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NEWSLETTER

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- **Water : Oil's Public Enemy Number One**

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Water is one of the most destructive contaminants of oil. Water attacks additives, generates oxidation and modifies the vapour pressure of oil; it corrodes metal surfaces, facilitates emulsions, blocks filters and hinders in the formation of the protective film. Water increases dramatically the corrosive potential of acids present in oil. In diesel engines, light contamination is normal, however, critical to certain hydraulic equipment and compressors. Severe contamination deserves close attention and will seldom be suppressed with an oil change.

Sources of Water Contamination

There are many sources to water contamination, amongst which: leaking coolant, cracks, damaged cooling duct gaskets, condensation of atmospheric humidity, combustion chamber blow gas and storage or transport oil tanks.

Water in oil may take on different states: dissolved, emulsified and free. When dissolved in oil, water cannot be detected because it dilutes down to the molecular state. Lubricants can only absorb a specific quantity of water, called saturation, before reaching the separation phase (free water). The saturation phase and the speed and quantity of water absorption vary with the type of oil, its composition, its additives, its viscosity, its pressure and its temperature. As a rule of thumb, synthetic oils have a higher saturation point than mineral oils.

Problems Generated by Water in Oil

Water contamination can create many problems, among which corrosion is always present. On any piece of equipment, water can chase oil out of the contact surfaces, which will reduce the lubricating capabilities of the lubricant and cause surfaces to react and act as catalysts of oil degradation. This problem mainly affects ester-based synthetic oils.

Emulsified water can increase the viscosity of the lubricant and lead to severe oil instability and depletion of the additives. These problems occur in systems where water exceeds 0.2% (more or less). A number of systems do not tolerate water absorption.

Failures caused by water can result from many mechanisms:

- Corrosion of metal surfaces
- Depletion of chemical additives
- Formation of emulsions

In oil storage tanks, water contamination can generate microbiological cultures leading to the formation of yeast, mould and bacteria that in turn will block filters and corrode the supply devices extremely fast.

Detection Methods

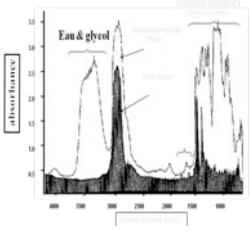
1. **Crackle Test**

Water contaminated oil crackles when heated at 100° C, even in low concentration (0.1 %). The method consists in shedding a few drops of oil on a heating plate (100° C). Results are disclosed in %, between 0.1 % and 5%.

The crackle test is very useful to detect water in engines, gearboxes and differentials, where water content is higher than 0.1 %. It is a simple, effective and inexpensive method for certain types of equipment.

2. **Fourier Transform Infrared Spectrophotometry (FTIR)**

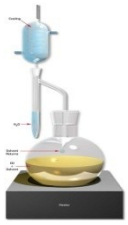
The result is expressed in absorbance, detected at 3400 cm-1 wavelength. It is a semi-qualitative method and quantified a 50 %. It is very effective with engine oils.



3. **Karl Fisher**

KF is the most widely used water dosing method, where water contamination is critical and must be kept very low (less than 50 ppm). It is very much used for hydraulic equipment and compressors.

4. Distillation



This method is based on the separation of the two phases (oil/water), where water content in oil is very high (a few tens of %).

There are also other indicative methods, such as spectroscopy, where water content is indicated by the presence of anti-corrosion additives such as potassium, sodium or boron.

Water Elimination (Filtration)

The most widely used method to eliminate water from oil is filtration. Oil does not wear out over time, but becomes contaminated while lubricating the equipment by accumulating metal residues, dirt, water and glycol.

There are two categories of contaminants in oil: solids (particles) and liquids, mainly water, which result from condensation and infiltrations.

The filtration system used to eliminate water is based on the installation of a filter with sieve mesh of a few microns in size (3 to 40 microns). These filters can be installed either upstream or deviate slightly. Filtration allows regenerating and purifying the oil at 100 %.

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