fluid-maintenance-changeout

FLUID MAINTENANCE AND CHANGE-OUT PROCEDURES

With literally thousands of uses for heat transfer fluids, it is nearly impossible for any heat transfer fluid manufacturer to recommend an exact oil change interval or maintenance schedule.

Each application has its own unique characteristics that can contribute to the degradation of a heat transfer fluid. As well, each heat transfer fluid will react differently in different user environments.

To give an example of the extremes, the same heat transfer fluid used in, for example a PVC extruder, may have a life cycle as short as a few months while that same fluid in a larger 'closed' system can last upwards of 10 to 15 years.

To begin we should understand the two basic ways in which a heat transfer fluid can become degraded:

Oxidative (Most Common In Open Systems)

The scientific definition of oxidative degradation is the reaction of oxygen (in air) with the fluid by a free radical mechanism to form larger molecules that end up as polymers or solids. These thicken the fluid thereby increasing its viscosity. A more viscous fluid will be more difficult to pump, have poorer heat transfer characteristics and will have an increased chance of forming coke within the system. Oxidation is also accompanied by an increase in the acidity (TAN) of the fluid.

As with most chemical reactions, oxidation occurs more rapidly as the temperature is increased. At room temperature, the reaction rate is hardly measurable. However, at elevated temperatures, the effect is exponential and can impact the fluid life in systems not utilizing oxidation-reducing measures such as nitrogen blanketing the expansion tank.

In layman's terms, oxidation occurs when hot fluid is exposed to air. Signs of fluid oxidation become evident with the formation of sludge within the system – most notably in low flow areas such as reservoirs or expansion tanks.

Thermal

Thermal degradation, or thermal cracking, is the breaking of carbon-carbon bonds in the fluid molecules by heat to form smaller fragments or free radicals. The reaction may either stop at that point – in which case smaller molecules than previously existed are formed – or the fragments may react with each other to form polymeric molecules larger than those that previously existed in the fluid. In heat transfer terminology, these two types of degradation products are known as "low boilers" and "high boilers".

If thermal degradation occurs at extremely high temperatures the effect is it not only to break carbon-carbon bonds but to also separate hydrogen atoms from carbon atoms resulting in the formation of coke. In this situation, coke will start to foul the heat transfer surfaces very quickly and the system could soon cease to operate.

The degrading effect of low boilers is a measured decrease in the flash point and viscosity of the fluid as well as an increase in the fluid's vapor pressure. High boilers on the other hand, tend to increase the viscosity of the fluid – as long as they remain in solution. However, once their solubility limit is exceeded, they begin to form solids that can foul the heat transfer surfaces as they build up over time.

In layman's terms, thermal degradation is the result of overheating the oil past its boiling point. As the fluid boils, much like water, it produces a lighter component in the form of vapors. Excessive overheating or cracking can cause reduced viscosity as well as pose safety concerns. Along with the creation of these lighter components, the overall flash point, fire point and auto ignition temperatures of the fluid will be reduced to possibly unsafe levels.

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Caption:

Description:

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