

## Aerospace Grade Oils and Greases

### Product Information

#### Typical Properties of Krytox™ Aerospace Grade Fluorinated Oils\*

Property	ASTM Test Method	Test Conditions	Units	Aerospace Oil Grade				
				143AZ	143AA	143AB	143AC	143AD
Average Molecular Weight	NMR			2060	2210	3800	5940	7480
Viscosity	ASTM D445	-32 °C (-25 °F)	cSt	7480	12,340	44,620	—	—
		0 °C (32 °F)		228	350	1070	3940	7500
		20 °C (68 °F)		60	88	240	800	1540
		38 °C (100 °F)		24.7	35	86	270	502
		40 °C (104 °F)		22.8	32	78	243	450
		99 °C (210 °F)		4.2	5.4	10.5	26	44
		100 °C (212 °F)		4.1	5.3	10.2	25.4	42.4
		204 °C (400 °F)		1.1	1.3	2.1	4.1	6.0
		260 °C (500 °F)		—	—	—	2.4	3.4
Viscosity Index	ASTM D2270			60	96	113	134	146
Pour Point	ASTM D97		°C	-55	-50	-40	-35	-30
			°F	-70	-60	-40	-30	-20
Distillation Range	ASTM D1160	53 Pa (0.4 torr)	°C	140/210	170/245	215/290	260/370	300/400+
			°F	285/410	340/475	420/555	500/700	570/750+
Oil Density		0 °C (32 °F)	g/mL	1.91	1.92	1.93	1.95	1.95
		100 °C (212 °F)		1.72	1.74	1.75	1.77	1.78
Vapor Pressure	Knudsen	38 °C (100 °F)	torr	4 x 10 <sup>-4</sup>	1 x 10 <sup>-4</sup>	5 x 10 <sup>-6</sup>	8 x 10 <sup>-8</sup>	6 x 10 <sup>-9</sup>
		260 °C (500 °F)	torr	1.5	0.8	3 x 10 <sup>-2</sup>	2 x 10 <sup>-3</sup>	3 x 10 <sup>-10</sup>
		38 °C (100 °F)	KPa	5 x 10 <sup>-5</sup>	1 x 10 <sup>-5</sup>	7 x 10 <sup>-7</sup>	1 x 10 <sup>-8</sup>	8 x 10 <sup>-10</sup>
		260 °C (500 °F)	KPa	0.2	0.1	4 x 10 <sup>-3</sup>	3 x 10 <sup>-4</sup>	4 x 10 <sup>-5</sup>
Volatility	ASTM D2595	149 °C (300 °F)	wt% loss	18	15	1.9	—	—
		204 °C (400 °F)	in 22 hr	—	—	17.3	<1	—
		260 °C (500 °F)		—	—	76.2	4	2
Estimated Useful Range			°C	-57-149	-51-177	-40-232	-34-288	-29-316
			°F	-70-300	-60-350	-40-450	-30-550	-20-600

\* This table gives typical properties (not specifications) based on historical production performance. Viscosity may vary within +10%. Chemours does not make any express or implied warranty that these products will continue to have these typical properties.

Figure 1. Viscosity vs. Temperature of Krytox™ Aerospace Grade Fluorinated Oils

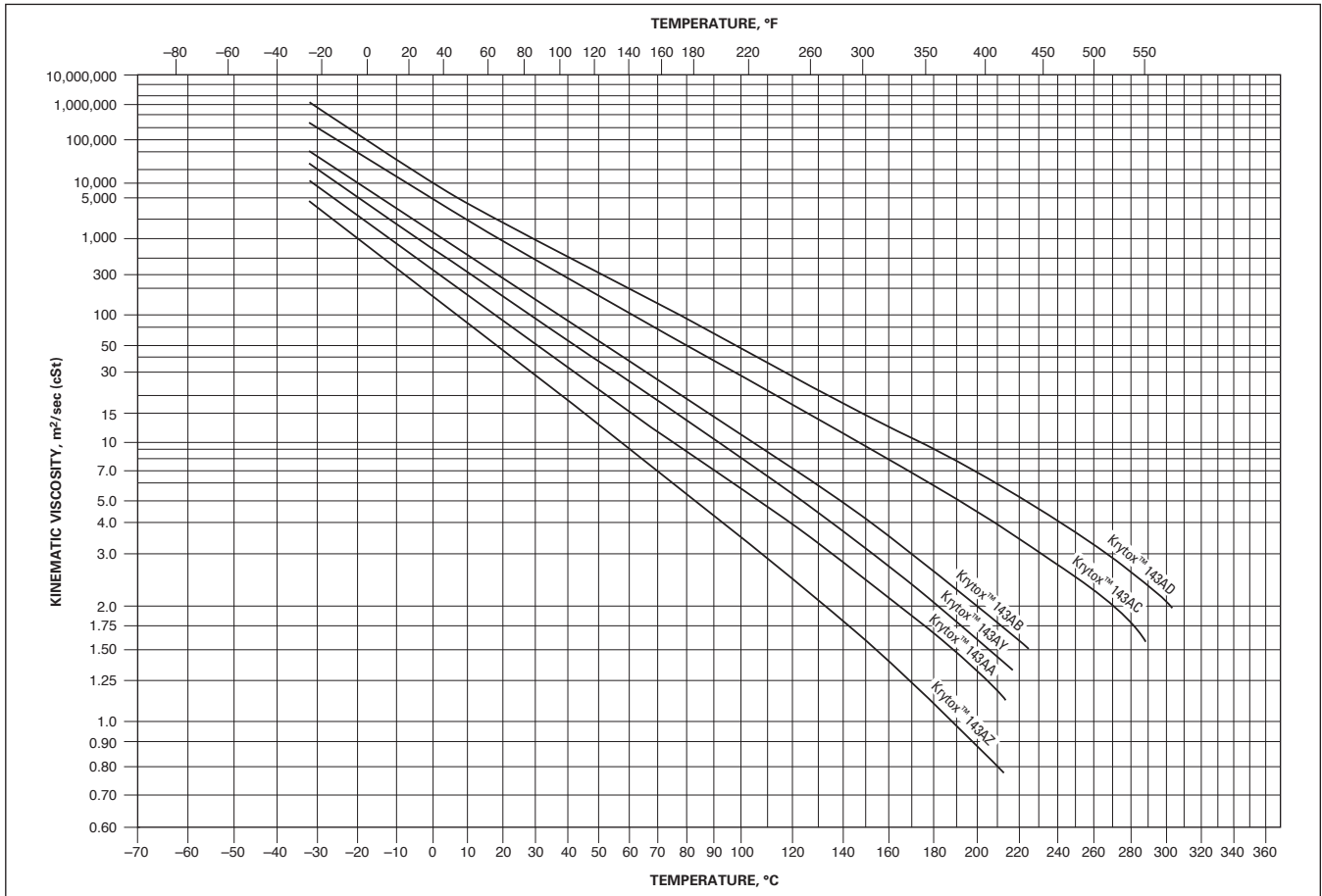
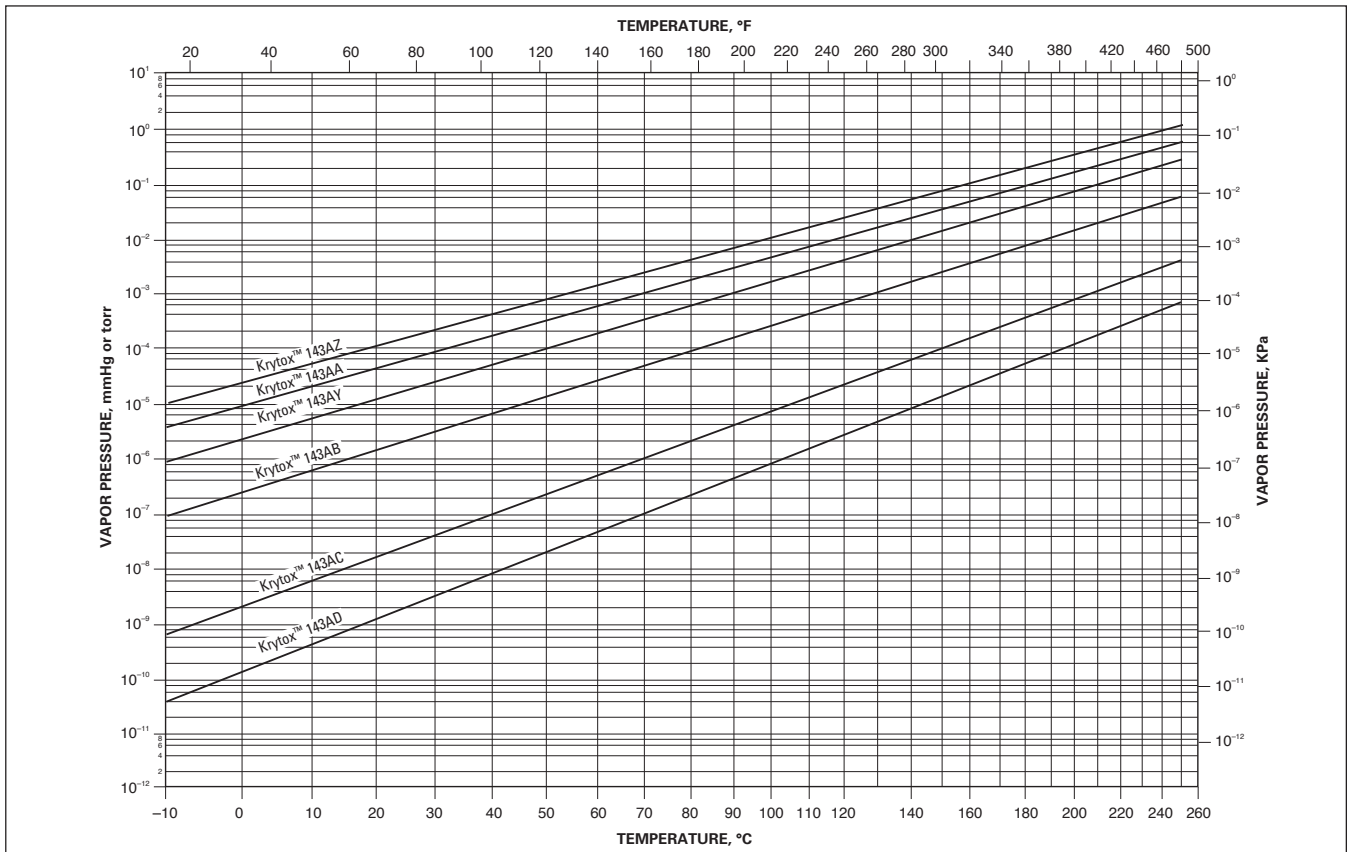


Figure 2. Vapor Pressure vs. Temperature of Krytox™ Aerospace Grade Fluorinated Oils

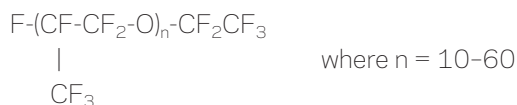


### Typical Properties of Krytox™ Aerospace Grade Fluorinated Greases\*

Property	ASTM Test Method	Test Conditions	Units	Aerospace Grade				
Aerospace Grease Grade				240AZ (H-1)	240AA	240AB (H-1)	240AC (H-1)	240AD
Extreme Pressure Grade				250AZ	—	—	250AC	250AD
Rust Inhibited Grade				—	—	280AB	280AC	—
Rust Inhibited Grade				283AZ	283AA	283AB	283AC	283AD
Viscosity of Base Oil	ASTM D445	20 °C (68 °F)	cSt	60	88	240	800	1540
		38 °C (100 °F)		24.7	35	86	270	502
		99 °C (210 °F)		4.2	5.4	10.5	26	44
		204 °C (400 °F)		1.08	1.3	2.1	4.1	6.0
Vapor Pressure of Base Oil	Knudsen	38 °C (100 °F)	torr	$4 \times 10^{-4}$	$1 \times 10^{-4}$	$5 \times 10^{-6}$	$8 \times 10^{-8}$	$6 \times 10^{-9}$
		260 °C (500 °F)	torr	1.5	0.8	$3 \times 10^{-2}$	$2 \times 10^{-3}$	$3 \times 10^{-4}$
Volatility of Base Oil	ASTM D2595	149 °C (300 °F)	wt% loss in 22 hr	18	15	1.9	—	—
		204 °C (400 °F)		—	—	17.3	<1	—
		260 °C (500 °F)		—	—	76.2	4	2
Pour Point of Base Oil	ASTM D97		°C	-55	-50	-40	-35	-30
			°F	-70	-60	-40	-30	-20
Texture				Buttery				
Penetration	ASTM D217	60 Strokes		265–295				
Mechanical Stability	ASTM D217	10,000 and 100,000 Strokes		No change from original grade				
Oxidation Stability	ASTM D942	99 °C (210 °F)		0 psig O <sub>2</sub> pressure drop after 600 hr				
Liquid Oxygen Impact	ASTM D2512, NASA MSFC 106B			Pass				
Grease Density		25 °C (77 °F)	g/mL	1.89	1.91	1.92	1.93	1.93
Oil Separation	ASTM D6184	99 °C (210 °F)	wt% loss in 30 hr	6	5	4	3	3
		204 °C (400 °F)		—	20	12	11	10
Estimated Useful Range			°C	-57–149	-51–177	-40–232	-34–288	-29–316
			°F	-70–300	-60–350	-40–450	-30–550	-20–550+

\* This table gives typical properties (not specifications) based on historical production performance. Viscosity may vary within +10%. Chemours does not make any express or implied warranty that these products will continue to have these typical properties.

Krytox™ 143 series oils are clear, colorless, fluorinated synthetic oils that are non-reactive, nonflammable, safe in chemical and oxygen service, and are long-lasting. Krytox™ is a perfluoropolyether (PFPE)—also called perfluoroalkylether (PFAE) or perfluoropolyalkylether (PFPAE)—with the following chemical structure:



The polymer chain is completely saturated and contains only carbon, oxygen, and fluorine. On a weight basis, a typical Krytox™ oil contains 21.6% carbon, 9.4% oxygen, and 69.0% fluorine.

All standard grades of grease are thickened with high efficiency PTFE, whose formula is  $(\text{CF}_2-\text{CF}_2)_n$ . This special high efficiency thickener has a melting point of 325 °C (617 °F), and has low molecular weight and submicron (0.2 μ) particle size for higher performance in bearings.

Krytox™ 240 series greases are white buttery greases with all of the same properties as our 143 series oils that they are made from, but they are in grease form.

Krytox™ 250 series EP greases are black greases that contain molybdenum disulfide added as an extreme pressure additive for highly loaded gears and bearings.

Krytox™ 283 series anticorrosion greases are white greases that contain sodium nitrite. These grades provide rust protection at ambient temperatures, corrosion protection at high temperatures, and antiwear protection.

**Krytox™ 240 AC, 240 AB, and 240 AZ Grade 1 greases now have NSF approval for incidental food contact (H-1) in and around food processing areas. These three products meet the requirements of Mil Spec PRF 27617, Types 1, 2, and 3.**

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Replaces: H-58519-10  
C-10275 (9/15)