Effect of Gear Oil and Way Oil Lubricants on Water based Metalworking Coolants by Duane Fudge

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Gear lubricants are used on gears not running in oil to reduce noise. Gear lubricants are mainly of two types: straight mineral oil and extreme pressure lubricants. Straight mineral oil gear lubricants are petroleum oil based systems fortified to provide superior antiwear property and oxidation resistance.

Typical Components found in gear oils can be:

â€¢ Sulfur/Phosphorous antiwear systems â€“ Sulfur usually more active than found in hydraulic oils.

â€¢ Demulsifiers

â€¢ Antioxidants

â€¢ Fatty additives for lubricity

â€¢ Higher viscosity base oils

Because of the chemical nature of gear lubricants, their incorporation into water based metalworking system can cause a number of problems.

1. Microbial growth would be prominent not only due to the oil ingestion into the system, but the presence of the type of sulfur and phosphorous components used which could act as a food source.

2. Even though gear oils contain additives for oxidative stability, and water demulsification, they are more hydrolytically unstable than hydraulic fluids (primarily due to their fatty components). Emulsion and fluid instability can often result in water based metalworking systems if large amounts of gear oils are inadvertently added to systems.

3. Acidic by-products as a result of component breakdown in presence of water can also result in corrosion and staining issues.

4. Minimal levels of gear oils can readily emulsify into metalworking systems causing undesired foaming issues.

5. Due to the fatty components, saponification can also occur over time creating grease- like sludges in system.

Overall, gear oil system leakage into metalworking coolants should be eliminated if at all possible. It can cause staining of parts and make cleaning of parts more difficult. It can also greatly reduce coolant sump life and cam effect tool life. If leakage is inherent in system, coolant system should be monitored closely.

Way lubricants are used where the parts of a machine tool slide one against the other.A variety of lubricants can be used on machine ways, varying in viscosities and additive levels. Way oils are specially formulated with non-corrosive additives to provide anti â€œstick slipâ€• as well as tackiness additives to provide adhesive properties needed. A way lubricant should prevent chatter and metal â€“to-metal contact between localized machine areas. Due to the high degree of metal-to metal contact

seen on machine ways, way lubricants have the highest level of additive treat of all lubricant systems.

Typical components found in way oils are:

â€¢ High viscosity base oil (Viscosity grades are normally ISO 68, or ISO 220)

â€¢ Sulphur/Phosphorous additives or Sulfurized fatty materials for antiwear and stick slip requirements.

â€¢ Demulsifiers for water rejection (usually in higher end, high performance lube systems)

â€¢ High molecular weight Polymers for tackiness and adhesive properties.

Concentrations of such additive systems can be as high as 25% in formulated products. Because of the high additive concentration, way oils can result in adversely affecting water based coolant performance. Some of the conditions resulting from way lubricant contamination are:

1. Like all other lube oils, additional oil ingestion into water based system can promote microbial growth-particularly anaerobic.

2. Polymeric tackifiers used are oil soluble and will result in sludge formation and residue production when exposed to water based coolants. Cleaning ability on machined parts could be impacted as well as buildup on tools and dies.

3. More prone to emulsification in water based alkaline coolants due to higher levels of additives and types of sulfurized fatty additive chemistries traditionally used here.

4. Corrosion and staining can also occur due to presences of extremely active sulfur based materials.

Spindle and bearing lubricants (sometimes classified as cylinder lubricants) are based on oxidatively stable base oils ranging in viscosities from 30 SUS to 300 SUS, depending on application. They are the least compounded of all lubricating oils, containing only additives for stability (both thermal and oxidative). These systems are usually based on highly refined and higher purity base oils than found in hydraulic, gear, or way lubricant applications.

Typical components found in spindle oils:

â€¢ Base Oils (normally 30 - 50 SUS)

â€¢ Antioxidants

â€¢ Low levels of Phosphorous based additives

Contamination of water based metalworking fluids coolants by spindle oils is one of the most prominent sources of tramp oil in metalworking systems. As with most oils, incorporation into a water based system can introduce environments for microbial growth. One of the major effects is one of dilution of active ingredients in the metalworking system. Additive concentrations here are the range of those found in hydraulic lubricants (1-5%).

Spindle lubricant contamination into a water based metalworking system can result in the following:

1. Oil contamination into water based coolants can result in increased microbial growth and contamination.

2. Lower levels may be emulsified in, resulting in dilution of coolant additive systems.

3. Can produce staining and corrosion.

4. May result in residue and cleaning issues.

In summary, any oil contamination into a water based metalworking coolant will result in some effect on system performance, sump life, and maintenance requirements for that system. Such contamination should always be addressed and minimized- if not eliminated, to allow for the highest coolant performance.

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Headquartered in New Providence, NJ, Chemetall Americas has been developing, manufacturing, and supplying state-of-the art specialty chemical products since 1909. Our speciality in a coolants, iron phosphating, a rust preventatives, tube drawing, a zinc phosphating, metal working fluids.

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