TECHNICAL BULLETIN

Oil Additives: What's In Your Oil and Why is It There?

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Most people take motor oil for granted. Often, it doesn't get changed as regularly as it should and when it does get changed, many people don't always do their homework to get the right product for their particular application.

Regardless of brand, viscosity, base oil type, OEM approval or specification, most good engine oils have a combination of additives, balanced to produce a particular specification of lubricant.

So what are these additives, why are they important and what do they do?

Starting with the base oil, these can either be a mineral, synthetic or combination such as semi synthetic. These base oils act as a starting point for oil manufacturers, who then add a variety of additives to help the oil achieve its desired function. The additive packs can range from as much as 25% of the total volume of the oil and as low as 8% of the volume.

So what are these additives and what do they do when added to the engine oil? Below we have put together a glossary of additives to help you understand your options better the next time you're shopping for motor oil or gear oil:

Detergents

Nearly any oil with an API (American Petroleum Institute) engine rating has a level of detergency. Generally the later the specification, the higher the detergency. They are oil soluble bases that are derived from the organic soaps or salts of calcium, magnesium, sodium or barium. They are polar in nature, which allows them to cling to the surfaces of particles. Detergents serve two principal functions.

1) They lift any deposits from the surfaces of the engine to which they adhere to and then chemically combine to form a barrier film, which keeps the deposits from coming out of suspension and coagulating.
2) Detergents neutralize any acids formed by the combustion of the fuel by chemically reacting with the acids in order to form harmless neutralized chemicals.

Dispersants

These non-metallic, organic chemicals keep contaminants, sludge and by-products dispersed in the oil, helping to prevent deposits from forming. They are highly effective in controlling low temperature contaminants and can keep them so fine in suspension, they pass through the oil filter with the oil additives. They are "polar" and attract themselves to contaminants in the oil and form a barrier around it that doesn't let the contaminant attach to a metal surface. They also prevent viscosity increase & particulate abrasive wear, minimise and prevent sludge formation and stop oxidation related sludge formation.

Extreme Pressure Additives

Oils rated at API GL-2 and up contain extreme pressure (EP) additives of some description. Typically found in gear oils, these additives tend to be sulphur phosphorus based, although chlorine is also used. Some types are also found in compressor and hydraulic oils, and especially in slide-way oils and chain lubricants.

Friction Modifiers

These reduce internal engine friction between metal surfaces and vary in chemical nature depending on the type of oil. They are more commonly used in low viscosity oils where fuel economy is important. They can also be effective anti-wear agents in some oils. Current technologies do not cause the same problems with bore glazing as in the past.

Oxidation Inhibitors

These inhibitors reduce the effects of oxygen on the oil, helping to reduce oil thickening, especially at high temperatures. They also control carboxylic additives acids that attack iron metal and copper and lead bearings to form metal carboxylates, which further enhance the rate of oxidation.

Rust and Corrosion Inhibitors

These inhibitors prevent rust and corrosion on metal surfaces from acids.

Anti-Wear Agents

These agents prevent wear due to seizure or scuffing of rubbing surfaces. They are normally zinc, phosphorus or other organo-metallic materials. ZDDP (zinc dialkyl dithiophosphate), commonly used in break-in oils for flat tappet cam applications, is one of the more common anti-wear agents. Zinc is a polar molecule, so it is attracted to steel surfaces. Under heat and load, the Zinc reacts with the steel surface and creates a phosphate glass film that protects the steel surface by forming a sacrificial film that covers the peaks and fills in the valleys of the steel surface.

PENRITE OIL COMPANY PTY LTD, 88 Lewis Road, Wantirna South
Victoria AUSTRALIA 3152, ABN 25 005 001 525
Enquiries: Phone 1300-PENRITE (1300 736 748)
Fax: 1800-PENRITE (1800 736 748)
International: Phone: 61 3 9801 0877,Fax: 61 3 9801 0977
New Zealand Ph: 0800 533 698, Fax: 0508 736 748
United Kingdom and EU Ph: +44 (0) 1594 562357, Fax: +44 (0) 1594 564234
Website: www.penriteoil.com, Email: penrite@penriteoil.com

Foam Depressants/Air Release Agents
Foam inhibitors stop foam formation by altering the surface tension of the oil and by facilitating the separation of air bubbles from the oil phase. These additives generally have a limited solubility in oil, and therefore are added as very fine dispersions. These agents prevent foaming within the oil, thereby maintaining a lubrication film and the ability of the oil to be pumped at the required rate.

Pour Point Depressants:
In general, the pour point is indicative of the amount of wax in an oil. At low temperatures, wax tends to separate as crystals with a lattice-type structure. These crystals can trap a substantial amount of oil via association, inhibit oil flow, and ultimately hinder proper lubrication of the equipment. Pour Point Depressants reduce the oil's tendency to crystallize at low temperatures.

Emulsifiers & Demulsifiers
Emulsifiers are chemical compounds that enable two immiscible fluids to form an intimate mixture known as an emulsion. Water and oil mixtures are often used as lubricants in a number of industries for a variety of applications. **Emulsifiers** reduce the surface tension of water, and thereby facilitate thorough mixing of oil and water to form an emulsion. **Demulsifiers** are used in applications where water contamination of the lubricant is a problem and quick separation of water is desired. Automatic transmission fluids, hydraulic fluids, and industrial gear oils are examples of such lubricants.

Viscosity Index Improvers
Oils, which are effective lubricants at low temperatures, become less effective lubricants at high temperatures. At high temperatures, their film-forming ability diminishes, because of a drop in viscosity (oil film strength). Before VI Improvers, we had Mono Grade engine oils. VI improvers gave us Multi-grade engine oils.
VIIs change the oil's rate of thinning out the oil's viscosity as temperatures increase. They are polymers that expand as temperature increases–much like a slowly uncoiling spring. As they get hotter, they expand which reduces the oils thinning out process. There are many different types and those used in engine oils are very different to those in gear oils.

So next time you buy engine oil, you are not buying just oil alone. You are buying a complex and balanced blend of base oils and additives to protect for your engine.

Penrite recommend the "Right Oil for the Right Application"

Click Here to visit the Penrite Recommendation Guide, which will ensure you receive the correct oil for your vehicle

Click Here to visit the Penrite Pre-70's product guide.

PENRITE OIL COMPANY PTY LTD, 88 Lewis Road, Wantirna South
Victoria AUSTRALIA 3152, ABN 25 005 001 525
Enquiries: Phone 1300-PENRITE (1300 736 748)
Fax: 1800-PENRITE (1800 736 748)
International: Phone: 61 3 9801 0877,Fax: 61 3 9801 0977
New Zealand Ph: 0800 533 698, Fax: 0508 736 748
United Kingdom and EU Ph: +44 (0) 1594 562357, Fax: +44 (0) 1594 564234
Website: www.penriteoil.com, Email: penrite@penriteoil.com