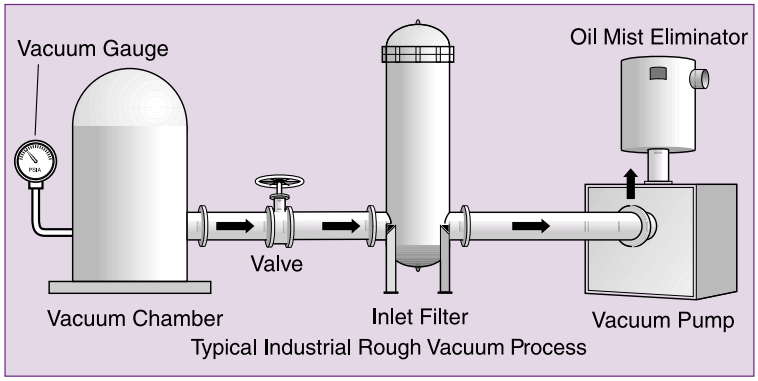
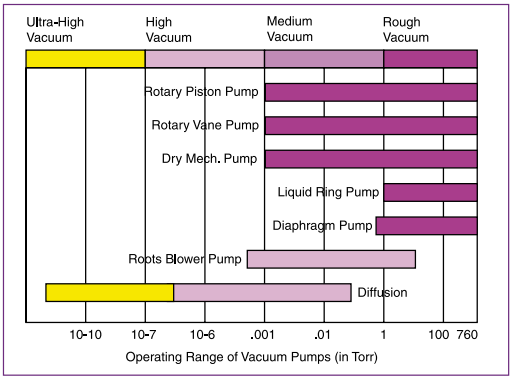
Filters for Vacuum Pumps



Typical Industrial Rough Vacuum Process



Operating Range of Vacuum Pumps (in Torr)

ISSUE 2

The Process

A vacuum is a negative pressure condition created to remove gas molecules from a process work chamber. The objective is to provide a clean space, free of gases that can affect product quality and process performance. Vacuum is used for a number of industrial products, processes, and applications:

Packaging	Chemical Process
Pharmaceutical Processes	Food Processing
Circuit Board Tests	Semiconductor Processes
Drying	Plastics
Heat Treat Furnaces	Evaporation
Pneumatic Conveying	Degassing liquids & steel
Distillation	Freeze drying
Incandescent & neon lights	

Pressure levels of a vacuum are often measured in units called Torr, mm Hg, atmosphere, Pascal, or mbar. Four generally accepted pressure ranges are used to classify vacuum work:

Rough Vacuum (RV):	760 to 1 torr
Medium Vacuum (MV):	1 to 0.001 torr
High Vacuum (HV):	0.001 to 10-7 torr
Ultra-High Vacuum (UHV):	less than 10-7 torr

Most industrial applications will fall into the rough to medium vacuum spectrum. The major components of this process are:

- **Vacuum Chamber:** The initial work location where gas molecules are to be evacuated from.
- **Vacuum Gauge:** Pressure gauge monitors the vacuum.
- **Valve:** Isolates work chamber from the pump.
- **Inlet Filter:** Particulate filter located on the suction side of the roughing vacuum pump.
- **Vacuum Pump:** Common rough to medium pump technologies used are: Oil Sealed (Rotary Vane, Rotary Piston), Liquid Ring, and Dry (Roots, Diaphragm, Claw, or Screw).
- **Oil Mist Eliminator:** Coalescing filter to remove oil mist from exhaust side of an oil sealed, oil lubricated mechanical vacuum pump.

The Problem

Filters and roughing pumps play a vital role in the performance of a vacuum system. Several criteria are often used to evaluate them.

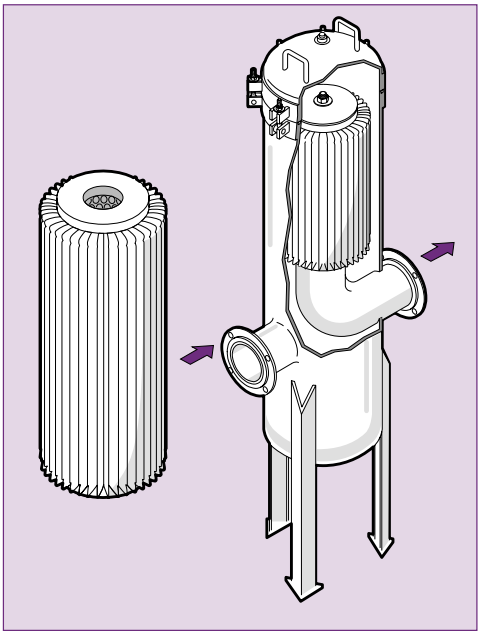
- **Contaminants:** The space in a vacuum needs to be very clean and gas molecules are considered contaminants. Air contains a mixture of gases, some harder to remove than others. The degree of its removal is affected by the application and vacuum pump.
- **Vacuum Pump Type:** Rarely does a single pump develop the needed degree of vacuum and often multiple pumps are teamed up. They are used two ways, either to "rough" pump the chamber to a certain vacuum level or as a "forepump" to exhaust a high vacuum pump. The choice of pump depends on its useful operating vacuum range and the application type.
- **Conductance:** An important factor in a vacuum is the ability of an opening or pipe to allow a volume of gas to pass through in a given time. Good conductance is achieved by using fewer turns, shorter pipe runs, larger pipe sizes, and larger pump and filter connections to maximize gas movement through the system.
- **Solid Particles Removal:** In a rough vacuum, a high incidence of solid particulates can become part of the dynamic gas flow being handled by a vacuum pump. If left unchecked, it can lead to abrasive wear or even loss of lubrication in oil sealed pumps. An inlet filter is essential to protect and extend the life of the vacuum pump. This filter is highly recommended for rough vacuum applications and is selected based on pump flow and vacuum rating.
- **Oil Mist Removal from Vacuum Exhaust:** The mechanical actions of oil lubricated, oil sealed vacuum pumps often generate large concentrations of sub-micron size visible oil, mist, or smoke in their exhaust stream. This can lead to contamination of the surrounding air and unsightly oil plumes on the side of a building. An oil mist coalescer is recommended to trap these airborne contaminants, conserve expensive pump oil by collecting and returning it back into the pump, and act as a pump silencer.
- **Materials:** Filters or vacuum pumps often require materials with:
  - A compatibility to wide changes in temperature: Fiberglass filter elements are common for applications above 300 F.
  - Low outgassing rate: Buna N and Viton are good elastomers.
  - Good seal connection: KF, LF, flat flange fittings are common.

Filters For Vacuum Pumps

Graver Technologies

LKV/HKV Series Inlet Filter

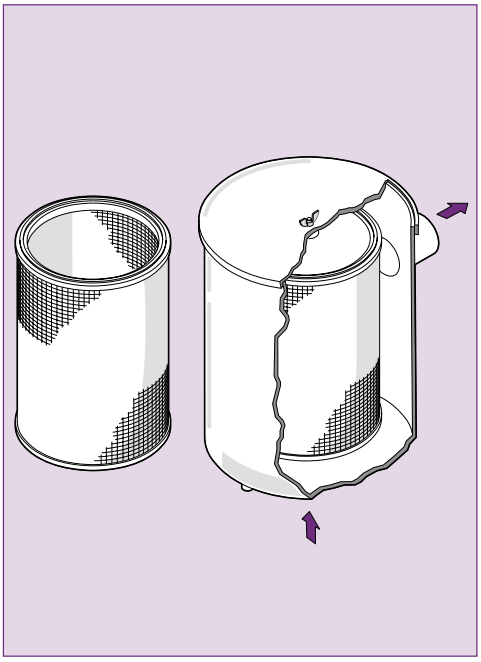
How it Works:
The LKV/HKV Series is a vacuum filter located on the inlet (i.e. suction) side of a vacuum pump and works to protect the pump from considerable amounts of particulate material that evolves from a vacuum process. The gas stream enters the housing and flows from the outside of the element inwards with solid particles being intercepted on the filter element exterior.



Features:
- Filtration of solid particulates from 0.3 up to 25 microns. Most inlet filters are nominally rated for 10 microns.
- Replaceable pleated, "radial fin" elements with extensive surface area for long life and high dust holding capacity.
- Filter media options including polyester and fiberglass. Fiberglass is often used for high temperature processes.
- LKV housings are for rough vacuum ratings above 1 torr.
- HKV is for medium vacuum ratings down to 0.001 torr.
- Many housing connection sizes available from 1/2" to 24" provide for maximum conductance in a vacuum.
- Connections: threaded, flat face flanges or KF fittings.
- Low outgassing O-ring sealing elastomers: Viton, Buna N.
- Housing materials available in carbon steel or stainless.

PME/KME Oil Mist Eliminator

How it Works:
The PME/KME Series is a high efficiency coalescer located on the exhaust side of an oil sealed, oil lubricated rough vacuum pump to trap and separate out small droplets of pump oil, preventing them from becoming airborne. The vacuum pump exhaust gas enters the bottom of the housing and flows upwards from the inside, through the element to the outside. The fine oil mist is intercepted or impinged by the filter medium and extracted from the vacuum exhaust stream. Coalesced larger droplets fall by gravity to the housing bottom for drainage.



Features:
- Replaceable multistage coalescing element constructed of two concentric tubes of ultra-fine microglass with metallic sleeves for support and drainage assistance. The inner tube provides an ultra-high efficiency stage to coalesce fine droplets while the outer tube is used to promote liquid drainage and prevent re-entrainment.
- Removes visible oil, smoke, and mist down to 0.3 micron at efficiencies to 99.95% from vacuum pump exhaust air.
- Easily mounts directly to exhaust port of a vacuum pump.
- Each housing has a bottom inlet and side discharge outlet with connections available in threaded or flanged.
- Connections available in sizes from 1" to 8".
- Employs a lower NPT drain tap for removing coalesced oil.

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