. and Canada for more than twenty years. He's always accessible at PilotMike2012@gmail.com.