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SAVANT LABS
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On the Horizon

A World of Lubrication Understanding®

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Today's Topics:

- Foam Challenges in Lubricating Oils
- Custom Blending and Testing Services
- Visit Us at Upcoming Events

Foam Challenges in Lubricating Oils

Industry Standards for Measuring Foam - ASTM Methods D892 and D6082

Savant Labs Author: Jennifer Richter, Laboratory Instrument Technician

Reducing foaming tendency is an important aspect of lubricating oil formulation and is a requirement in most modern engine oil specifications. Foam testing can also be an important tool in condition monitoring of in-service lubricants. When foam appears in lubricating oil, there is a good chance of contamination in the system. Lubricating oils always have some air content, and it is common to have up to about 12 percent of its volume attributed to always have some air content, and it is common to have up to about 12 percent of its volume attributed to dissolved air. In this state, there will be no visual presence of air and the oil will appear transparent. It does not become problematic until the air is no longer dissolved in the oil as it is heated quickly or there is a sudden drop in pressure. Once the bubbles are in the oil, they can cause damage in the form of oxidation, impaired cooling abilities, shortened oil life, reduced carrying capacity of the oil film, oil spills, decreased pump capacity, lack of lubrication, cavitation, micro dieseling, and additive depletion.

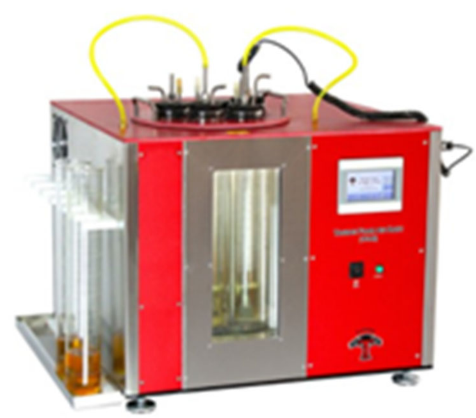
Contaminants Causing Foam in Lubricating Oil

Contaminants may include solids, oxidizing agents, water contamination, or solvents. These contaminants alter the speed at which air bubbles can travel through oil and arrive on the surface. The foam produced from the introduction of contaminants can cause an aging effect on the oil, which allows polar products to form, the viscosity to increase, and it can result in antifoaming properties to be filtered out. Some other sources of foam include the depletion of or too much antifoaming agents, mechanical issues, cross-contamination of lubricants, and grease contamination.

Effects of Foam in Your System

The foam acts as an insulator and reduces a lubricant's cooling abilities, resulting in overheating. Foam can also lead to poor performance, mechanical failure, costly repairs, and a shortened operability lifetime due to an inability to lubricate effectively or undergo cavitation. Therefore, for oil to have optimal performance, it must have the ability to separate the air that becomes suspended in it. Oils that can separate entrained air have improved performance and can be used in smaller systems where the oil circulates through much quicker.

Testing Foaming Characteristics



There are two common methods for measuring foaming characteristics. **ASTM D892 Foaming** covers sequences I-III and tests foaming tendency and stability at 24°C and 93.5°C. Both sequences I and III are completed at 24°C. Sequence III utilizes the cooled sample of oil that was tested in Sequence II at 93.5°C, whereas Sequence I uses a fresh sample. **ASTM D6082 Foaming** covers sequence IV and determines the foaming characteristics of lubricating oils at 150°C. ASTM D6082 was designed to reflect operations in high-speed gearing, high-volume pumping, and splash lubrication. These tests measure both the volume of foam formation and the stability (amount of foam left as a function of settling time).

If option A is selected for either method, a sample will be blended in a high-speed blender for one minute before testing. This option is intended for stored samples to ensure antifoam agents are of the intended particle size and uniformly dispersed. Both methods utilize a diffuser stone that is submerged in the test oil. Before introducing air into the sample, the initial volume of oil is recorded. Once testing commences, air will be forced through the diffusers at a constant rate. For ASTM D892 the rate is regulated at 94ml/min whereas for ASTM D6082 it is at 200ml/min. After allowing the air to flow through the diffusers for five minutes, the total volume and the volume of the top of the oil or kinetic foam is recorded. The difference between the total volume and the initial volume gives a value of the total increase in volume. The difference between the total volume and the top of the oil/kinetic foam gives the foaming tendency. The volume of the kinetic foam is recorded only for ASTM D6082. The sample is then observed for foam collapse for up to 10 minutes and testing is completed.

Example of a Passing Sample

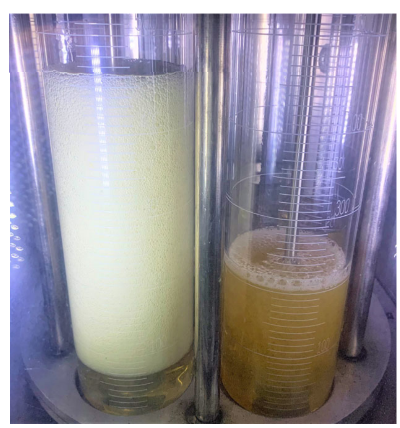
Sequence	Initial Volume (mL)	Total volume (mL)	Top of Kinetic foam (mL)	Total Kinetic foam (mL)	Total Volume Increase (mL)	Tendency (mL)	Foaming Stability (sec)					Collapse (sec)
							5	15	60	300	600	
1	210	230	220		20	10			0		0	5
2	200	230	210		30	20			0		0	10
3	195	205	200		10	5			0		0	3
4	215	240	220	170	25	20	10	0	0	0	0	9

Example of a Failing Sample

Sequence	Initial Volume (mL)	Total volume (mL)	Top of Kinetic foam (mL)	Total Kinetic foam (mL)	Total Volume Increase (mL)	Tendency (mL)	Foaming Stability (sec)					Collapse (sec)
							5	15	60	300	600	
1	200	600	50		400	550			500		110	>600
2	220	270	200		50	70			15		0	89
3	210	560	50		350	510			540		510	>600
4	220	270	210	0	50	60	40	10	0	0	0	31

Savant also has available an additional article entitled *"Why is ASTM D3427 Air Release different from ASTM D892 Foaming Characteristics testing?"* This article is available on our website under Testing Highlights.

Kinetic Foam Versus Static Foam



Static foam is the foam that sits on the surface of oil and is the type with which most people are familiar. Demonstrated in the left cylinder of this image is an oil with a high foaming tendency. As you can see, static foam constitutes nearly all of its volume. In comparison, the oil on the right has very little static foam. Kinetic foam is a little more difficult to observe. To observe kinetic foam, you have to see below the surface of the oil. Kinetic foam is the entrained air that has been created by the passage of air through the diffuser during the test; the visible layer of bubbles accumulated below the surface of the oil still migrating through the oil up to the surface. The right cylinder in this image demonstrates kinetic foam where there is air dispersed within the oil that has not yet made it to the surface. Kinetic foam is significant as it estimates the amount of air still trapped in the oil that will come up to the surface to become static foam.

Additional Test Methods

In addition to the foam testing mentioned above, Savant can recommend additional testing when high foam results are found. For example, **ASTM D5185 Determination of Additive Elements, Wear Metals, and Contaminants** can help identify changes in additive concentrations or elemental contaminants like iron or silicon. **ISO 4406 Particle Count** may be useful in identifying suspended solids. **ASTM D7414 FTIR Analysis** could be used to determine the oxidation levels and **ASTM D6304 Water by Karl Fischer** can be used to determine water levels. It is also useful to run **ASTM D445 Kinematic Viscosity** to assure it aligns with original specified values for the lubricant.

Summary

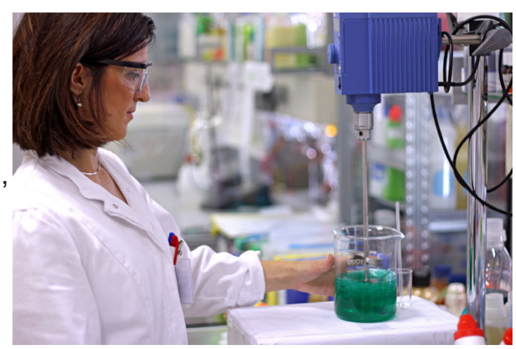
Foam can have a detrimental effect on the life of the equipment. The test methods mentioned above are the industry standard for measuring foam and Savant's team of dedicated chemists and technicians will recommend the appropriate testing. In addition, the team is here to interpret and provide insights into the results. Contact us for your testing needs.

Because Quality Matters

Savant is positioned to offer some of the most precise data found in the industry to date. Regular instrument calibration and maintenance to meticulous reference values and control chart monitoring is part of the quality regimen. In addition, all test results undergo a stringent quality review process, data is delivered on time and reported via email in a logical format designed for easy interpretation.

Request Quote

Custom Blending and Testing Services



Savant Labs can provide unique custom oil blending capabilities and services to supplement your R&D activities. R&D partnering and initial production for market or performance testing is Savant’s specialty. No size of blending project is too small, we specialize in the smaller volume, flexible batch sizes, and can support short-lead times.

Directed Formulations and More

You provide the components, initial blend ratio, and desired specifications...we do the rest:

- Blending
- Testing
- Optimization based on performance results

Most directed formulation customers are seeking the convenience, speed, and flexibility that come from formulating and testing in the same location:

- Reduce formulation and testing delays
- Minimize resources by taking advantage of Savant Labs' experience
- Reduce material handling and formulation errors.

Custom Services

For more than 50 years, Savant has provided a variety of different oil blending services to our customers.

- Adding anti-wear, corrosion inhibitors, and antioxidant additives to base oils and test for performance
- Blending reference oils and then testing
- Creating blends to fail specifications for evaluation
- Additizing known fluids to alter low-temperature viscosity
- International producers without a USA facility or assets.

Savant Labs have extensive knowledge in lubrication oil, and fluid testing for passenger vehicles, heavy-duty diesel, turbine, and industrial applications. Our expertise, precision, fast turnaround, and customer service will ensure a great experience for your next custom blending and testing project.

Request Quote

Upcoming Events

STLE 76th Annual Meeting in Orlando, Florida on May 15-18, 2022. Please stop by and ask about our electric vehicle fluids testing at our booths #725 and #727.

NLGI 89th Annual Meeting - *Finding the Green in Grease*, in Toronto, Canada on June 12-15, 2022. Please stop by and ask about our recent grease testing capabilities.

SavantLab.com **Request Quote** **Test List**

Our mailing address is:
Savant Labs
4800 James Savage Road
Midland, MI USA 48642

Telephone: (989) 496-2301
Email: savant@savantgroup.com

Other Savant Group Companies

TANNAS KING REFRIGERATION IOM INSTITUTE OF MATERIALS EXCELL MANUFACTURING INC.