

Everyone's favorite part of the newsletter is the Report of the Month, so we thought this month we'd give you what you really want to see -- aircraft problems that you don't have to deal with! What follows are four aircraft samples, each with some sort of problem. We have reported what the owner or mechanic told us in the comments below each report. But before you look at the answer, take a minute to study the data. Can you figure out what went wrong?

### Report of the Month

We don't always need trends to see when there's a problem -- the very first sample after this O-470-R's overhaul looked bad. Can you tell what's wrong?

To learn more about where the elements are coming from, [click here](#).

ELEMENTS IN PARTS PER MILLION	MI/HR on Oil	6	UNIT/ LOCATION AVERAGES					UNIVERSAL AVERAGES
	MI/HR on Unit	500						
	Sample Date	5/31/2016						
ALUMINUM	101	101						9
CHROME	152	152						10
IRON	120	120						41
COPPER	9	9						6
LEAD	385	385						2896
TIN	2	2						1
MO LYBDENUM	4	4						1
NICKEL	3	3						5
POTASSIUM	1	1						1
BORON	0	0						1
SILICON	24	24						8
SODIUM	2	2						1
CALCIUM	5	5						26
MAGNESIUM	3	3						2
PHOSPHORUS	2	2						445
ZINC	10	10						6
BARIUM	0	0						0

PROPERTIES	SUS Viscosity @210°F	71.8	72 - 82				
	cSt Viscosity @ 100°C	13.42	13.5-16.3				
	Flashpoint in °F	500	>455				
	Fuel %	<0.5	<1.0				
	Water %	0.0	<0.1				
	Insolubles %	0.4	<0.6				

Two of the cylinders on this engine are chrome, but that level of chrome is abnormal even for chrome cylinders. The problem is that the rings that were installed on those cylinders were also chrome -- they were incorrectly tagged as standard steel. Once the incorrect rings were removed and replaced with steel, the engine started looking a lot better.

## Report of the Month

This IO-540 started wearing poorly in 2015, but it took until 2017 for the problem to fully reveal itself. Can you tell what was wrong?

To learn more about where the elements are coming from, [click here](#).

ELEMENTS IN PARTS PER MILLION	MI/HR on Oil	28	UNIT/ LOCATION AVERAGES	34	25	22	28	UNIVERSAL AVERAGES
	MI/HR on Unit	816		788	754	729	706	
	Sample Date	4/4/2017		7/28/2016	1/19/2016	9/1/2015	5/8/2015	
ALUMINUM	19	13	14	15	15	7	7	
CHROME	13	6	14	14	12	10	7	
IRON	83	43	53	40	51	37	34	
COPPER	36	9	13	8	7	9	7	
LEAD	5000	3708	5470	4225	3332	3494	3624	
TIN	3	1	2	0	0	0	1	
MO LYBDENUM	0	1	1	0	0	0	0	
NICKEL	3	9	4	2	3	2	3	
POTASSIUM	1	1	0	0	3	1	1	
BORON	0	1	0	0	0	0	1	
SILICON	12	7	18	24	22	4	6	
SODIUM	1	1	1	2	2	0	1	
CALCIUM	9	5	6	5	5	6	15	
MAGNESIUM	5	13	5	10	1	7	8	
PHOSPHORUS	16	786	0	0	1	0	634	
ZINC	4	4	3	2	2	2	7	
BARIUM	0	0	0	0	0	0	0	

Should Be\*

PROPERTIES	SUS Viscosity @210°F	96.0	86-105	93.8	95.7	102.5	97.0
	cSt Viscosity @ 100°C	19.41	17.0-21.8	18.88	19.34	20.95	19.65
	Flashpoint in °F	430	>430	450	455	490	450
	Fuel %	TR	<1.0	<0.5	<0.5	<0.5	<0.5
	Antifreeze %	-	-	-	-	-	-
	Water %	0.0	0.1	0.0	0.0	0.0	0.0
	Insolubles %	0.4	<0.6	0.3	0.3	0.1	0.3
	TBN						
	TAN						
	ISO Code						

\*THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

This engine had been experiencing morning sickness so the mechanics changed out a cylinder. Then they started finding a lot of metal in the oil filter. They took the sump off and found more large chunks in the pan and the pick-up. They split the case and found an intact set screw from the governor drive shaft that had worked its way through the engine. The cam followers were shot and the screw marked up the case badly, prompting an overhaul. They suspected that the screw was perhaps not installed or tightened correctly.

# Report of the Month

It's good that they were sampling this one regularly - it had a problem from the start. Can you tell what's going on with this IO-360-L2A?

To learn more about where the elements are coming from, [click here](#).

ELEMENTS IN PARTS PER MILLION	MI/HR on Oil	82	UNIT/ LOCATION AVERAGES	35	56	50	50	UNIVERSAL AVERAGES
	MI/HR on Unit	338		257	222		103	
	Sample Date	7/31/2017		6/12/2017	5/5/2017	4/4/2017	2/20/2017	
	ALUMINUM	7	4	5	3	6	9	3
	CHROME	6	3	4	3	4	5	3
	IRON	40	18	28	24	34	33	18
	COPPER	63	8	35	23	43	46	6
	LEAD	5485	5116	3560	3892	4597	3317	4536
	TIN	5	1	3	1	2	2	1
	MO LYBDENUM	0	0	0	0	0	1	0
	NICKEL	2	2	1	2	3	2	2
	POTASSIUM	3	1	0	0	3	0	1
	BORON	1	1	0	0	0	1	1
	SILICON	3	3	3	3	4	4	4
	SODIUM	2	2	2	1	2	2	1
CALCIUM	0	1	0	3	0	1	7	
MAGNESIUM	0	1	0	0	0	0	1	
PHOSPHORUS	1033	1077	1148	1010	1112	958	570	
ZINC	8	8	8	8	6	10	6	
BARIUM	0	0	0	0	0	0	0	

Values  
Should Be\*

PROPERTIES	SUS Viscosity @210°F	94.7	82-105	88.0	87.1	91.2	94.9
	cSt Viscosity @ 100°C	19.10	16.0-21.8	17.49	17.27	18.26	19.15
	Flashpoint in °F	455	>440	470	465	450	460
	Fuel %	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5
	Antifreeze %	-	-	-	-	-	-
	Water %	0.0	0.1	0.0	0.0	0.0	0.0
	Insolubles %	0.3	<0.6	0.4	0.2	0.5	0.5
	TBN						
	TAN						
	ISO Code						

\*THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

This engine was covered by the emergency AD warning from Lycoming. When copper didn't improve the way it should and the other metals started increasing too, the mechanics decided to take action. When they pulled the engine they found the rod bearings were spinning, and in cylinder 3 the wrist pin bearing was not only spinning but breaking up. One bushing had slid out of place and was grinding on the piston. "The engine was about to blow up, to tell you the truth," said the mechanic when they got in touch with us.

# Report of the Month

The change in wear is what alerted us to trouble in this IO-550-N. What's the problem?

To learn more about where the elements are coming from, [click here](#).

ELEMENTS IN PARTS PER MILLION	MI/HR on Oil	42	UNIT/ LOCATION AVERAGES	30	13	25	19	UNIVERSAL AVERAGES
	MI/HR on Unit	1172		1131	1101	1088	1050	
	Sample Date	6/6/2016		9/17/2015	6/9/2015	2/11/2015	5/17/2014	
	ALUMINUM	13	6	11	6	10	3	8
	CHROME	18	7	16	7	9	5	11
	IRON	89	34	60	28	33	26	58
	COPPER	25	12	21	15	21	8	7
	LEAD	9235	4053	5735	3140	4240	3595	6606
	TIN	2	2	2	1	4	0	2
	MO LYBDENUM	7	2	6	2	3	1	4
	NICKEL	27	12	17	12	14	9	18
	POTASSIUM	0	2	0	0	3	2	1
	BORON	0	1	1	1	5	2	1
	SILICON	8	9	9	9	16	5	7
	SODIUM	2	1	1	1	1	0	1
CALCIUM	0	1	1	1	2	0	36	
MAGNESIUM	1	0	0	0	1	0	1	
PHOSPHORUS	955	1226	1267	1267	1175	1305	438	
ZINC	8	630					5	
BARIUM	0	0					0	

Values  
Should Be\*

PROPERTIES	SUS Viscosity @210°F	83.2	82-105				
	cSt Viscosity @ 100°C	16.32	16.0-21.8				
	Flashpoint in °F	435	>440				
	Fuel %	TR	<1.0				
	Antifreeze %	-	-				
	Water %	0.0	0.1				
	Insolubles %	0.4	<0.6				
	TBN						
	TAN						
	ISO Code						



\*THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

The mechanic says that when he saw the change in wear, he had the customer bring the engine in right away. "We checked compression, borescope-inspected the cylinders, removed the rocker covers, and inspected the rocker shafts, bushings, and valves. Removed some sample lifters and found the problem. The lifters were just starting to spall and flake. The cam was okay, but I'm sure the iron getting into the oil was causing other metals to wear. We will keep an eye on the next two samples."