DuPont™ Krytox®
performance lubricants

Table 1
Krytox® Vacuum Pump Fluids*

	Test			Krytox®					
Property	**Method**	**Conditions**	**Units**	**1506/1506XP**	**1514/1514XP**	**1525/1525XP**	**1531/1531XP**	**1618**	**16256**
Average Molecular Weight	NMR			2400	3500	4600	4900	4300	11000
Vapor Pressure**	Knudsen	20°C (68°F)	torr	4×10^{-7}	2×10^{-7}	1×10^{-7}	1×10^{-7}	5×10^{-9}	3×10^{-14}
		50°C (122°F)		1×10^{-5}	3×10^{-6}	1×10^{-6}	1×10^{-6}	2×10^{-7}	2×10^{-12}
		100°C (212°F)		1×10^{-3}	1×10^{-4}	3×10^{-5}	3×10^{-5}	2×10^{-5}	1×10^{-9}
		200°C (392°F)		5×10^{-1}	1×10^{-2}	2×10^{-3}	2×10^{-3}	1×10^{-2}	2×10^{-6}
Kinematic Viscosity	ASTM D445	20°C (68°F)	mm^2/s	62	142	261	310	175	2717
		50°C (122°F)	(cSt)	16	32	53	63	37	444
		100°C (212°F)		4.4	7.2	11	12.5	8	63
		200°C (392°F)		1.2	1.7	2.2	2.5	1.8	8.4
Density		20°C (68°F)	g/cc	1.88	1.89	1.90	1.90	1.89	1.92
		50°C (122°F)		1.82	1.83	1.84	1.84	1.83	1.87
		100°C (212°F)		1.73	1.74	1.75	1.75	1.74	1.78
		200°C (392°F)		1.54	1.55	1.56	1.56	1.55	1.61
Pour Point	ASTM D97		°C (°F)	–60 (–76)	–54 (–65)	–48 (–54)	–41 (–42)	–40 (–40)	–15 (5)
Distillation Range at 0.4 torr	ASTM D1160	10%	°C (°F)	160 (320)	200 (392)	200 (392)	200 (392)	210 (410)	NA
		90%		220 (428)	280 (536)	300 (572)	300 (572)	280 (536)	NA
Heat of Vaporization	Knudsen	150–250°C (302–482°F)	cal/g	9	7	6	6	7	NA
Volatility at 22 hr	ASTM D2595	121°C (250°F)	%	7.3	1.9	1.0	1.0	0.5	0.2
Volatility at 22 hr	ASTM D972	149°C (300°F)	%	6	1	0.5	0.5	0.1	NA
		204°C (399°F)		35	3	Nil	Nil	8.9	0.3
Surface Tension		25°C (77°F)	dyn/cm	17	18	19	19	18	19

* This table gives typical properties based on historical production performance. DuPont does not make any express or implied warranty that these products will continue to have these typical properties.

** Actual values are equal to or less than those indicated.

Krytox® VPF fluids are now available with antirust protection. The new fluids are called 1506XP, 1514XP, 1525XP, and 1531XP. They have all of the same properties of the standard fluids listed above. Krytox® XP VPF oils contain a soluble additive to prevent rust. This new patented additive enhances the performance of Krytox® VPF fluids, giving them improved performance properties. The long-term antirust properties repel moisture, providing extra protection from corrosion of metal parts and bearing surfaces.

While Krytox® VPF fluids are inert and nonreactive to all elastomers, plastics, and metals, the soluble additives in the XP products are new and have not been tested with all materials. It is possible that some reactivity and damage could occur to some materials. Initial testing has shown no problems with Teflon®, Kalrex®, Viton®, nitrile, and silicone rubbers. There is some reactivity of the additive with copper, but it is less with brass. These additives could have degradation of performance at elevated temperatures over 175°C (347°F) over a long period of time.

Table 2
Other Krytox® Fluids for Vacuum Service*

Krytox®	Vapor Pressure, torr at 20°C (68°F) (Knudsen)	Kinematic Viscosity, mm^2/s (cSt at 20°C [68°F])	Pour Point, °C (°F)
16350	-4×10^{-15}	3500	–5 (23)
1645	-5×10^{-12}	509	–35 (–31)

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Figure 1. Typical Vapor Pressure-Temperature Characteristics

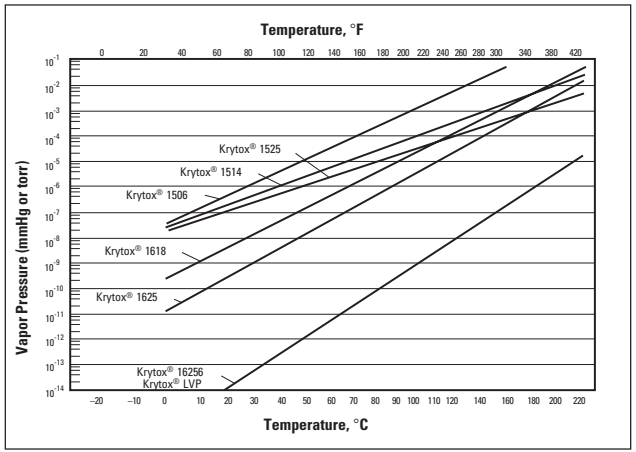

Figure 2. Relative Weight Loss of PFPE Fluids in Presence of a Lewis Acid (90 min at 120°C [248°F] by ISOTGA)

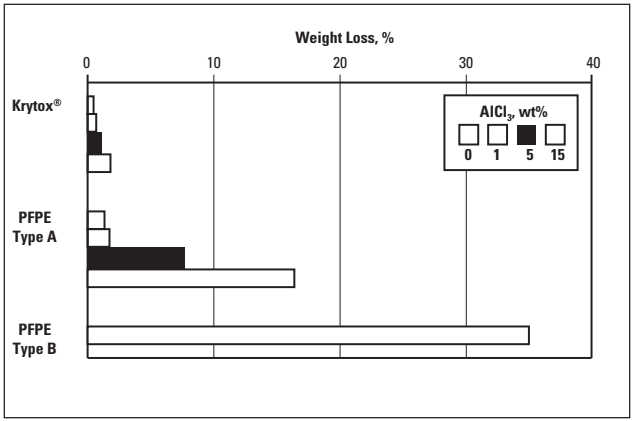

Table 3
Krytox® LVP High-Vacuum Grease*

Penetration (worked, 25°C [77°F]), mm/10	280
NLGI Consistency Grade	2
Vapor Pressure	
torr at 20°C (68°F)	$<1.0 \times 10^{-13}$
torr at 200°C (392°F)	$<1.0 \times 10^{-5}$
kPa at 20°C (68°F)	$<1.3 \times 10^{-14}$
kPa at 200°C (392°F)	$<1.3 \times 10^{-6}$
Oil Separation (30 hr, 204°C [399°F]), wt%	13.8
Evaporation Loss (22 hr, 204°C [399°F]), wt%	0.3
Density, (25°C [77°F]), g/cc	1.94

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Table 4
Initial Temperature for Depolymerization*

Fluid Type	°C (°F)
Perfluoroalky Ether Krytox® (no -0-CF_2-0- links)	142 (287)
Type A (some -0-CF_2-0- links)	102 (216)
Type B (many -0-CF_2-0- links and no shielding)	72 (162)
Hydrocarbon	79 (174)
Silicone	58 (136)
Fluorosilicone	82 (180)

* This is the threshold temperature for the initial reaction in the presence of the Lewis Acid Aluminum Chloride as measured in a differential scanning calorimeter.