

Dear Aviation Customer,

Total are excited about our entry into the Australian aviation lubricants market in 2014. General Aviation in Australia is of great importance in terms of its service to the population across your vast country, and also its key role in training the enormous numbers of airline pilots required for one of the fastest growing aviation regions in the world.

At Total, we have a long history of over 40 years in the aviation business and with leader status in Europe and Africa, we are very proud to now have a rapidly growing presence in Australia.

We are delighted to have the expertise of renowned aviation lubricants expert Murray Wilkes available to us in this market. Murray's knowledge and expertise is respected across the industry both in Australia and by us in Europe.

I hope that you will enjoy this, and future technical articles highlighting some of the important advances and benefits incorporated into the range of Total Aero lubricants.

Sincerely,

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General Aviation Lubricants Technical Bulletin

Modern Aviation

The world of aviation is always evolving. This has been especially true in General Aviation in recent years, where such things as the average lead level in avgas has significantly reduced due to the gradual phasing out of 100/130 grade fuel in favour of avgas 100LL and even 91UL (unleaded avgas). We are now also seeing some changes in fundamental engine operation with procedures such as 'Lean of Peak' becoming more widespread. These types of changes affect the environment inside your engine more than you might think, and it is important that your aero lubricant be formulated to provide the best possible operating life for your engine under the prevailing conditions.

Better Engine Oils

In the past when the lead content in avgas was on average much higher than the levels found today in 100LL, the traditional thinking with lubricant formulations was to focus more on the use of relatively unrefined base oils as the major oil component for these engines. The technical reasoning behind this was that the presence of molecules containing heteroatoms such as sulphur, nitrogen and oxygen in the finished lubricant helped to keep the higher levels of the various lead containing combustion by-products found in blow-by gases, in suspension in the oil system. Now that the lead levels typically found in used oil today are measurably lower, the use of a greater proportion of the more thermally stable groups of base oils available today is possible, whilst still maintaining a full control of lead contaminants. These more refined and better quality base oils produce lower amounts of the gummy deposits found around the inside of engines than when using older aero oil formulations. The degradation of lubrication performance with both temperature and age is much less evident with these advanced types of engine oils.

The Total Aero range of piston engine lubricants are formulated using these important principles.

Oxidation Stability

The reaction pathways that result in thermal oxidation of mineral oil based aero lubricants are complex and lead to the formation of deposits inside the engine, both in areas of extreme heat like around valves, valve guides and turbocharger bearings, and in low oil flow areas like piston ring grooves.

Some of the most easily oxidized components in engine oils are the aromatic molecules found in much higher concentrations in the relatively un-refined base oils used at high levels in many aero engine oils. The oxy-polymeric oxidation products that come from these and heteroatom containing molecules are particularly unhelpful when we look at the regions of highest temperature in aircraft engines, that is the upper regions of pistons and around the exhaust valves. The deposits formed in those regions are generally more gummy due to the partial combustion of the oxidation by-products, and cause the most immediate and noticeable issue of higher oil consumption, and un-even running in some cases. More oxidation resistant base oils are available, and these are called 'Group 2' oils. These oils contain virtually no heteroatom containing compounds, unlike the much more easily oxidized 'Group 1' base oils, and also contain very low levels of the undesirable aromatic molecules. Oxidation stability of 'Group 2' oils is typically twice the number of hours of 'Group 1' oils under similar conditions.

Total Aero oils use large percentages of Group 2 oils in their formulations.

Viscosity Index

Generally the more highly refined the component base oils in a formulated lubricant, the higher the Viscosity Index of the finished product for the same SAE grade (such as SAE 50) - when we are considering engine oils that do not include Viscosity Index improvers. Examples of commonly available SAE50 grade oils are Total Aero XPD100, Aeroshell W100 Plus and Phillips Victory 100AW.

Taking the typical Viscosity Index information for these three oils directly from their current published product data sheets, on their respective company's web sites, we find:

Total Aero XPD100 Viscosity Index = 124
Phillips 66 Victory 100AW Viscosity Index = 118
Aeroshell W100 Plus Viscosity Index = 116

Corrosive Acids

Another very unhelpful by-product of excessive oil oxidation is the production of much higher levels of very acidic compounds, in turn leading to the occurrence of increased internal engine corrosion such as seen on camshaft lobes. Of course, the consequence of this corrosion is subsequent failure of the hardened lifter surfaces and a costly premature engine overhaul or major repair.

For engines powered by leaded avgas, there are two major sources of acidic compounds in used oil, these are by-products of oil oxidation as discussed, and also the acids produced as a consequence of the presence of the lead scavenger Ethylene Di-bromide, which during the combustion process produces Hydrobromic Acid, a very corrosive substance that also contributes to engine corrosion issues.

Whilst some of the aero oils available today contain anti-corrosion additives, these additives are incapable of protecting an engine from corrosion properly for more than just a few weeks of non-use. It is helpful to reduce the load on these additives by trying to reduce the total acid levels in the used oil as much as possible. Using thermally stable lubricants such as the Total Aero range is a great option to assist here.

Summary

It is widely recognized by lubricant formulation chemists the world over, that oxidation degradation is one of the most important limiting factors in lubricant application. There is an intimate relationship between molecular structure, physical properties and thermal behaviour of a lubricant, and therefore real world performance.

Total Aero XPD100 has the potential to perform beautifully in your engine better due to its good oxidative stability, which results in lower oil acidity levels as the lubricant ages. There are potential savings for the aircraft owner of thousands of dollars in engine maintenance, and additional costs associated with failing to reach the TBO of your engine.

Authorised Total Aviation PE Lubricants Distributor

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