OIL FILTRATION SYSTEMS®
A CLARK-RELIANCE COMPANY

Your Number One Lube Oil Problem – Moisture

By **Ken Kaihlanen,** *Director*

If moisture is greater than 300 parts per million (ppm), BAD things are happening in your lube system. If you have ever worried about moisture levels in your lubrication oil, you are rightly concerned. Water's interaction with oil, at any contamination level, is harmful to plant and machinery. It will shorten the service life of your machinery, as well as the life of the lube oil protecting your sensitive components. Moisture is an exponentially damaging contaminant!

Left Unchecked, Moisture Will Affect Your System

Catastrophic Failure

Compressors handling 'sour' natural gas with higher levels of Hydrogen sulphide can strike real problems if the oil interacts with the product gas and any moisture present. The result is an attack on the compressor alloys called **sulphide stress cracking,** a form of hydrogen embrittlement. In extreme cases this can cause a compressor casting to split.

Hydrogen embrittlement is not limited to just compressors though, as electrolysis or corrosion will split a water molecule releasing hydrogen atoms to react. Unfortunately, this effect is self-amplifying.

Corrosion

Put simply, what rust does is impair the bearing surfaces and denies the oil a chance to form that critical elastohydrodynamic (EHD) film that separates the bearing surfaces.

Impaired Film Strength

Similar to corrosion, the oil is denied the opportunity to lubricate and separate the surfaces. This occurs when dissolved water affects the viscosity of the oil and allows the load zone to force the lubricant aside and 'bump'.

Did You Know? An amazing and very damaging event can occur when water is present in the bearing load zone. The effect produces superheated steam which creates a mini explosion inside the oil, similar to micro-dieseling, that will damage the oil & work harden, fatigue and crack the bearing surfaces

Foaming

Water (especially chemically treated water) can have an adverse effect on the ability of the lube oil to dissipate foam and separate from water. Excess foaming (aeration) will lead to sluggish response from hydraulic control systems, cavitation in pumps and bearings, and wear.

Lube Oil Additive Depletion

Additives are designed to be a sacrificial product. They are consumed as the additive pack anti-oxidant neutralizes unwanted chemical contaminants. However, if additives such as demulsifiers (which help shed water) are exposed to large amounts of water contamination, the demulsifiers can be stripped from the oil very quickly leaving the oil at risk.

Other additives like Extreme Pressure (EP) and Anti-wear (AW) can be hydrolyzed (broken down into acids) by water and deny your Equipment the protection those additives are designed for. If left unchecked the by-product is sludge and varnish.

Sludge

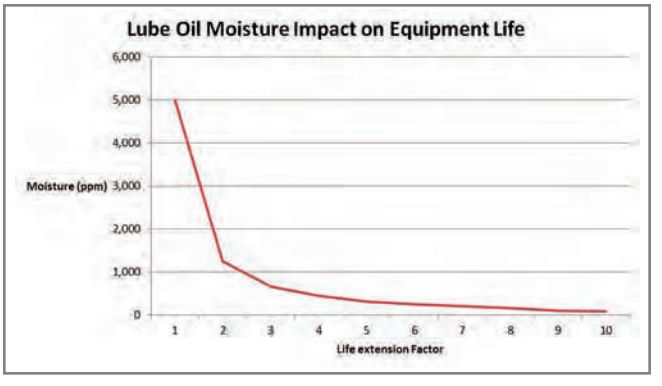
Water, being polar has an affinity with other contaminants in the lube oil such as soot, resin, spent additives, oxides and dirt. These agglomerate into a sludge that will overwhelm strainers, filtration and eventually restrict oil flow in the system.

Microbial Contamination

For microbes to thrive and grow with lubrication oil or diesel then the presence of water is a great promotor. Eventually this biomass or bug will grow to interfere with lube circuits and can plug fine lube capillaries and filtration. Microbial contamination is also corrosive and can be carcinogenic.

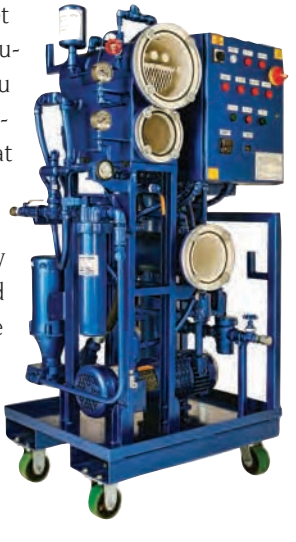
Dry Oil Equals Extended Life of Oil & Machinery

A trial of machines by the BHRA compared equipment life to moisture contamination. They found the correlation between dry oil and oil with high moisture content. Oil with a moisture level of 5,000 ppm was dehydrated and trialled to measure equipment life. The results show that equipment with oil drier than 100 ppm has three times the life of a machine with oil of 450 ppm moisture.



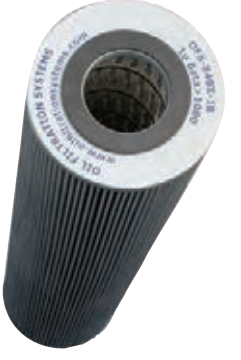
Resolving the Problem of Moisture

There are many solutions on the market today to mitigate moisture and particulate contaminant. For the best results you may want to consider a vacuum dehydrator **VDOPS** type unit. They are effective at removal of dissolved, free and emulsified water, entrained gas, and particulate for heavy gear oils right down to very light oils of any Group. They are the Gold Standard of the filtration industry. These VDOPS units have class leading microglass filtration media to remove particles as small as 2µm.



Vacuum Dehydration

In our opinion, this is the most effective and reliable technology on the market today. It has gained wide acceptance among Power Plants, Paper Mills, Steel Mills, Refineries, and other industrial facilities with rotating equipment that can be damaged by water contamination in the oil. By raising the oil temperature to approximately 150 degrees F and passing it through dispersal elements or media in a vacuum chamber at roughly 22" of vacuum, water essentially "flashes" off of the oil and turns to steam. In this way, even water that is tightly held in an emulsion is removed, along with free and dissolved water. Using a vacuum dehydrator, overall water content can be reduced to levels below the water solubility point in the oil, and results of 50 ppm are commonplace across a wide range of oil viscosity grades. Entrained gases are also effectively removed from oil by the vacuum dehydration process, and most systems are equipped with a high efficiency "absolute rated" filter element which removes particulate contamination to very low levels (ISO 18/16/13 or lower). For this reason, vacuum dehydrators are commonly referred to as "Oil Purifiers."



Centrifuges

Centrifuges work using the technology of "centrifugal force", and by spinning the oil quickly, water (which has a different specific gravity than oil) is separated from the oil and collects in a separate chamber. This technology is very effective at quickly removing large amounts of free water from oil, but centrifuges cannot remove water that is held in an emulsion, and they cannot remove dissolved water from oil. For this reason, the lowest overall water content in oil that centrifuges can typically achieve is around 200-300 ppm (depending on the water solubility point in the oil). Entrained gases cannot be removed by a centrifuge, and only large particulate contamination and sludge is effectively removed along with the free water. For this reason, centrifuges are unable to achieve very low particle counts in the oil to meet typical OEM cleanliness specifications of ISO 18/16/13 or lower.

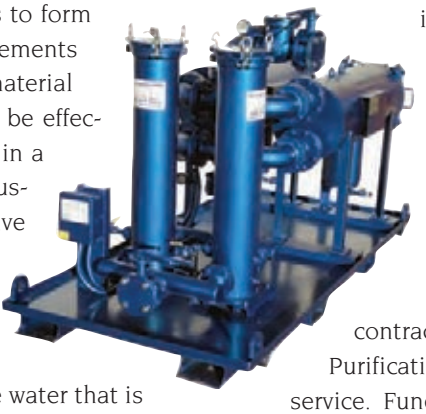
Depth Media/Water Removal Filter Elements

There are a number of different Water Removal Filter Elements on the market today which absorb free water. Utilizing cellulose "depth" type media or material similar to that used in diapers, these water absorbing filters cannot remove water that is held in an emulsion, and they cannot remove dissolved water from oil. For this reason, the lowest overall water content in oil that water absorbing filters can typically achieve is around 200-300 ppm (depending on the water solubility point in the oil).

Entrained gases cannot be removed by these filters, and very few of them are "absolute" rated for high efficiency particulate removal.

Lube Oil Coalescers

By passing oil through special coalescing filter elements (which cause free water droplets to form on the media) and then separator elements (which are typically made of teflon material that is water retardant), free water can be effectively removed from oil, which collects in a sump at the bottom of the coalescer housing. This technology can be very effective at quickly removing large amounts of free water from oil, but it is typically only cost-effective on very low viscosity oils like ISO 32 Turbine Oil.



Coalescers cannot remove water that is held in an emulsion, and they cannot remove dissolved water from oil. For this reason, the lowest overall water content in oil that coalescers can typically achieve is around 200-300 ppm (depending on the water solubility point in the oil). Furthermore, if the oil does not have good separability characteristics (often due to the presence of surfactants in the oil), the coalescer elements will not work at all. Entrained gases cannot by removed by a coalescer, but most systems are equipped with a high efficiency "absolute rated" filter element which removes particulate contamination to very low levels (ISO 18/16/13 or lower).

Options To Capital Expenditures – You Can Rent Vacuum Dehydrators With "Maintenance" Dollars!

Many end-users have constant ingression of water into the lube oil systems of critical rotating equipment, and they therefore elect to purchase a system to remove that water.

However, in today's economy with shrinking capital budgets, many facilities are increasingly deciding to "rent" Vacuum Dehydrators VDOPS on a weekly or monthly basis, depending on their needs. Funds are often more readily available in a maintenance budget, allowing facilities to quickly get a Vacuum Dehydrator onsite for emergency use or for scheduled maintenance operations.

Similarly, many facilities decide to hire a contractor who specializes in Oil Reclamation & Purification to come onsite to perform a "dehydration" service. Funds for this type of work also come from a maintenance budget, and because the contractor typically brings both equipment and manpower onsite to perform all work, an end-user can rely on an expert to purify their oil, and does not need to use its own maintenance personnel in that capacity.

Conclusion

Oil Filtration Systems, Inc. designs and builds the most effective, durable, and user-friendly vacuum dehydrators on the market today. Special engineered design features maximize the water extraction rates of our oil purifiers, and top-quality components and workmanship ensure years of maintenance-free operation and performance.

If you keep your lube oil moisture levels under 300 ppm then you will increase equipment life and prolong the life of your lube oil.

With Questions Please Contact: *Oil Filtration Systems*

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