Report of the Month

This IO-320 has a problem. Can you tell what it is?

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

UNIT

MAKE/MODEL: Lycoming IO-320-E2A
FUEL TYPE: Gasoline (Leaded)
ADDITIONAL INFO: Piper PA18-160, Chrome Cyls

OIL TYPE & GRADE: Aircraft Engine Oil
OIL USE INTERVAL: 5 Hours

COMMENTS

Thanks for discussing this sample with us on the phone. As you know, we're concerned about the amount of chrome this IO-320 is making. To give the engine some credit, chrome did improve nearly 400 ppm compared to the first sample, though the shorter run helped significantly. But at the same time, you only did a partial oil change after the first sample, so a good portion of the chrome could be carryover. We suggest 1. Compression test/borescope of cylinders 2. Looking into why the engine's running hot 3. Another run of 5 hours to see how chrome trends.

ELEMENTS IN PARTS PER MILLION

		UNIT / LOCATION AVERAGES			UNIVERSAL AVERAGES
MI/HR on Oil	5		30		
MI/HR on Unit			220		
Sample Date	11/30/2020		8/4/2020		
Make Up Oil Added			5 qts		
ALUMINUM	**17**	27	**27**		8
CHROMIUM	**219**	611	**611**		5
IRON	**43**	129	**129**		36
COPPER	3	9	9		7
LEAD	1516	4275	4275		2303
TIN	1	3	3		1
MOLYBDENUM	0	1	1		0
NICKEL	1	3	3		2
MANGANESE	1	2	2		0
SILVER	0	0	0		0
TITANIUM	0	0	0		0
POTASSIUM	0	1	1		1
BORON	1	2	2		1
SILICON	6	10	**10**		5
SODIUM	3	4	4		1
CALCIUM	5	33	33		17
MAGNESIUM	1	2	2		1
PHOSPHORUS	28	104	104		844
ZINC	2	6	6		4
BARIUM	0	0	0		0

The owner knew something was obviously up when he got that first sample. In addition to metal in the oil report, the engine was seeing consistently high oil temps in cruise (210-230°F), and high CHT temps in #1 & #3 cylinders, as well as slightly rough running/vibrations in cruise & climb. Additionally, he reported, the engine felt very underpowered. “My engine is supposed to be rated at 160HP, but we had quite a difficult time getting off the water with two passengers, and one instructor who flew it said it felt like it had about as much power as his 100HP super cub. (His plane however is not on floats.)

I suspected the high oil temps might be from a poorly designed/located oil cooler, but several mechanics said that's likely not enough to cause the consistent high temps I was getting, especially since we had the issue when flying in colder temperatures. Since I bought the aircraft used and didn't know the complete history on it, and since the engine only had ~225 hours on it in the 20 years since the major overhaul was done, I decided that I'd play it safe and pull all the cylinders after getting your oil analysis results of the extremely high chrome content, twice in a row.

The company who is inspecting and fixing/replacing my cylinders called me yesterday saying the following was wrong with my cylinders: the wrong piston rings were installed for chrome cylinders; heavy wear in every cylinder- scratches/gouges in #1 & #3 which tells him the plane likely sat for over a year in between startups; evidence of blow by in #1 & #3 - those cylinders also had small cracks developing; and several valves installed backwards (intake installed on exhaust side, & vice versa). He said this isn't a huge issue, but shows the laziness or inattention to detail by the mechanic who installed them (aka a warning sign that they did other things wrong, like use the completely wrong piston rings). So I'm having to get 2 new (reman'd) cylinders to replace the ones with cracks. And then he's overhauling everything else.”

Report of the Month

This O-300 has a problem. Can you tell what it is?

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

UNIT

MAKE/MODEL: Continental O-300-A
FUEL TYPE: Gasoline (Leaded)
ADDITIONAL INFO: Cessna 172, Mixed Cyl
OIL TYPE & GRADE: Phillips XC (A/C) 20W/50
OIL USE INTERVAL: 31 Hours

CLIENT

The owner says: In reference to the oil analysis surprise of a week and a half ago and the loaded oil filter media, we found the source of the aluminum flakes - worn piston pin plugs. This single plug was from cylinder # 4 and two more were worn on cylinder # 2. Also, we think the (front) thrust bearing is worn beyond limits, allowing the crankshaft to move too much. Looks like a major overhaul is coming.

COMMENTS

Thanks for noting the stuck exhaust valve. Aluminum is really high - high enough to show a problem. If temps got high in the cylinder with the stuck exhaust valve, aluminum could be the result. We are also seeing copper, which in this engine is often from piston pin plugs, connecting rod piston pin bushings, or wrist pin problems. With iron, copper can be from the starter adaptor. Maybe all this will improve now that you've freed the valve, but check for problems anyway. Borescope the cylinders and check compressions. Watch for metal.

ELEMENTS IN PARTS PER MILLION

			UNIT / LOCATION AVERAGES						UNIVERSAL AVERAGES
	MI/HR on Oil	31		38	23	21			
	MI/HR on Unit	1,079		1,048	1,011	972			
	Sample Date	1/17/2021		5/28/2020	10/2/2019	3/31/2019			
	Make Up Oil Added	2 qts		4 qts	1.5 qts	1 qt			
	ALUMINUM	**140**	45	10	7	**23**			8
	CHROMIUM	5	5	3	3	**10**			4
	IRON	31	45	19	**21**	**108**			35
	COPPER	**25**	14	10	10	10			9
	LEAD	912	1658	1374	1380	2965			2146
	TIN	1	2	2	1	2			1
	MOLYBDENUM	0	1	0	0	2			1
	NICKEL	1	1	1					2
	MANGANESE	1	1	0					1
	SILVER	0	0	0					0
	TITANIUM	0	0	0					0
	POTASSIUM	0	0	0					1
	BORON	0	1	2					1
	SILICON	8	15	10					7
	SODIUM	3	3	3					1
	CALCIUM	53	74	62					18
	MAGNESIUM	28	20	26					10
	PHOSPHORUS	87	241	99					443
	ZINC	27	20	30					5
	BARIUM	0	0	0	0	0			0

PROPERTIES

			Values Should Be*					
	SUS Viscosity @ 210°F	93.6	86-105	**85.8**	88.8	**84.3**		
	cSt Viscosity @ 100°C	18.84	17.0-21.8	**16.97**	17.70	**16.59**		
	Flashpoint in °F	**410**	>430	480	475	445		
	Fuel %	**1.0**	<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	0.2	0.3	0.5		
	TBN							
	TAN							
	ISO Code							

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

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