

Fluids & Greases

6

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➤ Why Are Fluids Used in Mechanical Pumps?

In an oil-sealed rough vacuum pump, the fluid or oil:

- Lubricates bearings and wear surfaces
- Seals gas into compressible volumes
- Transports heat away from wear surfaces
- Inhibits corrosion of metallic parts
- Flushes away moisture

■ Matching the Fluid and Application

When operating, an oil-sealed pump compresses the gas to a pressure slightly greater than atmospheric to expel it through the exhaust valve.

At this pressure and an operating temperature of 70–100° C, active gases readily attack pump surfaces, bearings, seal materials, and the oil. Choosing an appropriate oil for the application is critical to good pump maintenance.

■ Normal or “Clean” Vacuum

When pumping a chamber from atmosphere, the major component is air. After the chamber has been at high vacuum for some hours, H₂O vapor, CO, and H₂ are the major gases.

Almost any vacuum-grade, distilled hydrocarbon oil works in this application. Note that fully hydrogenated oils are usually less reactive than unsaturated oils.

■ Oxygen Service

Many processes (e.g., *photo-resist stripping*) create conditions where the pumped gas is 100% oxygen. While the chamber pressure may be low, to exhaust the gas from the pump, it must be more than 1 atmosphere.

Oxygen at atmospheric pressure is exceptionally dangerous. To avoid a fire or explosion, the pump fluid **MUST NOT** be flammable. We recommend an inert PFPE fluid (see [page 6-13](#)) that is unreactive with O₂ and cannot act as a fuel for an explosion.

■ Corrosive Service

Plasma systems, particularly those using halogen-containing gases, require pump oils that either resist radical/halogen attack or are inexpensive to replace.

An inert PFPE fluid (see [page 6-13](#)) is the best choice, but a hydrogenated hydrocarbon oil that is frequently replaced (*perhaps daily*) may be a lower-cost alternative.

■ Lewis Acids (AlCl₃, BCl₃, etc.)

Compounds of this type attack most pump oils and deposit sludge in the pump. To counteract these effects, an inert PFPE fluid (see [page 6-13](#)) should be used together with continuous oil filtration for particulates and acid neutralization.

■ Choosing a Replacement Oil for an Oil-Sealed Pump

To avoid warranty questions, contaminated pump oil is often replaced by oil recommended by the pump manufacturer. However, this “safe” approach may not be the lowest-cost option once the pump is beyond warranty.

When selecting a replacement fluid, there are many relevant characteristics (noted **below**) but two, vapor pressure and viscosity, **MUST** be considered.

NOTE: Some fluid combinations are immiscible and mixtures may be hazardous for some applications. Please read “Changing Pump Fluids.”

■ Vapor Pressure

Oil vapor backstreaming depends on the fluid’s vapor pressure at the pump’s operating temperature. To reduce backstreaming, ensure that the new oil’s vapor pressure is equal to, or lower than, the original oil’s vapor pressure.

Since backstreaming occurs from any pump that has fluid in the vacuum volume, we strongly recommend the use of a good, well-maintained foreline trap for such pumps.

■ Viscosity and Lubricity

The new fluid’s viscosity has two main requirements: at room temperature it must be low enough that the pump rotates when its motor starts; at working temperature it must be high enough to provide good lubricity and gas sealing.

Typically, rotary vane pumps have small clearances and need a low viscosity fluid. Rotary piston pumps have larger clearances and need higher viscosity oils to lubricate and seal.

Roots pumps are not oil-sealed but have high-speed gears that need good lubrication.

While viscosity values are readily available, lubricity values are not. Even experts debate the meaning of lubricity values for vacuum pumps.

In general, oils with hydrocarbon-like (C-C-C) or ether-like (C-O-C) backbone will have adequate lubricity (*where appropriate for the intended application*). Oils with siloxane-like backbone (Si-O-Si) do not.

■ Water Separation

Good water separation is rarely considered but is an important property. An oil that emulsifies with water or absorbs large concentrations of water will give poor foreline pressures.

■ Pour Point

For pumps mounted in an outdoor “shed,” the pour point is important during winter maintenance. If the pump is refilled when cold, the resulting high viscosity may prevent the pump’s motor from rotating the mechanism.

■ Flash Point

Flash point can be roughly defined as the temperature at which the oil vapor will catch fire in air, given an ignition source. Normally this temperature is much higher than a pump’s working temperature, but it is never a mistake to choose an oil with a high flash point.

Handling Pump Fluids

Eye Contact

ALWAYS wear splash-proof goggles when handling pump oils. Allowing new or contaminated oils to reach one’s eyes is exceptionally dangerous. If this happens get immediate medical attention.

Skin Contact

ALWAYS wear oil-proof gloves and protective coveralls. While skin contact with fresh oil is not often hazardous, the affected area should be immediately washed multiple times using a good, hypoallergenic detergent and large volumes of water.

Skin contact **MUST** be avoided with “old” oil. Even if innocuous gases and materials are added to the vacuum system, the process products may be very different.

Any contact area must immediately be washed with a good detergent and large volumes of water. Get medical attention at the first sign of itching, burning, or redness.

Breathing

Fresh oils have low vapor pressures. Breathing their vapors at room temperature is rarely hazardous; however, at elevated temperatures present in operating pumps, breathing any oil vapors, contaminated or not, **MUST** be avoided.

Breathing aerosols exhausted by a pump displacing large gas volumes **MUST** also be avoided. Even when using fresh hydrocarbon oil to pump air, it is never wrong to assume aerosols will cause deteriorated lung performance.

Smoking

We cannot overemphasize that smoking and handling fluoro- and chlorofluoro-carbon fluids are strictly incompatible.

These fluids’ thermal decomposition products include HF, HCl, phosgene, and carbonyl fluoride. . . each an irritant, toxic, deadly, or all three!

Cigarettes are too easily contaminated with oils transferred from gloved fingers or surfaces where the cigarette has rested, and a lit cigarette may reach decomposition temperatures.

Disposal

Do not throw fresh or contaminated oils into the local dump. All contaminated pump oils should be analyzed before disposal. Only then can appropriate disposal or reclamation by a licensed company be arranged.

Routine Fluid Maintenance

We strongly recommend that log books are kept for every pump, detailing its working history, oil changes, and other maintenance steps.

We suggest using the pump manufacturer’s recommended oil change intervals unless some, empirically determined, shorter interval is used. The pump’s service life will strongly influence the oil change schedule.

If service intervals are unclear, use an Acidity Analysis Kit to help establish them. Oil lifetime is often determined by the concentration of oxidizing components pumped.

Oxidation of the oil by O₂, halogen, or Lewis acid will cause organic acids to form. Regular testing of the oil’s acidity provides some measure of the service period. One thing is certain: ignoring routine oil changes quickly leads to pump damage.

➤ Types of Vacuum Fluids

■ Hydrocarbons

The bulk of vacuum pump oils are petroleum fractions (*hydrocarbons*) distilled from crude oil.

Without too much chemistry, a true hydrocarbon oil contains carbon, hydrogen ($\text{CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-}$) and nothing else—a point missed by some major vacuum fluid suppliers.

Hydrocarbons from cracked crude oil inevitably contain sulfur compounds, aromatic ring compounds, plus (*non-conjugated*) carbon-carbon unsaturation. These components are more reactive and, therefore, undesirable for vacuum fluids.

Sulfur compounds are removed from all hydrocarbon fractions no matter what their ultimate application. For vacuum fluids, the better grades are treated to remove aromatic compounds.

The best grades are also hydrogenated to remove all unsaturation and distilled once or twice to remove "light ends" and give a narrow cut in molecular weights.

The major advantages of hydrocarbon fluids are their low cost (*which encourages frequent oil changes*), low toxicity (*when uncontaminated*), and high lubricity.

The disadvantages are: reactivity to all but the simplest gases and their potential to form explosion mixtures in oxygen service.

Possible health risks from aerosols and vapors from the pump's exhaust are reduced by installing a good mist eliminator.

It is never a disadvantage to duct exhaust gases out of the building (*following all local, state, and federal regulations governing emissions*).

■ Silicones

The chemical name for a silicone fluid is siloxane, which has alternating atoms (-Si-O-Si-O-Si-). A tri-siloxane has 3 Si atoms.

The three/two spare valences on the silicon atoms (*depending on their position in the chain*) are satisfied by adding either methyl (-CH_3) or phenyl ($\text{-C}_6\text{H}_5$) groups.

The fluid's basic properties—not easily oxidized by air at operating temperatures; not hydrolyzed by water vapor; unreactive with metals, elastomers, and gases such as H_2 and CO ; and high molecular weight—make the siloxanes excellent diffusion pump oils.

■ Polyphenyl Ethers

The best known polyphenyl ether, Santovac® 5, has a backbone of 5 phenyl groups, each linked through an O atom, or ether link, ($\text{-C}_6\text{H}_4\text{-O-C}_6\text{H}_4\text{-}$). This structure is very resistant to oxidation.

The oil's extreme viscosity at room temperature prevents its use in an oil-sealed pump; however, its lack of chemical reactivity, its extremely low vapor pressure at RT, its reasonable boiling point under vacuum, and its high molecular weight make it an almost ideal, albeit expensive, diffusion pump oil.

Indeed, this fluid has been used to produce UHV chamber pressures with a diffusion pump.

■ Esters

The ester grouping is formed when an organic alcohol (>C-OH) reacts with an organic acid (-COOH) to eliminate water (>C-O-C(O)-). If di-alcohols and/or di-acids are reacted, multiple ester groups form in one molecule.

For example, phthalic acid reacted with a C_8 length alcohol gives the well-known dioctyl phthalate used as a vacuum oil and as a PVC plasticizer.

Esters, in general, are unreactive and, depending on molecular weight, used in both mechanical and diffusion pumps.

If a long chain alcohol is reacted with an inorganic acid (*phosphoric*), the resulting fluid (*erroneously called a phosphate ester*) has good lubricity and oxidation resistance. Both organic esters and inorganic "esters" are used in oil-sealed pumps.

■ Chlorofluorocarbons (*inert CFCs*)

Low molecular weight, highly volatile chlorofluorocarbons (CFCs) were employed as refrigerant fluids and aerosol propellants until their ozone layer destruction properties were recognized.

High molecular weight (*low volatility*) CFCs are used as vacuum pump oils because they do not react with aggressive gases used in many semiconductor processes.

■ Perfluoropolyethers (*inert PFPEs*)

The perfluoropolyethers (PFPE) fluids are completely inert and do not react with aggressive chemical agents. The only known (*rare*) reaction is the cracking of a single molecule into two shorter chain molecules.

In the polyether structure, a single molecule has many (-C-O-C-) groups throughout the molecular chain. The chain length is adjusted to achieve an appropriate viscosity.

The degree of branching (-C-O-C-(C)-) and the chain length of the branch controls lubricity.

Unresolved valences on all carbon are satisfied with F atoms. The key to PFPE's stability is the high energy of C-F and C-O bonds in a molecule.

PFPEs of appropriate viscosity and vapor pressure are used in both oil-sealed and diffusion pumps.

NOTE: Any application warranting inert pump fluid makes hazardous products.

All exhaust gases must be directed to an exhaust gas abatement system or, if appropriate, vented to outside air (*following all local, state, and federal regulations governing emissions*).

■ Reclaiming Vacuum Fluids

The advantage of expensive synthetic fluids (*Fomblin®*, *Santovac 5*, *silicone*) is that, if correctly chosen, their performance in harsh operating conditions is substantially better than hydrocarbon fluids. However, any fluid may be contaminated by the gases, vapors, and particulate materials from the vacuum process.

Because the synthetic fluids are so expensive, many companies have sought local, state, and federal licensing to reclaim contaminated fluids.

By combining chemistry (*active filtering, neutralization, distillation, etc.*) with administration (*solid waste disposal, tracking documentation, etc.*) the fluids are reclaimed and restored to "as new" condition.

Reclaiming is less costly than purchasing new oil and causes less environmental damage because the contaminant's are concentrated to a small, solid bulk before disposal.

NOTE: There is no limit to the number of times a particular fluid volume can be reclaimed. Contact us for fluid reclaim information.

Changing Pump Fluids

Changing fluid can mean two things:

- Replacing a used oil with more of the same (*equivalent to a car's oil change*)
- Changing from one oil type to another because the new oil is less expensive or the pump is entering a different application

Different procedures and precautions must be observed in each case (*see facing page*).

Changing Used Oil

If the oil is discolored, dirty, acidic, or has reached the end of its recommended life, shut down the pump, vent the inlet, and drain out the oil while hot.

Replace the oil with a new charge. Remember, if the pump has an integrated oil filter, it, too, must be drained and the elements changed.

Sludge-Filled Pumps

If process gases cause sludge buildup, there are two recommendations:

- Where hydrocarbon (*or hydrocarbon-miscible*) oils are used, drain the hot oil, fill the pump with a vacuum-grade flushing fluid, and run it for a few minutes. Drain the pump again while still hot and refill with the correct grade of operating oil.
- The safest course is to strip the pump and thoroughly clean/degrease, and rebuild it. If this is beyond local capabilities, call our Vacuum Services group.

Changing Oil Type (*same application*)

Here, the only concern is miscibility. If the old and new oils are miscible, then simply drain and refill. If they are not miscible, then just draining may be unacceptable because even a few ccs of old oil will remain. When mixed with immiscible new oil, the bulk turns milky. Often this is only a cosmetic problem and the milkiness disappears after the next oil change.

If it is unacceptable, however, drain, strip the pump, clean with a suitable solvent, rebuild, (*lubricating the moving parts with new oil*) and then recharge with new oil.

Changing Oil Type (*different application*)

If the pump's service will change and the oils are immiscible, then the new service's details are critical. For example, if a hydrocarbon-filled pump is being transferred to oxygen or corrosive gas service, then any residual hydrocarbon oil is a serious hazard.

The pump **MUST** be completely stripped, degreased, cleaned, re-lubricated with PFPE fluid, reassembled, and charged with PFPE fluid. Contact us with any special application questions.

Assistance

We have been formulating, testing, selling, and reclaiming pump fluids for over 45 years. Please call for advice on more complicated applications (*or email techinfo@lesker.com*).

➤ Pump Oils & Fluids Reclamation Services

■ Our Goal

The Kurt J Lesker Company is dedicated to providing our customers with quality products and services to enhance and protect their process. For over 20 years, the Kurt J. Lesker Company has been reclaiming inert PFPE and silicone fluids. Our reclaim service provides a significant savings over the cost of new fluid and helps protect our environment by drastically reducing the amount of waste contributed to the waste stream.

■ How can KJLC help you Reduce Your Waste Stream

- Enormous savings of up to 75% over the cost of new oil.
- High recovery yields of up to 95%.
- Cradle-to-grave process, incinerated waste.
- **ISO 14001** documentation available upon request. We can provide documentation for you on the ISO14001 requirements.
- Certified analysis of reclaimed oil provided with each lot.
- Two week process time typical (expedited delivery available upon request).
- Permits and certifications of operation under State DEP (301278) and Federal EPA (PAD981939846).
- **Free D.O.T.** approved shipping containers to send used oils directly to our facility.
- Endorsed by Solvay Solexis for reclamation of Fomblin[®] PFPE oils.

You will not only see a savings by having to purchase much less new fluid, you will also have less fluid that you have to pay to properly dispose of.



➤ Pump Oils & Fluids Reclamation Services

■ Start Saving Money and the Environment Today

Step 1 — Contact us at the phone number below or e-mail us at sales@lesker.com to receive Free DOT Approved Containers to send in your spent fluid. If this is your first time reclaiming fluid, please also fill out the Declaration of Product Safety Form.

North America — 1-800-245-1656

Europe — +44 1424 719101

Asia — +86 21 62181240

Step 2 — Fax or e-mail the Declaration of Product Safety form to 412.826.5295 or reclaim@lesker.com

Step 3 — After we review the safety form, we will provide you with a quotation for the reclaim service and if necessary, request a sample of your fluid for additional testing.

Step 4 — Fluid will be processed in 2 weeks or less after it is received at our reclaim lab (located just outside of Pittsburgh, Pa USA)

*Fluid shipping from outside North America can be shipped directly to our European or Asian headquarters.

Step 5 — We will ship your reclaimed fluid back to your facility along with the certificate of analysis which shows that your fluid has been brought back to manufacturer's specifications.



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Fluids & Greases



➤ **Fluids for Vacuum Pumps: Reference Table**

Fluid	Vapor Pressure (Torr)	@ ° C	Viscosity (cSt/SUS)		Flash Point (° C)	Fire Point (° C)	Boiling Point (° C*)	Specific Gravity (g/cc)
			@ 40° C (100° F)	@ 100° C (210° F)				
Apiezon AP-201	5 x 10 ⁻⁶	20	—	5.0/43	196	204	160	0.86
DC-702	1 x 10 ⁻⁶	25	27/ —	6/ —	193	—	180	1.07
DC-704	1 x 10 ⁻⁷	25	24/ —	6/ —	221	—	215	1.07
DC-705	1 x 10 ⁻⁹	25	66/ —	10/ —	243	—	245	1.09
KJL-704	1 x 10 ⁻⁷	25	—	—	243	—	245	1.09
KJL-705	1 x 10 ⁻⁹	25	—	—	243	—	245	1.09
Fomblin [®] SV	5 x 10 ⁻⁹	20	—	—	—	—	—	1.90
YL-VAC 18/8	2 x 10 ⁻⁸	20	—	—	None	None	—	1.89
YL-VAC 25/9	2 x 10 ⁻⁹	20	—	—	None	None	—	1.90
YL-VAC 06/6	3 x 10 ⁻⁸	20	—	4.0/39	None	None	—	1.88
YL-VAC 14/6	2 x 10 ⁻⁷	20	—	7.5/51	None	None	—	1.89
YL-VAC 16/6	2 x 10 ⁻⁶	20	—	9.0/56	None	None	—	1.89
YL-VAC 25/6	4 x 10 ⁻⁸	20	—	10.5/60	None	None	—	1.90
Permavis [™] 8	3 x 10 ⁻⁷	25	46/230	7.8/52	257	290	145	0.83
Permavis 10	3 x 10 ⁻⁷	25	63/320	9.6/60	264	300	145	0.84
Santovac [®] 5	4 x 10 ⁻¹⁰	25	363/1860	13.1/72	288	349	275	1.2
Santovac 5P	—	—	363/1860	13.1/72	288	349	275	1.2
TKO19	1 x 10 ⁻⁶	25	69/333	8.5/56	236	252	127	0.872
TKO19Ultra	8.8 x 10 ⁻⁷	25	70/363	9.0/56	236	252	127	0.9
TKO-FF	1 x 10 ⁻⁶	25	28/150	4.5/41	218	244	112	0.86
TKO-500 Ultra	3 x 10 ⁻⁶	25	97.2/590	10.8/67	227	n/a	168	0.87
TKO-750 Ultra	7 x 10 ⁻⁷	25	120/546	13/70	250	n/a	157	0.89
TKO-800	4 x 10 ⁻⁶	25	161/660	20/103.3	n/a	290	161	0.88
TKO-1150	4 x 10 ⁻⁶	25	220/1167	18.1/93	227	n/a	158	0.89

*At the reduced pressure indicated in the corresponding tables of specifications (see product). **At 760 Torr.

➤ **Fluid Manufacturer Brand Equivalence Reference****Hydrocarbon & Semi-Inert Fluids Cross Reference**

The following tables list the major brands of hydrocarbon and inert fluids for vacuum pumps and the recommended Kurt J. Lesker Company fluid.

NOTE: As always, when substituting fluids, please consult our Product Manager to be sure the equivalent fluid listed is appropriate for your pumping application.

Alcatel	KJLC [®] Equivalent Fluid
A100	TKO-19
A102	TKO-500 Ultra
A111	TKO-500 Ultra
A113	MFY25/6
A119	TKO-19
A120	TKO-77 Ultra
A121	TKO-19 Ultra
A200	Diffoil-20
A300	TKO-W/7 Ultra
A214	DC704
CMP	KJLC [®] Equivalent Fluid
CMP-19	TKO-19
CMP-20	Diffoil-20
CMP-21	Diffoil-20
CMP-25	PV10
CMP-41	TKO-19
CMP-44	TKO-700
CMP-51	TKO-750 Ultra
CMP W1, W2	TKO-W/7 Ultra
CMP ELITE	PV 8
Edwards	KJLC [®] Equivalent Fluid
Ultragrade 15	TKO-19
Ultragrade 20	Diffoil-20
Edwards TW	TKO-W/7 Ultra

Inland	KJLC [®] Equivalent Fluid
Inland 19	TKO-19
Invoil 20	Diffoil-20
Inland 21	TKO-19
Inland 43	TKO-19
Inland 45	PV 8
Inland 45Z	PV 10
Inland 77	TKO-77 Ultra
Inland 87	TKO-1150
Inland 97	TKO-800
Inland 220	Thor Oil
Inland 300	TKO-300 Ultra
Inland TW	TKO-W/7 Ultra
Kinney	KJLC [®] Equivalent Fluid
Kinney A	TKO-500 Ultra
Kinney AX	TKO-500 Ultra
KV100	TKO-750 Ultra
Pfeiffer	KJLC [®] Equivalent Fluid
TL 011	Thor Oil
P-3	TKO-77 Ultra
F5	MFY25/6
Stokes	KJLC [®] Equivalent Fluid
V-LUBE A	TKO-350 Ultra
V-LUBE B	TKO-500 Ultra
V-LUBE C	TKO-750 Ultra
V-LUBE D	TKO-1150
V-LUBE F	TKO-750 Ultra
V-LUBE G	TKO-800
V-LUBE H	TKO-1170
V-LUBE J	TKO-19

Varian	KJLC [®] Equivalent Fluid
GP	TKO-19
CS	Diffoil-20
Welch	KJLC [®] Equivalent Fluid
DUO SEAL	TKO-19
GOLD	PV8

Inert Fluids Cross Reference

Brand	KJLC [®] Equivalent Fluid
Alcatel 113	Fomblin [®] MFY25/6
Edwards 1506	Fomblin MFY06/6
Krytox 1506	Fomblin MFY06/6
Krytox 1514	Fomblin MFY 14/6
Krytox 1525	Fomblin 25/6

➤ **KJLC® Hydrocarbon Fluids— The Clear Choice!**



SPECIFICATIONS

Vapor Pressure @ 25° C — 1×10^{-6}

Pour Point (°C) — -12

Flash Point (°C) — 236

Specific Gravity (g/cc) — 0.872

Viscosity (CST/SUS): —
@ 40° C (100° F), 69/333;
@ 100° C (212° F), 8.5/56

Color — Clear

Hazardous Decomposition — *See note

Incompatibility — Fire

Hazardous Ingredients — None

ISO Cleanliness Level — 14/12

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.

■ **TKO-19**

A good choice for general-purpose vacuum systems and batch coaters.

- Works in small, medium, and large, direct- and belt-drive mechanical pumps
- Narrow-cut-fraction distillate gives good ultimate vacuum and low backstreaming
- Chemical stability enables repeated cycling from atmosphere to high vacuum
- A good choice for general-purpose vacuum systems and batch coaters

Description	Size	Part No.	Price
TKO-19	1 quart	TKO19Q1	Call
	1 gallon	TKO19G1	Call
	5 gallons (pail)	TKO19G5	Call
	55 gallons (drum)	TKO19G55	Call

■ **TKO-19 Ultra**

Hydrotreated vacuum pump fluid that gives good, ultimate vacuum and low backstreaming.

- Works in small, medium, and large, direct- and belt-drive mechanical pumps
- Narrow-cut-fraction distillate gives good ultimate vacuum and low backstreaming
- Chemical stability enables repeated cycling from atmosphere to high vacuum
- A good choice for general-purpose vacuum systems and batch coaters

SPECIFICATIONS

Vapor Pressure @ 25° C — 8.8×10^{-7}

Pour Point (°C) — -14

Flash Point (°C) — 238

Specific Gravity (g/cc) — 0.90

Viscosity (CST/SUS): —
@ 40° C (100° F), 70/363;
@ 100° C (212° F), 9/56

Color — Clear

Hazardous Decomposition — *See note

Incompatibility — Fire

Hazardous Ingredients — None

ISO Cleanliness Level — 14/12

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.



Description	Size	Part No.	Price
TKO-19 Ultra	1 quart	TKO19ULTQ1	Call
	1 gallon	TKO19ULTG1	Call
	5 gallons (pail)	TKO19ULTG5	Call
	55 gallons (drum)	TKO19ULTG55	Call

➤ **KJLC[®] Hydrocarbon Fluids— The Clear Choice!**

■ **TKO-77 Ultra**

Excellent lubrication characteristics and high viscosity makes this fluid ideal!

- High viscosity and excellent lubrication characteristics
- Ideal for non-corrosive gas applications in larger rotary vane pumps, especially single-stage units and small rotary piston pumps
- Use as a gear and seal lubricant in small rotary lobe pumps



SPECIFICATIONS

Vapor Pressure @ 25° C (Torr) — 3×10^{-8}
 Boiling Point @ 0.01 Torr (° C) — 138
 Pour Point (° C) — -15
 Flash Point (° C) — 267
 Fire Point (° C) — 290
 Specific Gravity (g/cc) — 0.91

Viscosity (CST/SUS): —
 @ 40° C/100° F, 114/536;
 @ 100° C/210° F, 12/68

Color — Clear
 Hazardous Decomposition — *See note
 Incompatibility — Flame
 Hazardous Ingredients — None

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.

■ **TKO-W/7 Ultra**

- Little double bond unsaturation makes it the most corrosive-resistant natural hydrocarbon fluid
- Superior in direct- and belt-driven rotary vane pumps attached to a vacuum system producing moderately corrosive or reactive gases, as found in the milder semiconductor processes

SPECIFICATIONS

Vapor Pressure @ 25° C (Torr) — 8×10^{-7}
 Pour Point (° C) — -15
 Flash Point (° C) — 265
 Fire Point (° C) — 290
 Specific Gravity (g/cc) — 0.91
 Viscosity (CST/SUS): —
 @ 40° C/100° F, 65/355;
 @ 100° C/210° F, 8.9/54

Color — Clear
 Hazardous Decomposition — *See note
 Incompatibility — Fire
 Hazardous Ingredients — None
 ISO Cleanliness Level — 14/12



NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.

Description	Size	Part No.	Price
TKO-W/7 Ultra	1 gallon	TKOW/7ULTG1	Call
	5 gallons (pail)	TKOW/7ULTG5	Call
	55 gallons (drum)	TKOW/7ULTG55	Call

➤ **KJLC® Hydrocarbon Fluids— The Clear Choice!**



SPECIFICATIONS

	Permavis Fluid 8	Permavis Fluid 10
Vapor Pressure @ 25° C (Torr)	3×10^{-7}	3×10^{-7}
Pour Point (° C)	-57	-53
Flash Point (° C)	257	264
Fire Point (° C)	290	300
Auto-Ignition Temp. (° C)	369	369
Specific Gravity (g/cc)	0.832	0.836
Viscosity (CST/SUS)	@ 40° C/100° F, 7.8/52, 46/230	@ 100° C/210° F, 9.6/60, 63/320
Color	Clear	Clear
Hazardous Decomposition	*See note	*See note
Incompatibility	Flame	Flame
Hazardous Ingredients	None	None

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.

■ **Permavis™ 8 and 10**

Exclusive KJLC product is a fully synthetic hydrocarbon oil made by polymerizing ethylene.

- Extremely low carbon-carbon double bond unsaturation makes it the most stable hydrocarbon fluid possible
- Ideal for more chemically active applications: ion implantation, freeze drying (10), LPCVD, analytical instrumentation, electron microscopy, normal and reactive sputtering, plasma etching, and vacuum conditions required for metal smelting and casting (10)
- Permavis 8 works best when used in 2-stage direct- and belt-driven rotary vane pumps intended to reach into the 10^{-3} Torr pressure range
- Permavis 10 has a higher viscosity at operating temperature for use in large 1-stage rotary vane and small rotary piston pumps

Description	Size	Part No.	Price
Permavis 8	1 quart	PV8BL	Call
	1 gallon	PV8CA	Call
	5 gallons (pail)	PV8CP	Call
	55 gallons (drum)	PV8DD	Call
Permavis 10	1 quart	PV10BL	Call
	1 gallon	PV10CA	Call
	5 gallons (pail)	PV10CP	Call
	55 gallons (drum)	PV10DD	Call



SPECIFICATIONS

Vapor Pressure @ 25° C (Torr) — 8.8×10^{-7}	Color — Clear
Pour Point (°C) — -15	Hazardous Decomposition — *See note
Flash Point (°C) — 249	Incompatibility — Flame
Specific Gravity (g/cc) — 0.90	Hazardous Ingredients — None
Viscosity (CST/SUS): —	
@ 40° C/100° F, 70/330;	
@ 100° C/210° F, 8.5/60	

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.

■ **Diffoil-20 Ultra**

- Use in 2-stage rotary vane pumps
- Good LN₂ trapping into the chamber
- Provides low ultimate pressures
- Suits the very clean systems required in optical coating, food packaging, tube evacuation, sputter and e-beam coating, and analytical instrumentation

Description	Size	Part No.	Price
Diffoil-20 Ultra	1 quart	DIF20ULTQ1	Call
	1 gallon	DIF20ULTG1	Call
	5 gallons (pail)	DIF20ULTG5	Call
	55 gallons (drum)	DIF20ULTG55	Call

➤ KJLC[®] Hydrocarbon Fluids— The Clear Choice!

■ TKO-500 Ultra

This hydrotreated vacuum pump fluid has a moderate- viscosity oil.

- Used in medium-size single- and 2-stage rotary pumps and medium-size 2-stage rotary piston pumps
- Applications include large vacuum furnaces, vacuum freeze drying units, vacuum induction melting, and meat packing



SPECIFICATIONS

Vapor Pressure @ 25°C & 100° C (Torr) — 3 x 10 ⁻⁸ ; 4 x 10 ⁻³	Color — Clear
Boiling Point (° C) — 168	Hazardous Decomposition — *See note
Pour Point (° C) — -15	Incompatibility — Flame
Flash Point (° C) — 267	Hazardous Ingredients — None
Specific Gravity (g/cc) — 0.91	Equivalent to V-Lube — B
Viscosity (CST/SUS): — @ 40° C/100° F, 114/536; @ 100° C/210° F, 12/68	

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.

NOTE: We do not recommend TKO-500 Ultra for corrosive conditions. We recommend the user choose the fluid with a viscosity that most closely matches that required by the pump's manufacturer.

Description	Size	Part No.	Price
TKO-500 Ultra	1 gallon	TKO500ULTG1	Call
	5 gallons (pail)	TKO500ULTG5	Call
	55 gallons (drum)	TKO500ULTG55	Call

■ TKO-750 Ultra

- Used in larger-size single rotary pumps and medium-size single-stage rotary piston pumps
- Applications include large vacuum furnaces, vacuum distillation of petroleum feedstocks, and medium space-simulation chambers



SPECIFICATIONS

Vapor Pressure @ 25°C (Torr) — 7.0 x 10 ⁻⁷	Color — Clear
Boiling Point (°C) — 157	Hazardous Decomposition — *See note
Pour Point (°C) — -15	Incompatibility — Flame
Flash Point (°C) — 250	Hazardous Ingredients — None
Specific Gravity (g/cc) — 0.89	Equivalent to V-Lube — F
Viscosity (CST/SUS): — @ 40° C/100° F, 120/546; @ 100° C/210° F, 13/70	

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.

Description	Size	Part No.	Price
TKO-750 Ultra	1 gallon	TKO750ULTG1	Call
	5 gallons (pail)	TKO750ULTG5	Call
	55 gallons (drum)	TKO750ULTG55	Call

➤ **KJLC® Hydrocarbon Fluids— The Clear Choice!**

■ **TKO-700**

- Applications include metallurgical vacuum furnaces, decorative coaters, and molecular distillation

SPECIFICATIONS

Vapor Pressure @ 25° C (Torr) — 1 x 10 ⁻⁴	Color — Clear Amber
Boiling Point @ 0.01 (Torr)(° C) — 138	Hazardous Decomposition — *See note
Pour Point (° C) — -21	Incompatibility — Flame
Flash Point (° C) — 227	Hazardous Ingredients — None
Fire Point — 290	Equivalent to V-Lube — A
Specific Gravity (g/cc) — 0.88	
Viscosity (CST/SUS): —	
@ 40° C/100° F, 79/410;	
@ 100° C/210° F, 9.5/58	

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.



Description	Size	Part No.	Price
TKO-700	1 gallon	TKO700G1	Call
	5 gallons (pail)	TKO700G5	Call
	55 gallons (drum)	TKO700G55	Call

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Fluids & Greases



■ **TKO-800**

- Used in larger single- and two-stage rotary piston pumps running at elevated temperatures
- Applications include large vacuum furnaces, vacuum heat treating systems, larger decorative coaters, and vacuum crystallization

NOTE: We recommend that the user choose the fluid with a viscosity that most closely matches that required by the pump's manufacturer.

SPECIFICATIONS

Vapor Pressure @ 25° C & 100° C (Torr) — 4 x 10 ⁻⁶ ; 6 x 10 ⁻⁵	Viscosity (CST/SUS): —
Boiling Point (° C) — 161	@ 40° C/100° F, 161/660;
Pour Point (° C) — -27	@ 100° C/210° F, 20/103.3
Flash Point (° C) — N/A	Color — Amber
Fire Point — 290° C	Hazardous Decomposition — *See note
Specific Gravity (g/cc) — 0.880	Incompatibility — Flame
	Hazardous Ingredients — None
	Equivalent to V-Lube — G

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.

Description	Size	Part No.	Price
TKO-800	1 gallon	TKO800CA	Call
	5 gallons (pail)	TKO800CP	Call
	55 gallons (drum)	TKO800DD	Call

➤ **KJLC[®] Hydrocarbon Fluids— The Clear Choice!**

6

Fluids & Greases



SPECIFICATIONS

Vapor Pressure @ 25° C & 100° C (Torr) — 4×10^{-6} ; 6×10^{-3}	Color — Amber
Boiling Point (° C) — 158	Hazardous Decomposition — No
Pour Point (° C) — -12	Incompatibility — Flame
Flash Point (° C) — 227	Hazardous Ingredients — None
Specific Gravity (g/cc) — 0.89	Equivalent to V-Lube — H
Viscosity (CST/SUS): —	
@ 40° C/100° F, 220/1167;	
@ 100° C/210° F, 18.1/93	

■ **TKO-1170**

- Works in large single-stage rotary piston and single-stage rotary-vane pumps (roughing pumps for large gas loads)
- Applications include large space-simulation chambers, larger decorative coaters, and vacuum degassing

NOTE: We recommend the user choose the fluid with a viscosity that most closely matches that required by the pump's manufacturer.

Description	Size	Part No.	Price
TKO-1170	1 gallon	TKO1170CA	Call
	5 gallons (pail)	TKO1170CP	Call
	55 gallons (drum)	TKO1170DD	Call

■ **TKO-FF Flushing Fluid**

A “light-end” distillation cut used to improve mechanical vacuum pump cleaning.

Like a car, a vacuum pump's fluid is changed at regular intervals to remove contaminant's that have collected in the fluid and to restore lubricity. Typically, the pump is just drained and refilled with fresh oil; however, filling the pump with **TKO-FF Flushing Fluid** (after draining) then running the pump for 10 minutes before filling with the correct oil (after draining the TKO-FF) substantially improves the pump's lifetime.

SPECIFICATIONS

Vapor Pressure @ 25° C (Torr) — 1×10^{-5}	Viscosity (CST/SUS): —
Boiling Point (° C) — 112	@ 40° C/100° F, 28/150;
Pour Point (° C) — -15	@ 100° C/210° F, 4.5/41
Flash Point (° C) — 218	Color — Clear Amber
Fire Point (° C) — 244	Hazardous Decomposition — *See note
Specific Gravity (g/cc) — 0.860	Incompatibility — Flame
	Hazardous Ingredients — None

NOTE: Decomposition: Normal combustion forms carbon dioxide; incomplete combustion may produce carbon monoxide.



WARNING: Use TKO-FF only in pumps made for hydrocarbon fluids.

Description	Size	Part No.	Price
TKO-FF	1 gallon	TKOFFG1	Call
	5 gallons (pail)	TKOFFG5	Call
	55 gallons (drum)	TKOFFG55	Call

➤ Inert PFPE Fluids

■ Solvay Solexis Fomblin®

A perfluorinated polyether (PFPE) fluid that remains totally inert in vacuum pump operations.

- Doesn't react with most corrosive vapors or act as a fuel when pumping oxygen or oxidizing agents
- Withstands high temperatures and oxygen conditions (photo-resist stripping), processes forming Lewis acids (aluminum etching), products from sulfur hexafluoride etching, most acids, bases, and oxidizing agents
- Thermally highly stable. Thermal decomposition will only occur at temperatures over 290°C (554°F)
- Applications include extreme operating conditions, pumping oxygen or other oxidants, photo-resist stripping, LPCVD, plasma etching, and reactive ion etching
- Choose Fomblin® by viscosity—use the fluid closest to the pump manufacturer's recommendation for normal fluids
- Recommended for direct and belt-driven rotary vane pumps used in extreme operating conditions found in semiconductor processing

SPECIFICATIONS

	Fomblin 06/6	Fomblin 14/6	Fomblin 16/6	Fomblin 25/6
Vapor Pressure @ 25° C (Torr)	8×10^{-7}	2×10^{-7}	2×10^{-6}	6×10^{-8}
Pour Point (° C)	-50	-45	-45	-35
Flash Point (° C)	None	None	None	None
Fire Point (° C)	None	None	None	None
Specific Gravity (g/cc)	1.88	1.89	1.89	1.9
Viscosity @ 20° C @100° C/210° F (cSt/SUS)	64	148	168	276
Color	Clear	Clear	Clear	Clear
Hazardous Decomposition	HF/COF ₂	HF/COF ₃	HF/COF ₄	HF/COF ₅
Incompatibility	Flame	Flame	Flame	Flame
Hazardous Ingredients	None	None	None	None



NOTE: KJLC is the exclusive North American distributor for Solvay Solexis.



Description	Size	Part No.	Price
North American Packages			
Fomblin 06/6	1 kg (.56 qt.)	MFY06/6BB	Call
	8 kg (4.48 qt.)	MFY06/6CA	Call
	50 kg (28 qt.)	MFY06/6DA	Call
Fomblin 14/6	1 kg (0.56 qt.)	MFY14/6BB	Call
	8 kg (4.48 qt.)	MFY14/6CA	Call
	50 kg (28 qt.)	MFY14/6DA	Call
Fomblin 16/6	1 kg (0.56 qt.)	MFY16/6BB	Call
	8 kg (4.48 qt.)	MFY16/6CA	Call
	50 kg (28 qt.)	MFY16/6DA	Call
Fomblin 25/6	1 kg (0.56 qt.)	MFY25/6BB	Call
	8 kg (4.48 qt.)	MFY25/6CA	Call
	50 kg (28 qt.)	MFY25/6DA	Call
European Packages			
Fomblin YVAC L 06/6	1 kg	MFY06/6-1KG	Call
	5 kg	MFY06/6-5KG	Call
	15 kg	MFY06/6-15KG	Call
	50 kg	MFY06/6-50KG	Call
Fomblin YVAC L 14/6	1 kg	MFY14/6-1KG	Call
	5 kg	MFY14/6-5KG	Call
	15 kg	MFY14/6-15KG	Call
	50 kg	MFY14/6-50KG	Call
Fomblin YVAC L 16/6	1 kg	MFY16/6-1KG	Call
	5 kg	MFY16/6-5KG	Call
	15 kg	MFY16/6-15KG	Call
	50 kg	MFY16/6-50KG	Call
Fomblin YVAC L 25/6	1 kg	MFY25/6-1KG	Call
	5 kg	MFY25/6-5KG	Call
	15 kg	MFY25/6-15KG	Call
	50 kg	MFY25/6-50KG	Call

* Rust Preventative Additive Available

** Larger package sizes are available. Please contact us.

■ Solvay Solexis Fomblin SV

Extremely low backstreaming rate with similar molecular structure to Fomblin.

- Backstreaming rate 13 times lower compared to Fomblin 25/6 (viscosity 276 CST)
- Backstreaming rate 150 times lower compared to a competitive PFPE fluid (viscosity 200 CST)
- Suitable for all rotary vane and some rotary piston pumps in oxygen or corrosive service applications that demand lower backstreaming

SPECIFICATIONS

Vapor Pressure @ 20° C & 100° (Torr) — 5×10^{-9} ; 2×10^{-5}	Specific Heat @ 38° C (cal/g) — 0.24
Ultimate Vacuum — 1×10^{-3}	Surface Tension @20° C (dyne/cm) — 22
Pour Point (° C) — -38	Viscosity (CST/SUS) — @20° C (CST), 200
Specific Gravity @ 20° C (g/cc) — 1.90	Evaporation Wt. Loss @ 149° C — 0.5%
	Color — Clear

Description	Size	Part No.	Price
Fomblin SV	1 kg (0.56 qt.)	MFYSVBB	Call
	8 kg (4.48 qt.)	MFYSVCA	Call

➤ Silicone Fluids

■ Dow Corning® DC 702 Silicone Fluid

Mixture of phenylmethyl and dimethyl cyclosiloxane making it resistant to oxidation/hydrolysis.

- Relatively low cost
- Ideal for high-speed diffusion pumps (10^{-5} Torr range) and large vapor booster pumps (10^{-4} Torr range) used in high gas-load production processes
- Applicable for heat-treat furnaces, aluminizing TV tubes, and vacuum metallurgy



NOTE: Do not use silicone fluids in mechanical pumps.

SPECIFICATIONS

	Dow Corning 702®	Dow Corning 704®	Dow Corning 705®
Vapor Pressure @ 25° C (Torr)	1×10^{-6}	2×10^{-8}	3×10^{-10}
Boiling Point @ 0.5 Torr (° C)	180	215	245
Pour Point (° C)	N/A	N/A	N/A
Flash Point (° C)	193	221	243
Fire Point (° C)	N/A	N/A	N/A
Specific Gravity (g/cc)	1.07	1.07	1.09
Viscosity @ 25° C (cST)	45	39	175
Color	Clear	Clear	Clear
Incompatibility	Flame	Flame	Flame
Hazardous Ingredients	None	None	None

■ Dow Corning DC 704 Silicone Fluid

Tetramethyl tetraphenyl trisiloxane—an ideal fluid for aggressive applications.

- Used in medium and large pumping speed diffusion pumps in a wide variety of research and production applications, as lower attainable pressure justifies the additional expense of this excellent fluid
- High resistance to oxidation and hydrolysis at operating temperature
- Ideal fluid for aggressive applications requiring ultimate pressures (without trapping) in the 10^{-7} Torr range
- With first class LN_2 traps, chamber pressures can approach 10^{-11} Torr range
- Applications include vacuum metal casting, diffusion bonding, and instruments (electron microscopes, TOF mass spectrometers, etc.)

■ Dow Corning DC 705 Silicone Fluid

Pentaphenyl trimethyl trisiloxane makes this top-of-the-line fluid an excellent choice!

- Its low vapor pressure and low backstreaming rate make LN_2 traps unnecessary for pressures in the 10^{-8} Torr range
- With first class LN_2 traps, the ultimate pressure can reach 10^{-11} Torr
- The high stability and high spontaneous ignition temperatures of this top-of-the-line diffusion pump fluid make it ideal for use in space-simulation chambers
- Applications include thin film coating systems, inexpensive surface science systems, and plasma physics research

Description	Size	Weight	Part No.	Price
DC 702	500 cc	2.5 lbs.	DC702BB	Call
	1 gallon	8.3 lbs.	DC702CA	Call
	5 gallons	42.5 lbs.	DC702CP	Call
	52 gallons	430 lbs.	DC702DD	Call
DC 704	500 cc	2.5 lbs.	DC704BB	Call
	1 gallon	8.3 lbs.	DC704CA	Call
	6.5 gallons	55 lbs.	DC704CP	Call
	52 gallons	430 lbs.	DC704DD	Call
DC 705	500 cc	3 lbs.	DC705BB	Call
	1 gallon	8.3 lbs.	DC705CA	Call
	5.3 gallons	44 lbs.	DC705CP	Call
	52 gallons	430 lbs.	DC705DD	Call

➤ Silicone Fluids



NOTE: Do not use silicone fluids in mechanical pumps.

SPECIFICATIONS

KJLC® 704	
Ultimate Vacuum (Torr)	
Untrapped	10^{-7} to 10^{-8}
Trapped	to 10^{-11}
Extrapolated Vapor Pressure (Torr) @ 25° C	8.4×10^{-8}
Specific Gravity @ 25° C	1.10
Viscosity @ 25° C	46
Flash Point, Open Cup	220
Boiling Point @ 0.06 Torr	223
Typical Boiler Temp.	230
Surface Tension (dynes/cm)	37.3
Heat of Vaporization (kcal/g mole)	22.0/200° C
Molecular Description	Tetramethyl Tetraphenyl Trisiloxane
Molecular Weight	484

SPECIFICATIONS

KJLC 705	
Ultimate Vacuum (Torr)	
Untrapped	10^{-9} to 10^{-10}
Trapped	to 10^{-11}
Extrapolated Vapor Pressure (Torr) @ 25° C	3×10^{-10}
Specific Gravity @ 25° C	1.09
Viscosity @ 25° C	165–185
Flash Point, Open Cup	243
Boiling Point @ 0.06 Torr	245
Typical Boiler Temp.	248 to 265
Surface Tension (dynes/cm)	36.5
Heat of Vaporization (kcal/g mole)	28.2/250° C
Molecular Description	Pentaphenyl Trimethyl Trisiloxane
Molecular Weight	546

■ KJLC® 704 Silicone Fluid

Tetramethyl tetraphenyl trisiloxane

- Use in identical applications requiring Dow Corning DC 704®
- Useful in medium and large pumping speed diffusion pumps in a wide variety of research and production applications
- High resistance to oxidation and hydrolysis at operating temperature
- Ideal fluid for aggressive applications requiring ultimate pressures (without trapping) in the 10^{-7} Torr range
- With first class LN₂ traps, chamber pressures can approach 10^{-11} Torr range
- Applications include vacuum metal casting, diffusion bonding, and instruments (electron microscopes, TOF mass spectrometers, etc.)

Description	Size	Weight	Part No.	Price
KJLC® 704	500 cc	2.4 lbs.	704BB	Call
	1 gallon	8.5 lbs.	704CA	Call
	5 gallons	42.5 lbs.	704CP	Call

■ KJLC 705 Silicone Fluid

Pentaphenyl trimethyl trisiloxane

- Use in identical applications to Dow Corning DC 705® fluid
- Low vapor pressure and low backstreaming rate make LN₂ traps unnecessary for pressures in the 10^{-8} Torr range
- With first class LN₂ traps, the ultimate pressure can reach 10^{-11} Torr
- The high stability and high spontaneous ignition temperatures of this top-of-the-line diffusion pump fluid make it ideal for use in space-simulation chambers
- Applications include thin film coating systems, inexpensive surface science systems, and plasma physics research

Description	Size	Weight	Part No.	Price
KJLC® 705	500 cc	2.4 lbs.	705BB	Call
	1 gallon	8.5 lbs.	705CA	Call
	5 gallons	42.5 lbs.	705CP	Call

➤ PFPE Fluids

■ Solvay Solexis Fomblin[®] 18/8

An inert and stable perfluoro polyether.

- Remains stable under the most severe operating conditions such as pumping Lewis acids, halogen acids, halogens, uranium hexafluoride, and the strongest hydrous acids
- Nonflammable under all conditions
- Ideal for pumping oxygen, ozone, or spontaneously combustible chemicals such as silane or phosphine
- Does not polymerize under ionizing radiation or when hot fluid is exposed to atmosphere

NOTE: Select Fomblin diffusion pump fluids by vapor pressure: Choose Fomblin 18/8 for ultimate pressures of 10^{-8} Torr and Fomblin 25/9 for 10^{-9} Torr range (without LN₂ trapping).

SPECIFICATIONS

Vapor Pressure (Torr) — @ 20° C, 2×10^{-8} ; @ 100° C, 2×10^{-4}	Specific Gravity (g/cc) — 1.89 Kinematic Viscosity (cSt) — @ 20° C, 190
Pour Point (° C) — -42	Color — Clear
Flash Point (° C) — None	Hazardous Decomposition — F ₂ /COF ₂
Fire Point (° C) — None	Incompatibility — Flame
	Hazardous Ingredients — None



Description	Size	Part No.	Price
North American Packages			
FOMBLIN 18/8	1 kg	MFY18/8BB	Call
	8 kg	MFY18/8CA	Call
	50 kg	MFY18/8DA	Call
European Packages			
Fomblin YVAC H 18/8	1 Kg	MFY18/8-1KG	Call
	5 Kg	MFY18/8-5KG	Call
	15Kg	MFY18/8-15KG	Call
	50Kg	MFY18/8-50KG	Call

* Larger package sizes are available. Please contact us.

■ Solvay Solexis Fomblin 25/9

A nonflammable perfluoro polyether.

- Remains stable under the most severe operating conditions such as pumping Lewis acids, halogen acids, halogens, uranium hexafluoride, and the strongest hydrous acids
- Nonflammable under all conditions
- Ideal for pumping oxygen, ozone, or spontaneously combustible chemicals such as silane or phosphine
- Does not polymerize under ionizing radiation or when hot fluid is exposed to atmosphere

NOTE: Select Fomblin diffusion pump fluids by vapor pressure: choose Fomblin 18/8 for ultimate pressures of 10^{-8} Torr and Fomblin 25/9 for 10^{-9} Torr range (without LN₂ trapping).

SPECIFICATIONS

Vapor Pressure (Torr) — @ 20° C, 2×10^{-9} ; @ 100° C, 2×10^{-5}	Specific Gravity (g/cc) — 1.9 Kinematic Viscosity (cSt) — @ 20° C, 285
Pour Point (° C) — -35	Color — Clear
Flash Point (° C) — None	Hazardous Decomposition — F ₂ /COF ₂
Fire Point (° C) — None	Incompatibility — Flame
	Hazardous Ingredients — None



Description	Size	Part No.	Price
North American Packages			
FOMBLIN 25/9	1 kg	MFY25/9BB	Call
	8 kg	MFY25/9CA	Call
European Packages			
Fomblin YVAC H 25/9	1 Kg	MFY25/9-1KG	Call
	5 Kg	MFY25/9-5KG	Call
	15 Kg	MFY25/9-15KG	Call
	50 Kg	MFY25/9-50KG	Call

* Larger package sizes are available. Please contact us.

➤ Polyphenyl Ether Fluids & Ester Fluids



SPECIFICATIONS

Vapor Pressure @ 25° C (Torr) — 4×10^{-10}	Color — Clear
Boiling Point @ 0.5 Torr (° C) — 275	Hazardous Decomposition — None
Pour Point (° C) — 4	Incompatibility — Flame
Flash Point (° C) — 288	Hazardous Ingredients — None
Fire Point (° C) — 349	
Specific Gravity (g/cc) — 1.198	
Viscosity (cSt/SUS) —	
@ 38° C (100° F), 363/1860;	
@ 99° C (210° F), 13.1/72;	
@ 260° C (500° F), 1.2	

NOTE: We strongly recommended Santovac 5P Ultra for bench-top GC-MS and instrumentation applications.

■ Santovac® 5

A (5-ring) polyphenyl ether with an extremely low vapor pressure

- Well-designed vacuum systems can approach UHV pressure without LN₂ traps when using this fluid
- For pressures in high vacuum ranges, cooled baffles are not needed
- Exceptional oxidation stability with little tendency to increase in viscosity

■ Santovac 5P Ultra

The original Santovac 5 further distilled to reduce light end 3- and 4-ring fractions (GC tests show 3-ring content below 0.02% and 4-ring below 0.1%)

- Santovac 5 and 5P are arguably the best diffusion pump fluids available, combining high molecular weight, low reactivity, and exceptional vapor pressure

Description	Size	Part No.	Price
Santovac 5	500 cc	MS5BB	Call
	1,000 cc	MS5BL	Call
	1 gallon	MS5CA	Call
	5 gallons	MS5CP	Call
Santovac 5P Ultra	500 cc	MS5PBB	Call

Fomblin® & Galden

THE Source of Solvay Solexis Vacuum Fluids and Greases in North America and Europe.

➤ Hydrocarbon Greases

■ Apiezon[®] H

A stable, inert, nontoxic hydrocarbon grease.

- Ideal for lubricating glass stopcocks and for general purposes requiring a higher temperature vacuum grease
- Easy to apply and remove
- Rubbery nature
- Low vapor pressure at operating temperature
- Compatible with high temperatures—does not melt when used in the temperature range from -15° C–250° C
- Thermal conductivity
- Good “stiction”
- Low to medium vacuum range



SPECIFICATIONS

Vapor Pressure @ 20° C (Torr) — 1.7×10^{-9}	Thermal Conductivity (w/m ° C) — 0.216
Melting Point (° C) — Does not melt	Lubricity 4 Ball Test* (kg) — 250
Specific Heat @ 25° C (J/g) — 1.7	Outgassing (ASTM .E595-90) — TML: <1%; CVCN: <0.1%
Temperature Range (° C) — -10 to 240; Stiff: -15 to 10; Optimum: 10 to 110; Stiff but Usable: 110 to 240	Relative Density @ 20° C — 0.918
	*ASTM .D 2763 (IP 239)

Description	Size	Part No.	Price
Apiezon H	25 g	APHB	Call

■ Apiezon L

A low vapor pressure hydrocarbon grease without additives.

- An ideal general-purpose vacuum grease and ground-glass joint sealant
- Low melting point limits its use to joints not heated above 30° C
- Widely used as a stationary phase in GLC
- Very high vacuum range
- Ambient and cryogenic temperatures
- Radiation resistant
- Added cushioning
- Excellent lubricity



SPECIFICATIONS

Vapor Pressure @ 20° C (Torr) — 7×10^{-11}	Relative Density @ 20° C — 0.896
Melting Point (° C) — 47	Coeff. of Expansion per ° C over 20° C–30° C — 0.00076
Average Molecular Weight — 1300	Thermal Conductivity @ 20° C (w/m ° C) — 0.202
Specific Gravity (g/cc) — 0.896	Latent Heat of Fusion (cal/g) — 15.1
Temperature Range (° C) — Stiff: 10 to 15; Optimum: 15 to 25; Soft: 25 to 30	Volume Resistivity (W cm) — 1.2×10^{16}
Viscosity of Molten Grease — @ 50° C (cP), 766; @ 100° C (cP), 62.3	Permittivity — 2.3
Lubricity 4 Ball Test* (kg) — 150	Surface Breakdown at Flash Over (kV) — 24
Outgassing Characteristics** — TML, <1%; CVCN, <0.1%	Electric Strength (V/0.001) — 730
Radiation Resistance — Yes	*ASTM .D 2763 (IP 239)
	**ASTM .E 595-90

Description	Size	Part No.	Price
Apiezon L	25 g	APLB	Call

■ Apiezon M

Lowest-cost Apiezon grease makes an excellent lubricant.

- Similar to Apiezon L with low melting point but contains more wax
- Higher vapor pressure limits it to general laboratory applications
- Use as a lubricant and sealant for moderate vacuum devices such as glass vacuum desiccators and o-rings on rough pump lines
- Very high vacuum range
- Ambient temperatures
- Cryogenic uses
- Radiation resistance
- Added cushioning
- Excellent lubricity



SPECIFICATIONS

Vapor Pressure @ 20° C (Torr) — 1.7×10^{-9}	Coeff. of Expansion per ° C over 20° C–30° C — 0.00075
Melting Point (° C) — 44	Thermal Conductivity @ 20° C (w/m ° C) — 0.192
Average Molecular Weight — 950	Latent Heat of Fusion (cal/g) — 18.7
Specific Gravity (g/cc) — 0.896	Volume Resistivity (W cm) — 1.2×10^{16}
Specific Heat @ 25° C (J/g) — 1.7	Permittivity — 2.1
Temperature Range (° C) — 10–30	Surface Breakdown at Flash Over (kV) — 28
Viscosity of Molten Grease — @ 50° C (cP), 413; @ 100° C (cP), 29.8	Electric Strength (V/0.001) — 850
Lubricity 4 Ball Test* (kg) — 140	*ASTM .D 2763 (IP 239)
Radiation Resistance — Yes	
Relative Density @ 20° C — 0.894	

Description	Size	Part No.	Price
Apiezon M	25 g	APMB	Call
	100 g	APMF	Call

➤ Hydrocarbon Greases



SPECIFICATIONS

Vapor Pressure @20° C (Torr) — 5×10^{-9}	Temperature Range (° C) —
Melting Point (° C) — 125	Stiff: 10 to 15
Average Molecular Weight — N/A	Optimum: 15 to 50
Specific Gravity (g/cc) — 0.912	Soft: 50 to 125
	Kinetic Viscosity — N/A

■ Apiezon® T

Rubbery consistency is formulated specifically for glass taps, stopcocks, and valves in vacuum systems.

- Use as a general-purpose lubricant
- Relatively high melting point makes it useful within the temperature range 0°–120° C

Description	Size	Part No.	Price
Apiezon T	25 g	APTb	Call



SPECIFICATIONS

Vapor Pressure @20° C (Torr) — 7×10^{-11}	Outgassing —
Melting Point* (° C) — 47	TML — <1%
Specific Gravity (g/cc) — 1.042	CVCM — <0.1%
Temperature Range (° C) — 10–30	Lubricity 4 Ball Test (kg)** — 450
	*ASTM.D 566
	**ASTM .E 595-90

■ Apiezon AP-100

High vacuum grease blended from a very low vapor pressure petroleum and polytetrafluoroethylene (PTFE) lubricant.

- Specifically blended to prevent ground glass joints in laboratory glassware from seizing
- Insoluble in virtually all solvents
- Ultra-high (UHV) vacuum range
- Anti-seize properties
- High load lubricant
- Ambient temperatures
- Silicone free

Description	Size	Part No.	Price
Apiezon AP-100	50 g	AP100D	Call



SPECIFICATIONS

Vapor Pressure @20° C (Torr) — $<10^{-5}$	Coeff. of Expansion per ° C* — 0.00066
Melting Point (° C) — >200	Lubricity 4 Ball Test** (kg) — 450
Specific Gravity (g/cc) — 0.981	
Temperature Range (° C) —	*Over 20° C–30° C
Stiff: -40 to -10	**ASTM .D 2763 (IP 239)
Optimum: -10 to 150	
Soft : 150 to 180	

■ Apiezon AP-101

The only grease in the Apiezon® range not manufactured by molecular distillation.

- Based on a heavy-duty lubricating grease gelled with lithium stearate and polytetrafluoroethylene
- Moderately high vapor pressure
- Wide temperature range: -40° C–180° C
- Prevents ground glass joints from seizing
- Anti-seize properties
- Critical lubricant
- Non-silicone based
- Solvent/chemical resistance

Description	Size	Part No.	Price
Apiezon AP101	50 g	AP101D	Call

➤ Silicone & PFPE Greases



SPECIFICATIONS

Specific Gravity @ 25° C — 1.0 g/cc	Melting Point — None
Bleed after 24 Hours @ 199° C — 0.5% max.	Color — Light Gray
Evaporation after 24 Hours @ 199° C — 2.0% max.	Vapor Pressure (Degassed) — @ 150° C, 1.2×10^{-5} Torr
Solidification Point — -40° C	@ 200° C, 7×10^{-4} Torr

■ Dow Corning[®] DC 976

Low volatility over a wide temperature range.

Rough-vacuum grease uses:

- Lubricates synthetic and silicone rubber gaskets for high-temperatures

Non-vacuum uses:

- Unaffected by vegetable oils, mineral oils, and common gases, and resists most aqueous solutions of inorganic salts
- Used in chemical plants to lubricate plug valves, flow meter bearings, ceramic plug cocks, water treatment equipment, and fire extinguisher valves

Description	Size	Part No.	Price
DC 976	5.3 oz.	DC976VF	Call
	8 lbs.	DC976VM	Call



SPECIFICATIONS

	Fomblin RT-15	Fomblin Y-Vac3
Base Fluid Viscosity @ 20° C (cSt)	1300	1500
Specific Gravity (g/cc)	1.91	1.92
Temperature Range (° C)	-20 to +250	-20 to +250



NOTE: KJLC is the exclusive North American distributor for Solvay Solexis.

■ Solvay Solexis Fomblin[®] RT-15

Based on Fomblin Y (PFPE) fluid with tetrafluoroethylene telomer.

- Resists oxidation and aggressive chemical reagents
- Compatible with glasses, metals, and elastomers
- Lubricates o-rings and glass or metal joints designed for vacuum
- In non-vacuum uses, Fomblin RT-15 seals joints in gas and liquid transport systems having hot and reactive flowing materials

■ Solvay Solexis Fomblin Y-Vac3

Based on low vapor pressure PFPE fluid (5×10^{-13} @ 20° C) thickened with a new grade of tetrafluoroethylene telomer.

- High vacuum seal and lubricant
- Outstanding chemical and thermo-oxidative stability

Description	Size	Part No.	Price
Fomblin RT-15	100 g	MFRT15F	Call
	1 kg	MFRT15L	Call
Fomblin Y-Vac3	100 g	MFY03F	Call



SPECIFICATIONS

Specific Gravity @ 24° C (g/cc) — 1.78	Viscosity Index (ASTM D2270) — 145
Viscosity (cSt) — @ 40° C, 500	Vapor Pressure (Degassed) — -1×10^{-9} Torr
Surface Tension @ 26° C (dyne/cm) — 19.3	

■ TorrLube[®]

High vacuum lubricant formulated for lubricating sliding and rotating seals at 10^{-8} Torr.

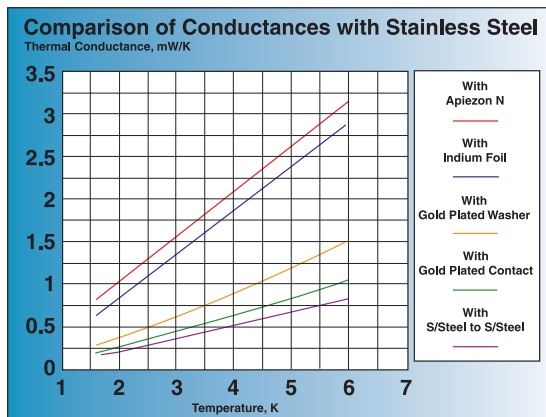
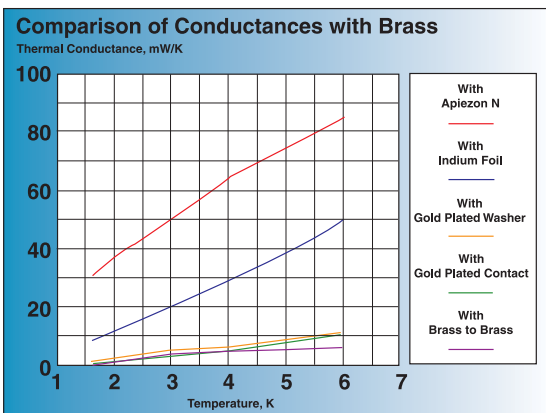
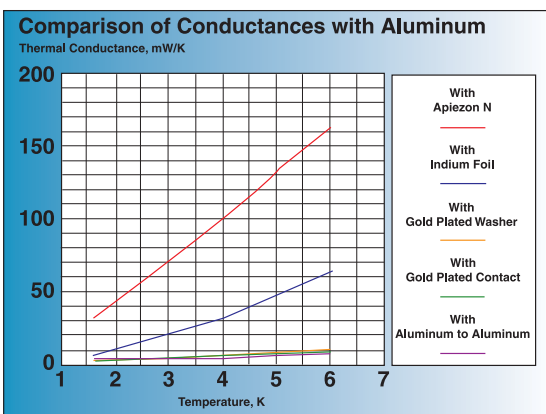
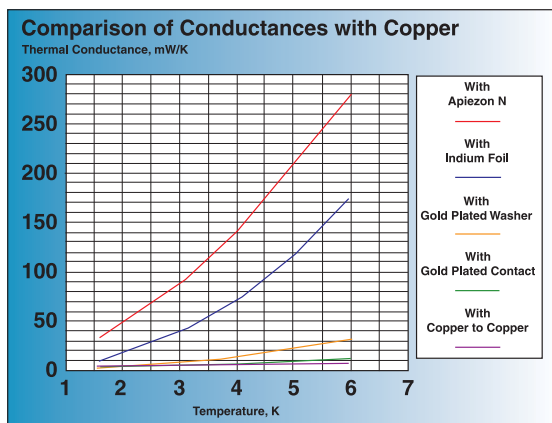
- No evidence of reaction with fluorine at 200° C, chlorine trifluoride at 50° C, molten NaOH, alcohol at RT, or boiling sulfuric acid
- Does not burn
- Lubricates fine mechanical devices as well as devices emitting high-pressure loadings in the atmosphere
- Conforms to the requirements of the semiconductor industry

Description	Size	Part No.	Price
TorrLube	1 cc	SF11711	Call
	2 x 60 cc	SF14514	Call

➤ Cryogenic Heat-Transfer Greases

6

Fluids & Greases



■ Apiezon® N: Cryogenic Thermal Contact Grease

With a high molecular weight polymeric additive, this rubbery consistency will form a cushion between the mating surfaces.



- Similar to Apiezon L, this contact grease contains a high molecular weight polymeric additive
- Popular in high vacuum applications and as a general laboratory lubricant (burette taps)
- Uses include Coupling of cooling systems to superconducting magnets, cryostats, temperature sensors, systems reaching cryogenic temperatures quickly, superconductor manufacturing applications (due to Apiezon N's low level of magnetic susceptibility), cryogenic equipment, and MRI magnets

Research by NASA has shown Apiezon N to have superior heat-transfer properties across metallic joints (held together by mechanical pressure) at liquid helium temperatures. Though indium foil has a long history and tradition in cryogenic sealing and heat-transfer applications, Apiezon N, which costs less than one twentieth of indium's cost, offers a sound alternative on technical and conservation grounds. Indium is not soft enough to fill micropores in surfaces, but Apiezon N covers evenly and fully at room temperature to give excellent thermal conductivity at cryogenic temperatures.

The charts, (*left*), taken from NASA's report, show the value of thermal conductance measured at various cryogenic temperatures. Both sides of the mating pair for each sample were made from the same material: OFHC copper, 6061-T6 aluminum, free-machining brass, or 304 stainless steel.

All contacting surfaces on the sample pairs were lapped to an 0.8-mm finish. Between the contacting surfaces, researchers placed either a thin layer of indium foil (99.9% purity and 0.005" thick), Apiezon-N grease, a gold-plated washer, gold-plated contact, or nothing. Then a mechanical arm pressed the surfaces together at 8 different forces ranging from 22 to 670N. Measurements of temperature, made with the lower contacts linked to a liquid helium bath held at 1.6K and 4.2K, yielded the results summarized in the various charts.

SPECIFICATIONS

Vapor Pressure @ 20° C (Torr) — 6×10^{-10}

Melting Point (° C) — 47

Temperature Range (° C) — -269 to 30

Lubricity 4 Ball Test* (kg) — 150

Outgassing Characteristics** — TML, <1%;
CVCML, <0.1%

Relative Density @ 20° C — 0.911

Coeff. of Expansion per ° C over 20° C–30° C —
0.00072

Thermal Conductivity —

@ 20° C (w/m° C), 0.194;

@ -269° C (w/m° C), 0.095

Latent Heat of Fusion (cal/g) — 15.0

Fusion Peak (° C) — 31

Volume Resistivity (W cm) — 2.0×10^{16}

Permittivity — 2.3

Loss Tangent — <0.0001

Surface Breakdown at Flash Over (kV) — 27

Electric Strength (V/0.001) — 820

*ASTM .D 2763 (IP 239)

**ASTM .E 595-90

Description	Size	Part No.	Price
Apiezon N	25 g	APNB	Call

➤ CFC Greases & Lubricating Oils

■ Halocarbon[®] Halovac[™] 25-5S

Perfect for aggressive reagents such as oxygen and red fuming nitric acid!

- Chlorofluorocarbon thickened with silica
- Excellent for o-ring seals or glass joints subjected to oxidizing and strong acidic processes that do not react with silica

SPECIFICATIONS

Technical Data	Test Method	Typical Results
Color	N/A	White
Penetration	ASTM D217-48	230 worked
Dropping Point (° F)	ASTM D566-42	350
Oil Separation: 30 Hours @ 212° F	FTMS 791-321.1	< 6.3%
Vapor Pressure, 77° F (mm Hg)	N/A	< 10 ⁻³
Oxidation (Norma-Hoffman) 300 Hours	ASTM D942-47	No drop in pressure
Mean Hertz Load (kg)	Shell E.P. Tester	100
Water Washout	FTMS 791-3252.2	< 2.7%
Service Temperature (° F)	N/A	0–350



NOTE: We do not recommend Halovac for use with caustic solutions, hydrofluoric acid, gaseous fluorine, or halogen fluorides. Before using 25-5S in any process known to react with silica, please test it thoroughly.

Description	Size	Part No.	Price
Halovac 25-5S PFPE Grease	1 oz.	HC255SB	Call
	1 lb.	HC255SK	Call

■ Apiezon[®] J

Apiezon J excels in its application on rotating gland seals.

- A heavy-lubricating, moderately viscous oil

SPECIFICATIONS

Specific Gravity @ 20° C (g/cc) — 0.94	Pour Point (° C) — -1
Vapor Pressure @ 20° C (Torr) — 10 ⁻⁹ to 10 ⁻¹⁰	Average Molecular Weight — 1355
Kinematic Viscosity @ 40° C (cSt) — 3330	Specific Heat @ 25° C (cal/g) — 0.46



Description	Size	Part No.	Price
Apiezon J	100 cc	APJAA	Call
	500 cc	APJBB	Call

■ Apiezon[®] K

Highly compatible where high viscosity and low vapor pressure occurs.

- Extremely viscous lubricating oil to be used on rotating gland seals

SPECIFICATIONS

Specific Gravity @ 20° C (g/cc) — 0.94	Pour Point (° C) — -1
Vapor Pressure @ 20° C (Torr) — 10 ⁻⁹ to 10 ⁻¹⁰	Average Molecular Weight — 1355
Kinematic Viscosity @ 40° C (cSt) — 5710	Specific Heat @ 25° C (cal/g) — 0.46



Description	Size	Part No.	Price
Apiezon K	500 cc	APKBB	Call

■ Anti-Seize Thread Lubricant

Specially formulated, copper-based lubricant for nuts and bolts external to the vacuum chamber.

- Ideal for UHV chambers where bakeout temperatures reach 450° C
- Protects parts against seizure and galling
- Meets or exceeds Mil Spec A907E



Description	Size	Part No.	Price
Anti-Seize Thread Lube	1 oz. Tube	VZTL	Call

► Apiezon Compounds and Waxes



6

Fluids & Greases

■ Apiezon® Compound Q

Low-cost, putty-like substance, works as a versatile sealant for medium vacuum work.

- Malleable—can be shaped into an “o-ring” to seal between two flat surfaces
- Use to seal joints and fill holes or gaps on the rotary pump side of both glass and metal vacuum systems

■ Apiezon Wax W

Highest melting point of the three Apiezon waxes.

- Particularly suitable for sealing joints that may become warm in operation

■ Apiezon Wax 40

Ideal sealant for soft glass systems incompatible with Wax W.

- Developed for applications where the sealing medium must flow into or around a joint in a system kept below wax-flow temperature

■ Apiezon Wax 100

Softer than Wax W.

- Works well where a rigid seal could increase the danger of the joint cracking under vibration

SPECIFICATIONS

Sealant	Compound Q	Wax W	Wax 40	Wax 100
Approximate Softening Point	45° C	85° C	45° C	55° C
Temperature for Applying Material	Ambient	130° C	90° C	110° C
Maximum Temperature for Use	30° C	75° C	35° C	45° C
Specific Gravity @ 20° C (g/cc)	—	1.055	1.017	1.567
Pack	1 kg	25 g & 1 kg	1 kg	1 kg
Est. Vapor Pressure @ 20° C	1 x 10 ⁻⁴ Torr	4 x 10 ⁻⁹ Torr	6 x 10 ⁻⁸ Torr	4.5 x 10 ⁻⁹ Torr

Description	Size	Part No.	Price
Apiezon Compound Q	1 kg Can	APQL	Call
Apiezon Wax W	500 g (25 x 20g) (Pkg. of Sticks)	APWK	Call
	1 kg Block	APWL	Call
Apiezon Wax 40	250 g Can	APW40H	Call
Apiezon Wax 100	250 g Can	APW100H	Call

Vacuum Epoxy Glue & Silver Epoxy Glue

KL-320K & KL-325K

Use both in pressure range atmospheres to 10⁻⁷ Torr when the exposed surface area is small.

Application:

When applied with extreme care and with high pumping speed, the KL-320K epoxy has been used as low as the 10⁻⁹ Torr range.



KL-320K

Use these epoxy adhesives for vacuum sealing or structural bonding in vacuum chambers.

- Milky-colored epoxy glue with high electrical resistivity and excellent resistance to solvents, lubricants, alcohol, mild acids, and alkalies

Application:

Used for structural joining inside the vacuum envelope where nuts/bolts are inappropriate. For example: Mounting a component to a thin chamber wall where drilling or tapping are not possible.

Instruction for Use:

Shipped in a package containing five separate plastic sachets. Open the package and remove one sachet. Slide the separator from the sachet's center to enable the components to mix. Knead the sachet for about 15 seconds, thoroughly mixing the contents to a uniform consistency. Slit open the package and apply the epoxy as required.

KL-325K

Silver-filled epoxy glue has high electrical and thermal conductivities.

Application:

Often used to bond conducting sputter targets to a backing plate or connect heat-sensitive components to heat sinks, bonding waveguide plumbing, connecting ground wires to vacuum mounted components, and as a metal solder replacement.

Instruction for Use:

Shipped in two separate containers—epoxy glue and hardener. Mix together equal quantities of Part A and Part B on a clean surface. When the mixture has a uniform consistency, apply as required.

SPECIFICATIONS

	Vacuum Epoxy	Silver Epoxy
Epoxy	KL-320K	KL-325K
Uncured Resin	Milky paste	Silver paste
Volume Resistivity		
@ 25° C	6 x 10 ¹³ ohm-cm	0.001ohm-cm
@ 100° C	1 x 10 ¹⁰ ohm-cm	N/A
Tensile Shear @ 25° C	N/A	1,200-2,500 psi
Shelf Life @ Room Temperature	4-5 mo	4-5 mo
Pot Life @ Room Temperature	30 mins	1-2 hrs
Cure Cycle (After Mixing)	18hr @ 25° C 4hr @ 65° C	18hr @ 25° C 2hr @ 60° C
Thermal Conductivity cal/sec/cm ² /° C/cm	N/A	25 x 10 ⁻⁴
Coeff. of Expansion cm/cm/° C	55 x 10 ⁻⁶	N/A
Working Temperature	-60° C to 130° C	-60° C to 175° C

Description	Size	Part No.	Price
Vacuum Epoxy	25 x 7.8g BIPAX®	KL-320K	Call
Silver Epoxy	Pkg parts A & B 25g ea.	KL-325K	Call

NOTE: Although warming any epoxy (between 50° C and 80° C) during curing shortens the curing time and increases the final bond strength, it leads to initially decreasing viscosity and may cause drips—leading to unintended seals and additional outgassing.

➤ Leak Sealants & PFPE Solvents



SPECIFICATIONS

Compatible with Ultimate Pressures
of (Torr) — 1×10^{-12}
Weight Loss @ 50° C for 175 hours
(gm/sq cm) — 5×10^{-6}
Temperature Extremes (° C) —
-200 to 450
Max. Leak Size (that can be sealed)
(T-L/sec) — 2×10^{-3}

Average Curing Times —
Room Temperature: 24 hours
230° C: 75–90 min.
250° C: 60–70 min.
400° C: 20–30 min.
Shelf Life —
Aerosol: 2 years
Bottled (unopened or opened
& resealed): 2 years

NOTE: A hazardous materials fee will be assessed in addition to shipping charges. Also, aerosol versions of KL-5 (KL-5-16A) cannot be shipped air.

■ KJLC® KL-5

Use this specially formulated silicone-based resin as a leak sealant for glass and metal (UHV) systems.

- Excellent electrical resistivity
- Withstands repeated cycling over a temperature range from cryogenic (-200° C) to high (450° C) temperatures
- Metal surfaces coated with KL-5 have reduced IR reflectivity, giving them higher emissivity values for better heat transfer
- Applications include sealing optical windows, sealing Brewster windows for lasers, repairing all types of gauge tubes, and repairing feedthrough electrodes

REMOVAL & CLEANING: Uncured sealant is removed by wiping with any hydrocarbon solvent. Cured sealant is removed using any acetate, ketone, or ester solvent.

Description	Size	Part No.	Price
KL-5	16 oz. Aerosol Can	KL-5-16A	Call
	0.5 and 8 oz. Pack	KL-5-K	Call
	3 oz. Bottle	KL-5-3B	Call
	1 Quart	KL-5-Q	Call



SPECIFICATIONS

Property — PFS-2
Ozone Depletion Potential — Zero
Boiling Point (° C) — 57
Flash Point — None
Density @ 25° C (g/cc) — 1.65
Surface Tension @ 25° C (dyne/cm) — 10
Kinematic Viscosity @ 25° C (cSt) — 0.45
Vapor Pressure @ 25° C (Torr) — 228

Heat of Vaporization @ BPT (cal/g) — 22
Solubility of Water (ppm by wt.) — 14
Electrical Properties — PFS-2
Dielectric Strength @ 25° C — 40kV
(2.54mm Gap)
Dielectric Constant @ 25° C — 1.98
Volume Resistivity @ 25° C — 1×10^{15}
OHM-cm

■ Golden Perfluorosolv® PFS-2

Low 340 molecular weight perfluoropolyether enhances performance in electronic and semiconductor cleaning applications!

- Applications include pump and compressor cleaning, degreasing, dewatering, vapor blanketing, flash point reduction, and trace residue elimination
- Compatible and miscible with perfluoropolyether fluid (PFPE) and perfluorocarbon fluids at all temperatures and with chlorotrifluoroethylene (CTFE) oils and greases above 45° C.
- Acts as a diluent in the application of more viscous PFPE fluids and greases
- Non-flammable and well-suited for cleaning operations where solvents are applied to hot components, heated prior to application, pressure sprayed onto components, used in forced air stream cleaning, and extended immersion baths are required
- Lower boiling point and for a faster evaporation rate than PFS-1

Description	Size	Part No.	Price
Perfluorosolv PFS-2	7kg (15.4 lbs)	MFYPFS2-7KG	Call
	15kg (33 lbs.)	MFYPFS2-15KG	Call

➤ Heat Transfer Fluids



6

Fluids & Greases

■ Galden[®] Heat Transfer Fluids

Ideal fluids for applications with component immersion, wafer etching, ion implantation, radar equipment, transformers, power supplies, UF₆ production, chillers, cooling towers, and freeze dryers.

- Fluids contain nine coolants with boiling points between 70° C and 270° C
- Perfluorinated, inert polyether have a high resistance to oxidation and thermal degradation
- Compatible with metals, ceramics, plastics, and elastomers
- Fluids have low viscosity, no hydrogen in the molecular structure, and low water absorption
- Excellent for use in direct immersion cooling and indirect cooling applications
- Nonflammable, nontoxic, and safe for the environment

SPECIFICATIONS

	HT55	HT70	HT90	HT110	HT135	HT170	HT200	HT230	HT270
Operating Range (°C)	-90 to 45	-80 to 60	-70 to 80	-60 to 100	-50 to 125	-30 to 160	-20 to 190	0-230	25-260
Boiling Point (°C)	55	70	90	110	135	170	200	230	270
Pour Point (°C)	-110	-115	-110	-110	-110	-97	-85	-77	-66
Density: (g/cm ³)	1.65	1.68	1.69	1.72	1.73	1.77	1.79	1.82	1.85
Kinematic Viscosity (cSt)	0.45	0.50	0.75	0.77	1.00	1.80	2.40	4.4	11.7
Vapor Pressure (Torr)	225	141	48	17	5.8	0.8	0.2	0.025	0.01
Specific Heat (cal/g°C)	0.232	0.23	0.232	0.23	0.23	0.23	0.23	0.232	0.232
Heat of Vap @bp (cal/g)	22	17	17	17	16	16	15	N/A	15
Thermal Conduct (W/cm°C)	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
Surface Tension (dynes/cm)	16	14	16	16	17	18	19	19	20
Dielectric Strength (kV) (2.54 mm gap)	40	40	40	40	40	40	40	40	40
Dielectric Constant (1 kHz)	1.86	1.88	1.9	1.92	1.92	1.94	1.94	1.94	1.94
Volume Resistivity (ohm-cm)	1E ⁻¹²	1 x 10 ⁻¹⁵	1.5E ⁻¹⁵	1 x 10 ⁻¹⁵	1 x 10 ⁻¹⁵	1 x 10 ⁻¹⁵	1 x 10 ⁻¹⁵	6E ⁻¹⁵	6E ⁻¹⁵
Solubility of Water (ppm by wt)	14	14	14	14	14	14	14	14	14
Solubility of Air (cm ³ gas/100 cm ³ liquid)	26	26	26	26	26	26	26	26	26
Average Molecular Weight	340	410	460	580	610	760	870	1020	1550

Measurements taken at 25°C.

Description	Size (lbs.)	Part No.	Price
North American Packages			
HT55	15.4	HT55-7KG	Call
	33.0	HT55-15KG	Call
HT70	15.4	HT70-7KG	Call
	33.0	HT70-15KG	Call
HT90	15.4	HT90-7KG	Call
	33.0	HT90-15KG	Call
HT110	15.4	HT110-7KG	Call
	33.0	HT110-15KG	Call
HT135	15.4	HT135-7KG	Call
	33.0	HT135-15KG	Call
HT170	15.4	HT170-7KG	Call
	33.0	HT170-15KG	Call
HT200	15.4	HT200-7KG	Call
	33.0	HT200-15KG	Call
HT230	15.4	HT230-7KG	Call
	33.0	HT230-15KG	Call
HT270	15.4	HT270-7KG	Call
	33.0	HT270-15KG	Call

* Larger package sizes are available. Please contact us.

Description	Size (kg)	Part No.	Price
European Packages			
HT55	5	HT55-5KG	Call
	15	HT55-15KG	Call
HT70	5	HT70-5KG	Call
	15	HT70-15KG	Call
HT90	5	HT90-5KG	Call
	15	HT90-15KG	Call
HT110	5	HT110-5KG	Call
	15	HT110-15KG	Call
HT135	5	HT135-5KG	Call
	15	HT135-15KG	Call
HT170	5	HT170-5KG	Call
	15	HT170-15KG	Call
HT200	5	HT200-5KG	Call
	15	HT200-15KG	Call
HT230	5	HT230-5KG	Call
	15	HT230-15KG	Call
HT270	5	HT270-5KG	Call
	15	HT270-15KG	Call

* Larger package sizes are available. Please contact us.

➤ Acidity Analysis Kit

■ Acidity Analysis Kit

Tests the pH of all classes of pumping fluid.

Benefits of conducting regularly scheduled acidity tests:

- Lowers pump-maintenance costs
- Informs operator of high acidity before the next routine oil change, preventing possible pump failure
- User can delay maintenance in situations where the fluid condition cannot be accurately estimated from usage

6

Fluids & Greases



Interpreting pH Reading

Color	Indication	Action
Blue-Green	Basic	Replace Fluid/Filter
Yellow-Green	Neutral	No Action Needed
Yellow	Mildly Acidic	Conditions Borderline
Orange or Red	Acidic	Replace Fluid/Filter

Description	Kits per Package	Part No.	Price
Acidity Analysis Kit	5	KJLAAC	Call

Did You Know?

We are a leading manufacturer of Thin Film Deposition Tools for Solar.

OPVs

CPVs

CIS/CIGS

Se Evap Source

Thin Film PV

Kurt J. Lesker
Company

**Fomblin®
&Galden®**

**HELPING YOU
RENEW THE FUTURE...**

Reduce the number of oil changes and the amount of waste you have to dispose of by switching from a hydrocarbon fluid to Fomblin. Fomblin does not break down in corrosive applications, making it the perfect choice for processes that contain high levels of oxygen.

Galden is the preferred heat transfer fluid because it offers wide operating temperatures, has high resistivity, is non-flammable, has low toxicity, and does not require a de-ionization system. This allows for minimal maintenance and the lowest cost of ownership.

The Kurt J. Lesker Company has Fomblin and Galden in stock available for immediate shipment.



**THE Source of Solvay Solexis Vacuum
Fluids and Greases in North America and Europe.**