

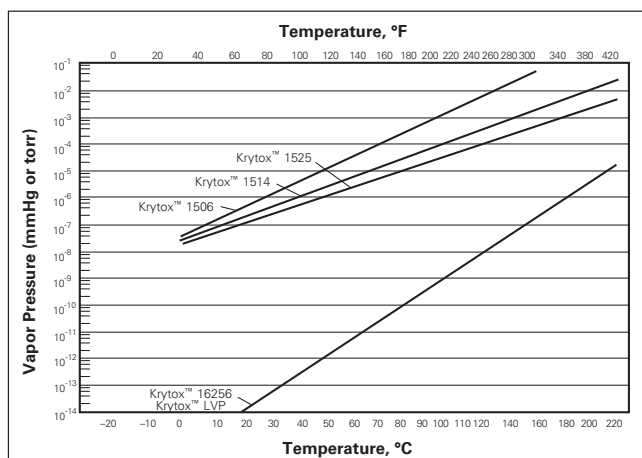
Vacuum Pump Fluids

Product Information

Krytox™ vacuum pump fluids (VPF) are used in applications where conventional vacuum pump oils cause safety, waste disposal, and maintenance problems. They are nonflammable and eliminate the chance of fire in pumps. They are non-reactive and safe to use in oxygen systems. They can replace competitive PFPE fluids as well as any other type of vacuum fluid. Krytox™ fluids do not contain acetal groups, which are susceptible to attack by Lewis acids (see Figure 2 and Table 3). This gives Krytox™ superior stability as a vacuum pump fluid. Krytox™ vacuum fluids are precisely distilled to provide low vapor pressures and superior performance (see Figure 1). In addition, Krytox™ fluids are recyclable.

Krytox™ XP VPF oils contain a soluble additive to prevent rust. This patented additive enhances the performance of Krytox™ VPF fluids, giving them improved performance properties. The long-term anti-rust properties repel moisture, providing extra protection from corrosion of metal parts and bearing surfaces.

Figure 1. Typical Vapor Pressure—Temperature Characteristics



While Krytox™ VPF fluids are inert and non-reactive to all elastomers, plastics, and metals, the soluble additives in Krytox™ XP products have not been tested with all materials. Initial testing has shown no problems with Teflon™ fluoroplastic resin, Kalrez® perfluoroelastomer parts, Viton™ fluoroelastomer, nitrile, and silicone rubbers. The performance of the soluble additives could degrade at temperatures more than 182 °C (360 °F) over a long period of time.

High-Vacuum Grease

Krytox™ LVP is a high vacuum grease formulated with a special low vapor pressure Krytox™ oil for high-vacuum applications. It is also useful for sealing laboratory glassware connections and as a thread lubricant/sealant.

For more information on Krytox™ LVP, see Table 2.

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

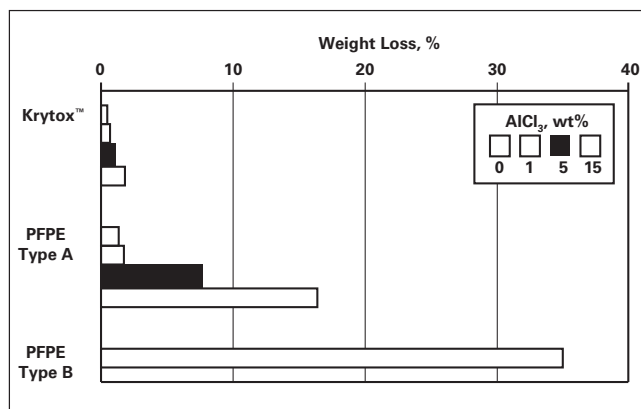


Table 1. Krytox™ Vacuum Pump Fluids Properties*

| Property | Test Method | Conditions | Units | Krytox™ | | | | | |
|--------------------------|-------------|----------------------------|-----------------------------|--------------------|--------------------|--------------------|--------------------|---------------------|---------------------|
| | | | | 1506/ 1506XP | 1514/ 1514XP | 1525/ 1525XP | 1531/ 1531XP | 16256 | 1645 |
| Average Molecular Weight | NMR | | | 2160 | 2840 | 3470 | 3940 | 9400 | NA |
| Vapor Pressure** | Knudsen | 20 °C (68 °F) | torr | 4×10^{-7} | 2×10^{-7} | 1×10^{-7} | 1×10^{-7} | 3×10^{-14} | 5×10^{-12} |
| | | 50 °C (122 °F) | | 1×10^{-5} | 3×10^{-6} | 1×10^{-6} | 1×10^{-6} | 2×10^{-12} | NA |
| | | 100 °C (212 °F) | | 1×10^{-3} | 1×10^{-4} | 3×10^{-5} | 3×10^{-5} | 1×10^{-9} | NA |
| | | 200 °C (392 °F) | | 5×10^{-1} | 1×10^{-2} | 2×10^{-3} | 2×10^{-3} | 2×10^{-6} | NA |
| Kinematic Viscosity | ASTM D445 | 20 °C (68 °F) | mm ² /s (cSt) | 60 | 140 | 250 | 310 | 2560 | 450 |
| | | 50 °C (122 °F) | | 15.5 | 32 | 52 | 63 | 437 | NA |
| | | 100 °C (212 °F) | | 4.1 | 7.2 | 10.6 | 12.5 | 64.6 | NA |
| Density | | 20 °C (68 °F) | g/cc | 1.88 | 1.89 | 1.90 | 1.90 | 1.92 | NA |
| | | 50 °C (122 °F) | | 1.82 | 1.83 | 1.84 | 1.84 | 1.87 | NA |
| | | 100 °C (212 °F) | | 1.73 | 1.74 | 1.75 | 1.75 | 1.78 | NA |
| | | 200 °C (392 °F) | | 1.54 | 1.55 | 1.56 | 1.56 | 1.61 | NA |
| Pour Point | ASTM D97 | | °C (°F) | -60 (-76) | -54 (-65) | -48 (-54) | -41 (-42) | -15 (5) | -35 (-31) |
| Distillation | ASTM D1160 | 10% | °C (°F) | 160 (320) | 200 (392) | 200 (392) | 200 (392) | NA | NA |
| Range at 0.4 torr | | 90% | | 220 (428) | 280 (536) | 300 (572) | 300 (572) | NA | NA |
| Heat of Vaporization | Knudsen | 150–250 °C (302–482 °F) | cal/g | 9 | 7 | 6 | 6 | NA | NA |
| Volatility at 22 hr | ASTM D2595 | 121 °C (250 °F) | % | 6.5 | 1.3 | 0.6 | 0.4 | 0.2 | NA |
| Surface Tension | | 25 °C (77 °F) | dyn/cm | 17 | 18 | 19 | 19 | 19 | NA |
| Food Contact Approval | | | | NSF H-1/No | NSF H-1/No | NSF H-1/No | None | None | None |

*This table gives typical properties based on historical production performance. Chemours 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.

Table 2. 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 [400 °F]), wt% | 13.8 |
| Evaporation Loss (22 hr, 204 °C [400 °F]), wt% | 0.3 |
| Density (25 °C [77 °F]), g/cc | 1.94 |

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Table 3. Initial Temperature for Depolymerization*

| Fluid Type | °C (°F) |
|---|-----------|
| Perfluoroalkyl Ether | |
| Krytox™ (no -O-CF ₂ -O- links) | 142 (287) |
| Type A (some -O-CF ₂ -O- links) | 102 (216) |
| Type B (many -O-CF ₂ -O- 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.

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For product information, industry applications, technical assistance, or global distributor contacts, visit krytox.com or within the U.S. and Canada, call 1-844-773-CHEM/2436 or outside of the U.S., call 1-302-773-1000.

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