

Kidney-Loop Filtration, Filter Carts and High Viscosity Oil

Most discussions on *kidney-loop filtration* and **Filter Carts** put the focus on the filter cart, and not on the requirements of the machinery it services. A more meaningful discussion on *kidney-loop filtration* and **High Viscosity Filter Carts** should put the focus on the lube oil and the machinery, and work back to the filter cart.

The Machinery

Kidney-loop filtration on rotating lubricated machinery requires a bottom outlet for extracting oil from the sump, and a top or side inlet for returning polished oil to the machine. Generally the machine will have an air breather on the top and a drain plug in the bottom which can be used for the outlet and inlet. Installing quick disconnects and conveniently locating them for the lube technician and the filter cart, is an essential part of an efficient maintenance procedure.

The machinery that keeps a facility up and running is not in the oil room. It's on a crowded operating floor, on elevated cat walks, at the end of ship loading conveyors, or 200 feet strait up in a wind turbine. Wherever the machinery is, the kidney-loop filter cart has to be pushed, pulled, dragged or hoisted up to the machine.

Kidney-Loop Filtration and High Viscosity Filter Carts

Viscosity is a measure of fluid friction, and its resistance to flow within a controlled space.

- Working back from the machine, the first components for kidney-loop filtration are the connecting hoses. The challenge is using the fewest connections and the shortest hoses, then getting the filter cart as close to the machine as possible. A kidney-loop procedure is most effective when the machine is running under load, and the lubricating oil is at normal operating temperature.

Filtration technology and filter media has improved immensely since return line oil filters were first used decades ago. However, the typical filter head still used today, is essentially unchanged. Since a machine will run longer on dirty oil than on no oil, filter heads are fitted with a bypass mechanism to maintain an uninterrupted flow of lubricating oil.

- True kidney-loop filtration functions independent of the machines lubrication system. The logic of kidney-loop filtration says that only polished oil should be returned to the machine. A filter that starts to bypass dirty oil becomes part of the problem and not part of the solution.

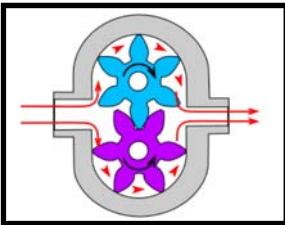
There will always be a debate over the type, size and number of filters used on a filter cart. The most common filter carts use two 5 inch diameter, by 11 inch long spin-on filters, the first is called a pre-filter, and the second, the final filter. Each filter head will have a condition indicator and a bypass mechanism, usually rated at 25 psi. Unknown, however, is the cracking pressure of the first filter. When it begins to open, unfiltered oil is bypassed to the final filter. At this point, your filter cart is effectively a single filter unit.

- Changing a filter is a messy, time consuming procedure, and is best done back in the oil room or maintenance shop. The question for the reliability supervisor is not only when to change a filter, but whether to change *one or both*. And how cost effective is it to discard a filter that bypassed at 25 psi, and holds close to 1 gallon of oil? A guessing game that only complicates the benefits of reliability centered maintenance.

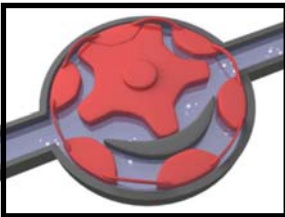
Kidney-Loop Filtration, Filter Carts and High Viscosity Oil

The heart of any filter cart is the pump. If we were only concerned with hydraulic oil, any pump would do. For lubricating oils, with a wide range of grade specifications and viscosities, pump selection becomes an important consideration.

A pumps rotating group, is driven by an electric motor to create a partial vacuum on the suction or inlet side of the pump. A fluid can only flow down hill or move to fill a vacuum. The vacuum draws the oil through the suction line to the pump, where it fills the cavities of the rotating group and is transferred to the pressure side. A pump can only deliver the oil it receives through the suction line. For a given lube oil and a given viscosity, there are four main factors we can control to insure that the cavities of the rotating group completely fill with fluid, (1), is the size of the suction line, (2), is the length of the suction line, (3) is the speed of the rotating group, and (4) is the configuration of the rotating group in the pump.



- The most common pump is the gear pump. It works well with hydraulic oil and the lighter lubricating oils. By design, it has a limited range for lube oils. The small cavities created by the internal spur gears, the close tolerances required for higher pressure, the knife edge gear tooth form, and the fixed outer gear housing, all combine to severely limit its suitability for higher viscosity fluids.



- The rotating group of a gerotor pump, or crescent pump is better suited for higher viscosity lube oils. Larger and fewer cavities with rounded corners, roll into and out of mesh, creating cavities that open and close more smoothly. This significantly reduces the shearing of the lube oil in the pump, reducing noise, aeration and cavitation. It also produces a ripple free oil flow, which is more compatible with the dirt holding capabilities of the filter media.
- The most important feature, however, is the adjustable relief valve built into the pump housing. This eliminates the need for a bypass valve in the filter head, and insures that only polished oil can be returned to the machine. When set at 60 to 80 psi, it increases the dirt holding capacity of a filter that would otherwise by-pass at 25 psi.

Kidney-Loop Filtration—A quick Overview

- Make the job easy. Pre-install connection points, and standardize procedures on all operating machinery.
- Keep the suction line as short as possible with the fewest twists and turns as necessary.
- Locate the kidney-loop connection points on the machine, where it is Safe and Convenient for the lube technician.
- Get the filter cart as close to the machine as possible. Accessibility is key to pro-active maintenance.
- Color code machinery. Clearly identify the type and grade of lubricating oil for each machine.
- Avoid cross blending of lubricating oils. Dedicate a filter cart to each Lube Oil Grade Specification.
- The dirt holding capacity of a filter increases with a higher pressure drop across the filter media.
- A filter is more effective when the oil flow is ripple free and the flow rate low.
- True kidney-loop filtration is independent of the machines lubrication system.
- A filter bypass valve begins to bypass unfiltered oil at a cracking pressure, below it's full flow bypass pressure.
- Circulating unfiltered oil is contrary to the ultimate purpose of kidney-loop filtration.
- Use the type of pump that is best suited to the fluid being pumped.
- Choose a filter cart equipped with a pump that includes a built in adjustable relief valve.
- A single non bypass filter takes the uncertainty and the guess work out of a filter change out.
- Consider a filter cart with a Duplex Filter capability. Switch to a clean filter without shutting down the filter cart.
- A complete oil change is sometimes advisable. Choose a filter cart where you can select Filter or No Filter
- For the highest viscosity lube oils specify an electric motor with a lower rpm like 1150 rpm.