

Hydraulic Fluid Contamination



Why is My Hydraulic Fluid Contaminated?

It has been stated that 75% of all hydraulic system failures may be traced back to contaminated hydraulic fluid. Hydraulic fluid was never intended to operate with either particulate or fluid based contaminants. When these contaminants are introduced to hydraulic fluid trouble inevitably follows.

Contaminated hydraulic fluid can result in a variety of potential system impacts, including:

- Sticking parts as a result of silting can lead to the seizure of component parts and significant downtime
- This same contamination based sticking issue, even when it does not lead to full-blown failure, can still lead to a degradation in performance in pumps and motors, reducing overall efficiency.

Types of Contamination

In general [hydraulic fluid](#), contamination tends to be based on either metal particulates or moisture.

Metal Particulates

Metal particulates can enter the fluid in a wide variety of ways. Once such particulates have contaminated the hydraulic fluid, they can produce considerable damage. Contamination from particulates comes from either a negative chemical reaction to the particulates or a build-up of particulates over time. It should also be noted that these particulates need not be large to cause problems as even particulates that are so small they are hard to see can generate issues.

Sources for metal particulate contamination include:

- The cutting of metal enforced hydraulic hoses before installation. This potential hazard can be reduced with the use of a compressed air projectile which is shot through the hose to clear out any particulates.
- Any time that moving metal parts come into contact within your machinery to potential exists for the production of metal particulates. Proper attention to the maintenance of the hydraulic fluid can help to reduce the risk of this occurring.
- Painting system parts, often with the intent of reducing rust, is another potential metal



particulate source. Painting provides a false sense of security against rust and will eventually break down allowing the rust into the system.

Water

Water contamination of hydraulic fluid is the most common source of contamination.

This form of contamination comes in several varieties. Water can mix with the hydraulic fluid creating an emulsion leading to the degradation of the fluid.

Water can also either float on the top of the fluid or sink to the bottom of the fluid.

In the end, it is not so much the actual water that produces the contamination, rather contamination is created by the effects of the water on the system. Water introduced into a system has a corrosive effect that produces material which leads to the damage.

Fluid Mixing

The most frequent source of fluid mixing contamination occurs when one hydraulic fluid is exchanged for another one in an application.

The resultant mixed fluid may produce chemical reactions which degrade the performance of the new fluid.

Sources of Contamination

In order to manage your hydraulic fluid and prevent its contamination, it is worth understanding what the possible sources of the contamination could be.

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Production Contamination

While hydraulic fluid manufacturers do take significant precautions to prevent contamination of their product during production, the complete elimination of contaminants at the source is not possible. There are multiple possible contamination sources associated with the manufacturing process. Most of these sources are related to the equipment used in the manufacturing process which, if improperly maintained, can introduce both particulate and moisture based contamination into the hydraulic fluid.

Contaminants can also be introduced during the mixing process or on-site storage of the product.

Built-in contamination is addressed through the appropriate use of filters, which includes changing filters out on a regular schedule and careful handling of the filters when they are installed

There are established standards for the production of hydraulic fluid and its cleanliness. Hydraulic fluid typically is manufactured in line with the ISO 4406 Cleanliness Code standard of 17/16/14 to 20/18/16. In doing so, the

hydraulic fluid producers are delivering a level of product cleanliness that is generally more than the stated requirements for most applications.

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Transfer Contamination

The transfer of hydraulic fluid from one vessel to another opens the door for potential contamination of the fluid.

Transfer contamination can start before the actual transfer takes place. Failing to ensure that the system receiving the fluid has been properly flushed, allows for the introduction of both particulate and other fluid mixing resulting in contaminated hydraulic fluid.

Environmental exposure represents another potential source of hydraulic fluid contamination. This type of contamination typically results from exposure to either moisture (fluid contamination) or dust (particulate contamination). Steps should be taken to ensure that the area in which the hydraulic fluid is being transferred in is as clean as possible.

One obvious source of environmental contamination is the filling process during which the fluid is transferred from its production container to the machinery it is to be used with. The use of filter-transfer pumps go a long way to dealing with this potential contamination source.

One way to deal with potential environmental contamination is to filter the hydraulic fluid before introducing it into your application. This step serves to reduce environmental contamination risk.

Another precaution to avoid environmental contamination is to simply not leave the hydraulic fluid container open to the environment for long periods of time.

Hydraulic Fluid Storage



Poor storage practices can lead to the contamination of your hydraulic fluid. The sources for storage based contamination are many, including:

- Improperly sealed hydraulic fluid containers are a major source of contamination
- Condensation can even take place within a sealed drum. If storage drums are exposed to significant temperature fluctuations moisture can develop inside the sealed drum through a process known as “breathing.”
- Careless opening and closing processes during storage also allow for the introduction of contaminants.

There are established best practices related to hydraulic fluid storage that will go a long way in reducing the risk of contamination during storage. These practices include; storing the containers at a controlled temperature, ensuring a proper container seal and laying the storage container on its side.

Even when appropriate precautions have been taken, it is advisable to filter any hydraulic fluid during the transfer process.

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Component Contamination

Your application may well be the source of contamination. Just as with the fluid manufacturer's contamination through exposure to the equipment used within your application can lead to the contaminated hydraulic fluid.

There is a long list of suspects for component-based contamination including:

- Excessive temperature exposure
- Hydraulic motor bearings
- Hydraulic pump seals/gaskets
- Poor cleaning post repairs
- Quick coupling fittings

If you have reason to suspect that your hydraulic fluid has been compromised then the best course of action is to flush the system in question and replace the hydraulic fluid.

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Operational Contamination

Cavitation is the formation of bubbles within a liquid. The operation of your machinery can potentially produce cavitation. Where cavitation occurs the resulting shock force can damage metal surfaces effectively scouring out small metal particulates and contaminating the fluid.

Once the metal particulates are created, they travel through the system coming into contact with valve port edges, doing considerable damage.

Hydraulic Fluid Maintenance Contamination



This contamination source should be fairly obvious. The potential contamination sources that are possible during routine maintenance procedures are many.

It is perhaps best to look at some maintenance best practices which can aid in reducing potential contamination from your maintenance activities, including:

- Cap all hoses once they have been exposed to the environment
- Clean, lint-free cleaning rags and materials should be used
- Do not remove any new parts from their protective packaging until just before their installation.
- Ensuring that exterior surfaces have been well cleaned before any maintenance activities

Hydraulic Fluid Failure Types



To conclude it is worth taking a moment to consider the two general forms of system

failure that may result from hydraulic fluid contamination.

The first is system failure based on deterioration. Deterioration based failure initially presents itself in the form of the loss of speed, accuracy, pressure or overheating. The real concern with deterioration based failure is that by the time it is addressed it is usually too late and the damage has been done.

Fatal failures are the second type of system failure that can be brought on by contaminated hydraulic fluid. Fatal system failures typically occur as the result of particulate build-up over time. Eventually the particulates accumulate to the point where moving parts are compromised and the system fails.