# DURATHERM

## Extended Life Fluids

## FLUID DEGRADATION

### Oxidative Degradation ( Most common in small systems )

Oxidative degradation is the reaction of oxygen (in air) with the fluid the reaction of which create polymers or solids. These thicken the fluid and increase its viscosity. A more viscous fluid will be more difficult to pump, have poorer heat transfer characteristics as well as an increased chance of coke formation. Oxidation is also accompanied by an increase in the acidity (TAN) of the fluid.

Oxidation occurs more rapidly as the temperature is increased. At room temperature, the reaction rate is hardly measurable However; at temperatures encountered in systems in use in the plastics extrusion and die casting industries, as an example, oxidation is the main cause of fluid degradation and sludge formation commonly found in reservoirs and piping.

### Thermal Degradation ( Heating above 630F )

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

**Low Boilers** The effect of the low boilers is to decrease the flash point and viscosity of the fluid as well as to increase its vapor pressure. The increased vapor pressure can affect overall system efficiency and can cause pump cavitation. The reduction in the flash point could also be cause for safety concerns.

**High Boilers** If thermal degradation occurs at extreme temperatures greater than 400℃ (752℉), the effect is not only to break carbon - carbon bonds but to separate hydrogen atoms from carbon atoms and form coke. The effect of the high boilers is 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 which can foul the heat transfer surfaces. In this case, fouling of the heat transfer surfaces is very rapid and the system will soon cease to operate.

### Total Acid Number( n/t-H)

The common measurement of oxidative degradation is TAN. TAN will increase as fluids experience oxidative degradation. These acids will promote sludge and resin formation. TAN values above the range of 1.0 to 1.5 mg KOH/g are usually a cause for concern.

It is important to note that with smaller less efficient draining systems these acids can remain behind and contaminate new fluids. It is extremely important especially if the TAN number is greater than 1.0 to ensure maximum evacuation of the spent fluid prior to refilling.

### Flash Point

The flash point is important from the viewpoint of safety; however, it is not a concern unless it falls below 120℃ (248℉). It is quite common for heat transfer systems to be operated at temperatures above the flash point of the fluid.