

From: [Nancy McAtee](#)
To: [Stephen Stein](#)
Cc: [Donald Kramer](#)
Subject: Email report-WPR23FA323 (Oil testing report review)
Date: Wednesday, August 28, 2024 1:58:50 PM
Attachments: [WPR23FA323 Sample #1 Drained oil wash sample.pdf](#)
[WPR23FA323 Sample #2 Gallon Jug sample.pdf](#)

Stephen,

Two samples were sent to an independent, third-party laboratory for analysis to determine what type of oil, what weight of oil, and if there was any metal/contaminant present. The testing reports were provided by the outside lab to the Materials Laboratory for review. The two samples sent included:

1. 6 oz sample from oil wash (from when pilot drained oil)*
2. An 8 oz sample from a 1-gallon jug containing oil suspected as the oil pilot used*

*The sample names in the attached reports are switched (Sample #1 is labeled "Pilot Oil" and #2 is label "Oil Wash Drained")

The following tests were done on both samples:

- ASTM D6304 -Standard Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration
- ASTM D5185M- Standard Test Method for Multielement Determination of Used and Unused Lubricating Oils and Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) (modified)
- ASTM D7279-14a Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids by Automated Houillon Viscometer
- Fourier-transform infrared spectroscopy (FTIR) to determine if the oil from the aircraft matched the oil in the 1-gallon jug.

Additional tests were done on Sample #2:

- ASTM D664M-Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration
- Particle Count as per ISO 4406 method

For result for sample #1 were as follows:

- ASTM D6304 -842 parts per million (ppm)

The water content for this sample was elevated consistent with used oil.

- ASTM D5185M

There were elevated levels (above 100 ppm) of iron (Fe), lead (Pb), boron (B), zinc

(Zn), phosphorous (P) magnesium (Mg) and sulfur (S). The presence of boron, sulfur and phosphorous are indicative of additives in the lubricating oil. The other metals present are consistent with wear particles.

- ASTM D7279

The viscosity of this sample was 61.63 mm²/sec. This viscosity meets the viscosity requirements for SAE 20 weight oil.

For result for sample #2 were as follows:

- ASTM D6304 -306 parts per million (ppm)

The water content for this sample was elevated consistent with used oil.

- ASTM D5185M

There were elevated levels (above 100 ppm) of iron (Fe), lead (Pb), copper (Cu), zinc (Zn), phosphorous (P) magnesium (Mg) and sulfur (S). The presence of sulfur and phosphorous are indicative of additives in the lubricating oil. The levels in this sample were lower than the sample removed from the aircraft. The other metals present are consistent with wear particles.

- ASTM D7279

The viscosity of this sample was 8.08 mm²/sec. This viscosity was indicative of either a very low-viscosity oil below SAE specifications or significantly degraded oil.

- ASTM D664M

The acid number value for this sample was 0.93 mg KOH/g which is within specification for lubricating oil.

- Particle Count as per ISO 4406 method

The ISO particle count was 26/26/24 indicating the oil contained a large number of particles of all sizes and exceeds allowed particle count for in-use oils.

The FTIR spectra for both oil samples matched one another and were consistent with a straight-chained aliphatic paraffinic hydrocarbon.

The tests results indicate that both samples were similar oils but that the drain oil sample was not the same oil as the bulk sample from the 1-gallon jug. The bulk sample showed a high degree of wear/age as well as significant particulate contamination. The sample from the aircraft, while it showed some wear and aging and would have required monitoring, was still within specification.

If you have any questions, please let me know.

Nancy B McAtee
Senior Chemist
RE-30