design FAQs

Filtration Types for Hydraulic Systems

FREQUENTLY ASKED QUESTIONS

Q: How does contamination affect hydraulic fluid reliability?

A: Research studies established that solid contamination in the hydraulic fluid is the highest factor influencing reliability and life of hydraulic systems.

More than 80% of all hydraulic and lube oil system failures are a direct result of solid contamination in the fluid, with most contaminants smaller than 75 microns, the minimum size the human eye can see.

Solid contamination causes abrasive wear, erosive wear, adhesive wear, and fatigue wear due to reduction of the lube film, and the reasons for loss of efficiency, reduced reliability and life of components and system. Even though the solid contamination cannot be completely eliminated, it can be managed and minimized in size and quantity with proper filtration, cleanliness monitoring and maintenance.

Contamination is detrimental to hydraulic components especially for the most sensitive components, like servo-valves, proportional valves or piston pumps and motors. Hydraulic component manufacturers know the effects of the contamination and recommend appropriate contamination classes for their components. For instance, ISO 4406 class cleaning level of 15/13/11 for Servo-valves, 16/14/11 for proportional valves, 17/15/12 for piston pumps/motors, and 18/16/13 for cartridge valves or gear or vane pumps.

Contamination is present in every system due to:

- Assembly of system components
- Excessively dirty components installed into the system
- Improper filling with unfiltered fluid
- Wear of the surfaces during the life of the system
- Improper or undersized reservoir air breather

For instance, the pump wear is a cause of progressive contamination into the valves, due to the wear of mating components and could cause inefficiency of the system, inaccuracy of controls due to spool jams or scoring of sealing surfaces in valves and cylinders. The control components are also sensitive to the contamination.

Q: Which type of filters work best against contamination?

A: To protect the most sensitive components of the system, use absolute filters with fine ratings. Absolute filtrations with fine ratings are available in that type of filters. High pressure filters save the control components against the contamination. Moreover high pressure filters are designed to work as close as possible to the control components of the system, usually with high pressures and duty cycles. For this reason, they are produced with robust materials suitable to work in these conditions.

Another benefit is their flexibility in connections and in-built valve options. High pressure filters with in-line connections flanged or threaded, others with manifold connections or filters that could be fitted directly into a cavity machined into the control manifold are available.

High pressure filters are available with flanged or threaded connections; others come with manifold connections or filters that can be fitted directly into a cavity a machined into a manifold.

Internal outlet check valve holds the fluid in pressure after the filter avoiding back-flow condition to the pump, reverse flow valve allows the fluid to go through the filter in the reverse direction.

Q: What are the benefits and drawbacks of high-pressure filters?

A: The advantages of high-pressure filters are fine filtration, robust construction, flexible connections and several valve options. However, there are some design concerns if not applied properly. First is the cost of the product. High pressure filters are designed to work in high duty cycles and heavy conditions. The robust design makes the price of high pressure filter higher than other filter options. Hydraulic system engineers design to achieve higher performance of the systems, but they have to balance costs.

High pressure filters, as other components within the system, cause a pressure drop, heat load and system losses. It is usually not necessary to apply high pressure filters in simple hydraulic system if sensitive components are not used; cartridge style return line filters are better suited. Size the components in order to get the right balance between cleaning level and pressure drop.

Q: What are different configurations possible when using high pressure filters?

A: The high pressure filter family is the most complete range in connection types and functions. Designing systems with high pressure filters an engineer has options for plumbing: inline threaded and flanged connections or manifold connections in according to the standards issued for hydraulic systems. Some filters can be designed for installation into a machined cavity of a manifold. In-line connections are the most common type of connection, which allows flexibility into the system. Manifold mounting allows an engineer to mount the filter directly onto a manifold, or close to valving. Common manifold connections

follow HF4 automotive, ISO 4401, SAE Code 61 & 62, and CETOP.

Q: When does one commonly use spin-on filters?

A: Spin-on filters are commonly used in hydraulic system low pressure return and suction lines where extremely fine filtration performance is not required. The price of spin-on filters is very competitive compared to the price of a pressure filter. At the same time replacement are readily available.

However they have some application limits. First of all they can't be applied to high pressure systems because of the limited working pressure and the construction. Moreover the filtration construction is not able to meet heavy conditions and duty cycles. Additionally, they pose as an environmental impact when disposing of the spin-on element.

Q: What are the advantages and disadvantages of using a duplex filter over a single, large filter?

A: Duplex filters are two filter elements piped in parallel. They are used in many applications such as, metal casting, machine tools, compressors, generator sets, lube systems and any industrial market where the shut-down is not permitted for costs or safety. Large filters suit in completely different conditions. They are designed to meet applications where long life and very low pressure drop filtration are needed. Usually they are designed to install multiple filter elements.

Q: What are the options for monitoring differential pressure?

A: An effect of the filter element capturing contaminants is in pressure drop across the filter. Differential indicators are used on the pressure lines to check the efficiency of filter elements. They measure the pressure upstream and downstream of the filter element (differential pressure). As soon as a particular limit value measured, the clogging indicator indicates an imminent element replacement. Typical indicator settings for high pressure filters are 5 bar for filters with a bypass valve and 7 bar for filters without a bypass valve. Electrical models with connections for industrial and mobile market, visual models with manual or automatic reset, and electronic models with several protocols are available to cover all the hydraulic needed. Models made of stainless steel are available for specific applications.■

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