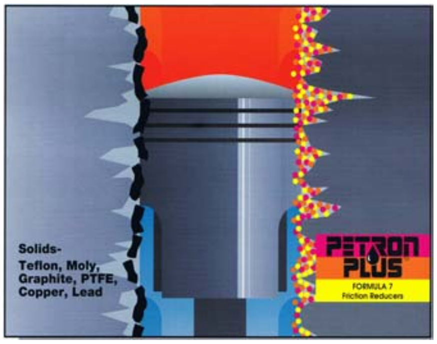
PETRON PLUS™

FORMULA 7



The Critical Role of Additives in Lubrication

TECHNICAL SERVICE BULLETIN

Lubrication professionals often become very familiar with the base oil viscosity of their lubricants. After all, viscosity is the most important property of a base oil. Baselines for incoming oils are set and the health of the lubricant is monitored based on viscosity alone. However, there is more to lubricants than just viscosity. It's crucial to understand the role of additives and their function(s) within the lubricant.

Additives are organic or inorganic compounds dissolved or suspended as solids in oil. They typically range between 0.1 to 30 percent of the oil volume, depending on the machine.

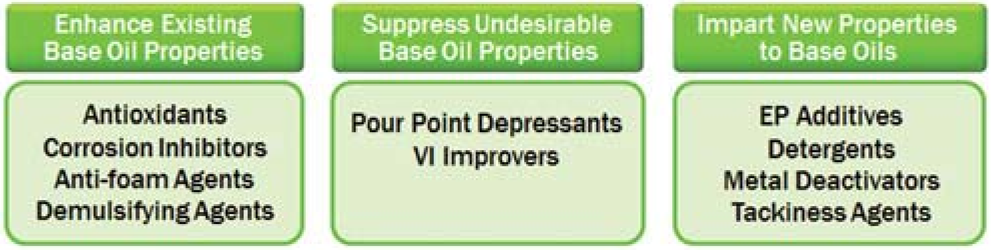
Additives have three basic roles:

- **1) Enhance existing base oil properties with antioxidants, corrosion inhibitors, anti-foam agents and demulsifying agents.**
- **2) Suppress undesirable base oil properties with pour-point depressants and viscosity index (VI) improvers.**
- **3) Impart new properties to base oils with extreme pressure (EP) additives, detergents, metal deactivators and tackiness agents.**

Polar Additives

Additive polarity is defined as the natural directional attraction of additive molecules to other polar materials in contact with oil. In simple terms, it is anything that water dissolves or dissolves into water. A sponge, a metal surface, dirt, water and wood pulp are all polar. Things that are not polar include wax, Teflon, mineral base stock, a duck's back and water repellents.

It's important to note that additives are also sacrificial. Once they are gone, they're gone. Think about the environment you work in, the products you produce and the types of contaminants that are around you daily. If you are allowing into your system contaminants that additives are attracted to, such as dirt, silica and water, the additives will cling to the contaminants and settle to the bottom or will be filtered out and deplete your additive package.



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Polar Mechanisms

There are a few polar mechanisms such as particle enveloping, water emulsifying and metal wetting that are worthy of discussion. Particle enveloping means that the additive will cling to the particle surface and envelop it. These additives are metal deactivators, detergents and dispersants. They are used to peptize (disperse) soot particles for the purpose of preventing agglomeration, settling and deposits, especially at low to moderate temperatures. You generally will see this in an engine. It offers a good reason to repair and eliminate any issues as soon as they are detected through an appropriate oil analysis test slate.

Too Much of a Good Thing

When using oil additives, more is not always better. As more additive is blended into the oil, sometimes there isn't any more benefit gained, and at times the performance actually deteriorates. In other cases, the performance of the additive doesn't improve, but the duration of service does improve.
In addition, increasing the percentage of a certain additive may improve one property of an oil while at the same time degrade another. When the specified concentrations of additives become unbalanced, overall oil quality can also be affected. Some additives compete with each other for the same space on a metal surface. If a high concentration of an anti-wear agent is added to the oil, the corrosion inhibitor may become less effective. The result may be an increase in corrosion-related problems.

Water emulsifying occurs when the additive polar head clings to a micro-droplet of moisture. These types of additives are emulsifying agents. Consider this the next time you observe water in a reservoir. While it is important to remove the water, determine where the water entered the system and repair it using a root-cause maintenance approach, you must also keep in mind that the additive package has been affected. In lubrication terms, this is known as additive depletion. A proper oil analysis report can determine the health of the additives remaining in the lubricant.

MACHINE	COMMON ADDITIVES USED	PERCENT OF OIL VOLUME
Engines	Antioxidant, corrosion inhibitor, detergent/dispersant, anti-wear, anti-foam, alkalinity improver	10 - 30%
Steam turbines, compressors	Antioxidant, corrosion inhibitor, demulsifier, anti-foam	0.5 - 5%
Gears (spiral, bevel or hypoid)	Anti-wear, antioxidant, anti-foam, sometimes corrosion inhibitor, extreme pressure	1 - 10%
Gears (worm)	Extreme pressure, antioxidant, corrosion inhibitor, fatty acids	3 - 10%
Hydraulic systems	Antioxidant, anti-wear, anti-foam, corrosion inhibitor, pour-point depressant, viscosity index improver	2 - 10%

Metal wetting is when additives anchor to metal surfaces, which is what they are supposed to do. They attach to the interior of the gear casing, gear teeth, bearings, shafts, etc. Additives that perform this function are rust inhibitors, anti-wear (AW) and EP additives, oiliness agents and corrosion inhibitors.

AW additives work specifically to protect metal surfaces during boundary conditions. They form a ductile, ash-like film at moderate to high contact temperatures (150 to 230 degrees F). Under boundary conditions, AW film shears instead of surface material.

One common anti-wear additive is zinc dialkyldithiophosphate (ZDDP). It reduces the risk of metal-to-metal contact, which can lead to increased heat, result in oxidation and negatively affect the film strength.

Whether they are enhancing, suppressing or imparting new properties to the base oil, additives play an important role in the lubrication of machinery. Remember, when the additives are gone, they're gone, so don't forget to check your additive package.

63%

of lubrication professionals monitor additive health as part of their oil analysis program, according to a recent poll at machinerylubrication.com

Pete Oviedo