TUTHILL
Vacuum & Blower Systems

4840 West Kearney Street, P.O. Box 2877
Springfield, Missouri USA 65801-2877
Tel 417 865-8715 800 825-6937 Fax 417 865-2950

TECHNICAL BULLETIN #36

What Oil Should I Use in my Kinney® Vacuum Pump, and How Often Should I Change It?

These are two of the questions most frequently asked of our engineers.

It is important to note that the oils listed in Table 1 should only be used for general purpose applications. Please refer to Table 3 on page 2 of this Technical Bulletin for oils for use in special process applications or where special requirements are dictated.

TABLE 1 – OILS FOR GENERAL PURPOSE APPLICATIONS
(NOT for Oxygen, refrigerant or Brake Fluid Service, or applications where the process will react with mineral-based lubricants)

Pump type	Pump Series	Recommended Oil
Small single stage pumps	KS, KD, KDH	Kinney AX
Large single stage pumps	KT	Kinney KV-100
Two stage pumps	KC. KTC	Kinney AX
Mechanical boosters	KMBD	Kinney KV-100 or S500 Synthetic
Oil filled Liquid Ring Pumps	KLR, KLRC, MLR A-series, T-Series	Kinney LR
Single stage Vane pumps	KSV, KUV, KVO, KVOH	Kinney AX
Two stage Vane Pumps	KVC, KVAC	Kinney AX

The Kinney oils listed above are specially blended to meet the specifications in our data sheets. They are recommended to achieve the best pump performance and durability. Key features of the General Purpose Kinney oils are shown in Table 2 below.

TABLE 2 – KEY FEATURES OF KINNEY BRAND GENERAL PURPOSE VACUUM PUMP OILS	
Kinney AX (Replaces Kinney Type-A and Super-X oils)	A high quality, low vapor pressure, and non-additive petroleum based oil for oil-sealed mechanical vacuum pumps. Ultimate pressure specification: .0002 Torr. (.00026 mbar a) Viscosity: Approx. 68 cSt @ 40° C (340 SSU @ 100° F)
Kinney KV-100	Specially formulated for peak performance in all KT pumps and Kinney vacuum boosters. Contains additives to increase oil life, and reduce foaming and varnish buildup. Ultimate pressure specification: .0002 Torr. (.00026 mbar a) Viscosity: Approx. 100 cSt @ 40° C (500-525 SSU @ 100° F)
Kinney S500	Synthetic diester-based oil designed to provide high temperature and long-term lubrication with minimal deposit formation. Generally, a synthetic version of KV-100. Ultimate pressure specification: .0002 Torr. (.00026 mbar a) Viscosity: Approx. 100 cSt @ 40° C (500-525 SSU @ 100° F)
Kinney LR Oil	A highly refined hydrocarbon oil used specifically in liquid ring vacuum pumps. Viscosity: Approx. 32 cSt @ 40° C (150 SSU @ 100° F)

There are no exact equivalents to Kinney oils in other brands, and few local oil distributors stock generic vacuum pump oils. It is possible that adequate performance may be found with oils which are close in specification to Kinney brand data sheets; however, **for best results**, always use Kinney brand oil in your Kinney vacuum pump.

To avoid damage to the pump or difficult operation it is most important to get the correct viscosity grade, viscosity too low may result in inadequate lubrication resulting in wear or failure, and viscosity too high may result in difficult starting, particularly at low temperatures. Additives may affect the vapor pressure of the oil and cause poor low pressure performance.

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SPECIAL REQUIREMENTS

The oils listed below are typical of oils that are used to meet the application or special requirements:

TABLE 3 – OILS FOR MECHANICAL VACUUM PUMPS (FOR SPECIAL PROCESS APPLICATIONS OR WHERE SPECIAL REQUIREMENTS ARE DICTATED)

Pump type	Application or Special Requirement	Recommended Oil
All Rotary Piston Pumps	Fire resistant oil is required	Kinlube 220
		Cosmolubric (KT Series Pumps)
	Water-soluble oil is required	Kinney LBX-300X – Ucon
	Automotive filling applications	Kinney LBX-300X – Ucon
	Refrigerant (R134A) applications	Kinney POE
	Higher resistance to oxidation/decomposition	Kinney OCR
	Starting in low-temperature (45-60° F [7-15° C])	Kinney LT
	Process requires a chemically inert fluid	Halocarbon 125, Fomblin® or Krytox®
	Oxygen Service (see Kinney Engineering Notice 140)	Halocarbon 125, Fomblin or Krytox

The Kinney oils listed above are specially blended to meet the specifications in our data sheets. They are recommended to achieve the best pump performance and durability. Key features of the Kinney oils for special process applications or where special requirements are dictated are shown in Table 4 below.

TABLE 4 – KEY FEATURES OF KINNEY OILS FOR SPECIAL PROCESS APPLICATIONS OR WHERE SPECIAL REQUIREMENTS ARE DICTATED

Kinney LT	Recommended for KT and other single stage pumps where low temperature starting (45-60° F [7-15° C]) is required. Viscosity: Approx. 56 cSt at 40° C (300 SSU at 100° F)
Kinlube 220	A fire-resistant, phosphate fluid for oil-sealed single stage or compound mechanical pumps with an ultimate pressure of 0.03 Torr. (single stage) and .005 Torr (compound). Viscosity: Approx. 42 cSt at 40° C (219 SSU at 100° F)
Kinney OCR	A highly refined hydrocarbon fluid providing improved resistance to oxidation and decomposition. For use in pumps with an ultimate pressure of 0.001 Torr. Viscosity: Approx. 100 cSt at 40° C (350 SSU at 100° F)
Kinney LBX-300X – Ucon	An effective lubricant in oil-sealed mechanical pumps that is fully compatible with fluid for automotive filling applications. Viscosity: Approx. 56 cSt at 40° C (300 SSU at 100° F)
Halocarbon 125	Used in oil-sealed mechanical pumps for semiconductor processes where gases pumped react rapidly with conventional pump oils. Halocarbon oils are the primary lubricants in processes using pure oxygen and other strong oxidizing agents. Vapor Pressure: 0.007 Torr @ 73°C. Viscosity: Approx. 120 cSt @ 40° C (580 SSU @ 100° F)

Table 4 continues on Page 3

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TABLE 4 – KEY FEATURES OF KINNEY OILS FOR SPECIAL PROCESS APPLICATIONS OR WHERE SPECIAL REQUIREMENTS ARE DICTATED	
Fomblin 25/6	Fomblin fluids are grades with low vapor pressures suitable for applications in the semi-conductor and related industries. These low molecular weight polymers include high oxidative and thermal resistance and chemical inertness. Viscosity: Approx. 70 cSt @ 40° C (370 SSU @ 100° F). Vapor Pressure: .000002 Torr @ 68° F.
Kinney POE	A synthetic lubricant formulated with selected Polyol Ester base stocks and with additives, which provide lubricity, stability and resistance to corrosion. Compatible in R134A applications. Viscosity: Approx. 62.5 cSt @ 40° C
Cosmolubric	Fire-resistant fluid for KT Series pumps.

Vapor pressure requirements for vacuum pump oils are not adequately described by ASTM vapor pressure tests. Kinney data sheets define the requirements in terms of the ultimate pressure of a vacuum pump.

For an individual application if the oil is of the correct chemical type and correct viscosity, and the pump is performing to expectations, then the oil is satisfactory.

When should the oil be changed?

The oil change period is different for different applications.

In general, the oil should be changed when:

- The viscosity of the oil changes by 100 SSU, viscosity may either increase or decrease with time. We recommend the use of a Visgage to measure oil viscosity.

  Sources: Louis C. Eitzen Company (888) 950-7572 http://www.visgage.com
  McMaster-Carr Supply Company http://www.mcmaster.com

- The oil changes color
- Oil odor becomes acrid
- Dirt or gritty particles in the oil

Oil condition will deteriorate for the following reasons:

- Oil oxidizes. Oil is mixed with air by the action of the pump and at high temperatures oil molecules break down producing gum and varnish, oil becomes darker and more viscous. Every 10 F° increase in oil temperature reduces oil life by half. Operating pumps at higher pressures (over 200 Torr) mixes more air with the oil and results in a higher rate of oxidation. Check for oil oxidation by color change and viscosity increase.
- Oil is contaminated by process gas. Chemically active process gas, even in small quantities can affect lubricating oil. Look for viscosity increase, change of color and oil odor.
- High boiling point condensate in oil. Process vapors such as kerosene, mineral spirits or transformer oil light ends, with boiling points over 250° F (120° C) cannot be removed by the use of gas ballast. Look for decreased viscosity, increasing oil level, loss of low pressure pumping speed and increase of blank of pressure. In systems with mechanical boosters the booster temperature switch may cut the booster out due to loss of pumping speed in the backing pump.

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- Water or low boiling point condensate in oil. Water makes oil milky in appearance, increase of blank off pressure and loss of low pressure pumping speed will result. Slight water contamination can be cleaned up by use of the gas ballast valve. Heavy water contamination may require changing the oil. Drain oil from the valve deck area on KT pumps. Free water can collect in the bottom of the oil reservoir and may be drained out. If water is allowed to accumulate to a point above the oil supply to the pump water may reach the pump in place of oil. This can result in damage to the pump. Look for milky appearance, loss of low pressure pumping speed and blank off, water in the oil drain.
- Dirt or wear particles in oil. Wear of cast iron parts of the pump will cause the oil to turn black, this may be caused by loss of oil viscosity. Change the oil immediately, if viscosity is low, more than one oil change may be needed to flush out contaminants.

To find a suitable oil change schedule for a new application, check the oil for viscosity, color, odor and dirt at increasing intervals. For example, one run, one day, two days, four days, one week, two weeks, one month, two months, four months. When the oil is noted to have deteriorated slightly, that interval is likely to be a suitable oil change interval. On some processes it is necessary to change the oil every run, on others six months may be satisfactory. For pumps which are used regularly, we recommend changing the oil at least every six months or 1,500 hours of use, whichever occurs first.