

## **CARE AND MAINTENANCE OF WATER GLYCOL FLUID SYSTEMS**

Proper care and maintenance of water glycol fluid systems assists in extending both the service life of your fluid and system component life. Regular testing of water glycol fluids ensures the fire resistance, corrosion protection, cleanliness and overall performance in water glycol systems. Forsythe Lubrication has designed a sampling program to help our customers receive the maximum performance with the No Fire series of water glycol fire resistant hydraulic fluids.

### **SAMPLING**

A representative sample of fluid from the operating system must be taken. The sample should be taken from the output side of the reservoir, avoiding the extreme top or bottom of the reservoir. If this location cannot be used, the next best place is just over the weir in the reservoir or at least a representative sample of fluid entering the pump. Be sure to sample from the same location every time so that the result trends will be more meaningful. The sampling can be accomplished by using a "sample thief" or a similar device. It is advisable from time to time to have a look at samples from the top and bottom of the reservoir, since this will give an indication of tramp oil on the surface and any particulate contamination on the bottom of the reservoir.

All samples should be placed in clean containers with a sealed lid. Care should be taken to avoid outside contamination. Each sample should be labelled with the fluid name, sample location, contact person and date taken. Your Forsythe Representative can provide you with sample bottles and labels upon request.

Bimonthly samples are requested until a trend is established for a particular system. If the system is problematic or a problem arises, samples can be analyzed immediately.

Once the samples have been tested, a report will be issued indicating any apparent problems and will advise any corrective measures that should be taken to avoid maintenance problems or costly downtime.

### **ANALYSIS OF WATER GLYCOL FLUIDS**

The following are the routine tests that are performed on water glycol fluids:

#### **Colour and Appearance**

Discolouration of the fluid can be indicative of changes in fluid parameters. Exposure to tramp oil, hard water, metal ions and excessive heat can cause changes in the appearance of the fluid by changes in viscosity, water content, or reserve alkalinity.

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## **Viscosity at 40C, cSt**

Viscosity is a measure of a fluid's resistance to flow at a standard temperature. Significant changes in viscosity are symptomatic of other system changes.

An increase in fluid viscosity is often a result of loss of water and as such is handled by the addition of deionized water plus corrosion inhibitor to the system. Increases in viscosity may result in sluggish operation of the hydraulic system and enhance frictional resistance within the system resulting in localized heat.

Decrease in viscosity of the fluid is often a result of contamination, over addition of water, heat exchanger leaks and/or fluid degradation with shear and oxidation. The viscosity of a system can be increased by the addition of new fluid to the system but this method frequently requires a partial drain of the hydraulic system.

## **Water Content**

Maintaining the water content of your fire resistant hydraulic fluid will provide maximum fire resistance. As long as the fluid maintains a minimum level of thirty-five percent water, an ignition source will merely generate steam. The fire resistance of the fluid is compromised when it is below thirty-five percent, thus it is important to continuously monitor this value.

Water does, however, evaporate during normal hydraulic system operation. This loss of water is often due to natural evaporation losses that can be accelerated by localized heat sources in the system. Water content may be adjusted through the addition of deionized water plus corrosion inhibitor. The corrosion inhibitor is added with the water due to the loss of volatile inhibitors which are designed to evaporate and protect the head space of reservoirs and holding tanks. This recommended addition also prevents fluid system dilution in tight systems. Additive levels in new fluid are sufficient to address normal losses in closed systems operating at regular hydraulic design temperatures with periodic makeup. If extremes exist, supplementing the vapour phase corrosion inhibition package may be necessary. Your Forsythe Representative can provide you with the recommended addition based on test results and system volumes. Increases in viscosity due to water loss may be detrimental to system performance.

## **pH and Reserve Alkalinity**

Regulating the corrosion inhibitor preserves maximum corrosion protection for metals in contact with liquid or vapour.

As water glycol fluids age, the polymer and glycol can oxidize to produce acidic by-products. pH and reserve alkalinity are measures of the fluids ability to neutralize natural acidic degradation products of the fluid. Aging is accelerated when fluids are not maintained appropriately. The pH of the fluid should have a value of 8.5 or greater, to properly impart its corrosion inhibiting properties. Values greater than 9.5 will increase the likelihood of skin irritation and possibly dermatitis.

Forsythe Lubrication's water glycol fluids contain a volatile vapour and liquid-phase corrosion inhibitor which, by design, evaporates from the fluid and dissipates to the atmosphere over a long period of time during service. Additional less volatile amines impart fluid corrosion inhibition properties. These amines assist in maintaining the required alkalinity of the fluid. The loss of these amines can be expected to accompany the loss of water that occurs through evaporation under normal operating conditions. The rate of the occurrence depends on the operating temperatures (the higher the temperature, the more rapid the depletion) and the system design (an open system will lose additive faster than a closed system). Also, the amine content can be depleted through contamination. Therefore, it is necessary to establish a routine testing interval for each hydraulic system based on operating experience.

Reserve alkalinity differs from pH, in that it is a true measure of the fluids ability to neutralize acidic degradation products. However, pH and reserve alkalinity are directly related and systems should not exceed the upper limit on pH. The recorded losses in reserve alkalinity are indicative of the fluid degradation process and component losses.

Thus, if the pH and reserve alkalinity drops significantly, it is possible to compensate for the loss in a system. Your Forsythe Representative will be able to assist in correcting your system.

## **ADDITIONAL TESTS FOR WATER GLYCOL-NOT ROUTINELY DONE**

### **Cast Iron Chip Test**

The Cast Iron Chip Test can be performed to give an additional indication of the corrosion protection of the fluid. The Cast Iron Chip Test has been used for many years to assess the ability of metalworking fluids to prevent the rusting of machines and components during manufacturing operations. This particular test can show the presence of certain degradation products; such as formate/acetate ions, that can be corrosive even at a high pH and a moderate reserve alkalinity.

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## **Tramp Oil**

Mineral oil contamination is often referred to as "tramp oil". Tramp oil contamination is evidenced by an oil film or droplets floating on the fluid's surface or observed as a haze in the fluid, if it has been emulsified. Tramp oil in water glycol will readily oxidize to form a varnish, which will plate out on valves and hydraulic system components, causing sluggish operation and potentially further system damage. Tramp oil and varnish deposits on hydraulic components interfere with anti-corrosion and anti-wear properties of water glycol hydraulic fluids. Both contaminants also contribute to excessive filter consumption. Anti-wear additives present in tramp oil, also contribute to the formation of a white floc or white precipitate. This tramp oil should be regularly skimmed off of the surface of the fluid to prevent system problems.

## **Particle Count**

Particulate matter in samples is indicative of system contamination and/or degradation. Proper filtration of dirt and sludge is essential for a well maintained fire-resistant hydraulic fluid. Removal of these contaminants will increase the service life of sensitive equipment (pumps, valves, and servo mechanisms) and reduce downtime and overall costs caused by lost production.

## **Hard Water Contamination**

Contamination with hard water is evidenced by the formation of a floc or haze due to a reaction between the ions in the water and additives in the water glycol fluids. This reaction depletes the anti-wear additives and interferes with the corrosion protection. Floc is detrimental to a system's performance because it plugs servo valves, filters, and will cause increased incidents of component wear and fluid oxidation. If the fluid has been contaminated with hard water or there is floc present, it should be removed and replaced with a fresh fluid charge. The addition of make up water is normal maintenance for water glycol hydraulic systems due to the process of evaporation. Only distilled, or deionized water should be used. Boiler condensate and boiler blow down water are not suitable for this application, since the quality is generally unknown or variable. Boiler condensate and boiler blow down water can contain ionic contaminants. Forsythe Lubrication can provide a quality controlled source of deionized water for fluid maintenance of your water glycol hydraulic systems.

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