

## Importance of Measuring Water Content in Greases

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### Introduction

In machinery with contacting parts or load-bearing moving parts like bearings and axles, lubricating greases are a pivotal part of efficiency and longevity of moving parts, and contribute to savings in repair costs and frictional energy losses. Through natural means, liquid or vaporous water may find its way into the greases, and has detrimental effects on its effectiveness and often damages parts, ruins lubricant, and increases the maintenance frequency. Because of this, measuring the water content in greases, and parts' resistance to water permeation, is vitally important for any application.

### Background

Water content contamination in greased parts such as bearings can cause oxidation in the grease and wear in the part. Water contamination in grease can sink up to 25% of the cost of wind energy production, and as little as 1% contamination can reduce the lifetime of a journey-bearing by 90%. With higher water content, the oxidation and production of acidic compounds will heavily contribute to the destruction of the parts, incurring significant replacement and maintenance costs.

Along with rust, corrosion, and erosion, water contamination can increase vaporous cavitation (bubbles in grease) and hydrogen embrittlement (pressure cracks in metal). For the improvement of lifetime and efficiency of machines and parts, it is imperative to perform testing on the grease's resistance to direct streams of water, and resistance to water contamination within parts.

	Life Extension Factor									
	ppm	2	3	4	5	6	7	8	9	10
Current Moisture Level	50,000	12,500	6,500	4,500	3,125	2,500	2,000	1,500	1,000	782
	25,000	6,250	3,250	2,250	1,563	1,250	1,000	750	500	391
	10,000	2,500	1,300	900	625	500	400	300	200	156
	5,000	1,250	650	450	313	250	200	150	100	78
	2,500	625	325	225	156	125	100	75	50	39
	1,000	250	130	90	63	50	40	30	20	16
	500	125	65	45	31	25	20	15	10	8
	250	63	33	23	16	13	10	8	5	4
	100	25	13	9	6	5	4	3	2	2

Figure 1: Life Extension Factor by reducing the ppm of water in lubricating grease, starting ppm on the left, and final ppm across the starting row, shows clear benefits from having low water content in greases

The American Society for Testing and Materials has imperative guidelines for testing of greased parts, to ensure parity with real water contamination. The Koehler Water Washout Tester and Water Spray Apparatus test grease and greased parts in realistic and highly controlled environments to test real water resistance and accurate grease damage progression to the precision and accuracy imposed by the ASTM.

### Instrumentation

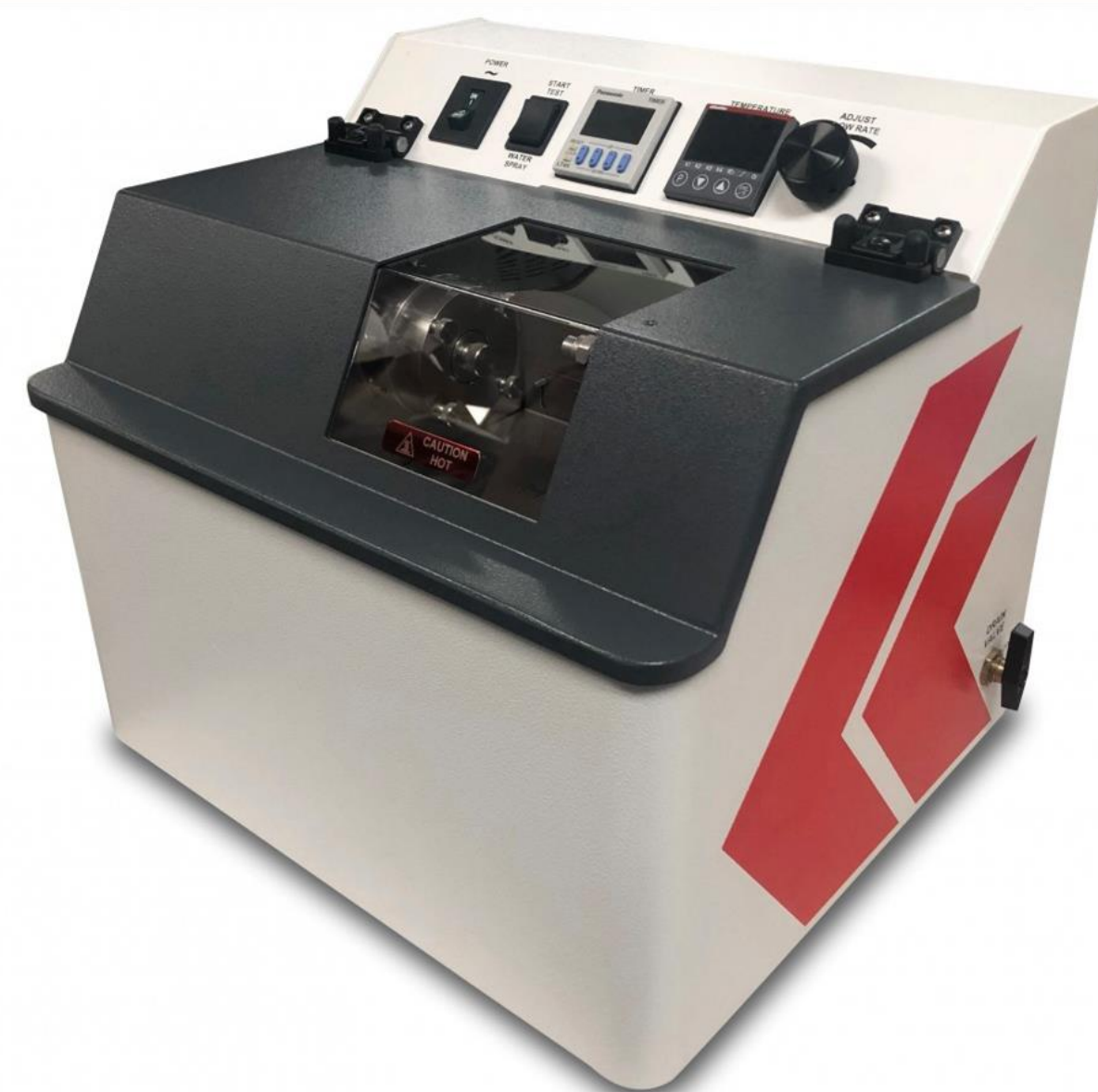


Figure 2: K19201 Water Washout Tester

An instrument like the K19201 Water Washout Tester would be an excellent way to test the permeation resistance of parts such as bearings by testing them in a highly controllable and maintainable environment against water spray. The instrument is capable of meeting the high ASTM D1264 standard. The test includes packing a specified amount of grease into a ball bearing, weighing it and then turning the bearing at 600 RPM while applying water at the rate of .5 mL/s for one hour. The percentage of grease washed out in an hour is measured by weight comparison. The instrument is capable of sustaining the specified temperature, pressure and RPM for exact compliance with these demanding standards.



Figure 3: K18201 Water Spray Apparatus

An instrument such as the K18201 Water Spray Apparatus is an effective method to test grease resistance to water washout. The apparatus is able to meet the demands of the ASTM D4049 specifications and sprays water at the specified rate and temperature on a test panel coated with sample grease. Water temperature is highly controlled and equalized throughout the water supply, and the pressure is controlled and consistent throughout the experiment. The water spray system includes 1/3 hp positive displacement pump; spray nozzle with snubber fitting; 0-60psi pressure gauge; bypass valve; shut-off and drain valves; and flexible high pressure water lines. The apparatus can be run with tap water, and can be run off of a static water supply. By meeting these strict ASTM guidelines, this apparatus gives critical information for grease resistance to water-wear, washout, and chemical alterations and is a great test to predict maintenance requirements and proper grease formulation.

### Conclusion

Water contamination in greases is a critical problem to reduce and the ASTM have created accurate guidelines for testing a particular part, or grease, resistance to water permeation and washout. The K19201 Water Washout Tester and the K18201 Water Spray Apparatus are capable of meeting these high standards to ensure parts and greases are up to standard.

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