

AeroShell TECH TALK

W100 PLUS PLUS WHAT?

MODERN ADDITIVES COME TO AVIATION ENGINE OIL

A number of years ago, Shell developed a new aviation monograde oil which takes advantage of modern additive technology. This oil, AeroShell Oil W100 Plus, is a SAE 50 grade similar to the traditional W100 grade, but includes an anti wear additive, an anti corrosion additive and a metal passivator.

HOW DO THESE ADDITIVES WORK AND WHAT ADVANTAGE DO THEY GIVE YOU?

I am often asked about whether after market "wonder cure" additives benefit an engine and if they can be used in aviation piston engine oils. The general rule is that, unless they have been properly tested and approved for use in aircraft engines, they should not be used. Often these additives at best give no benefit at all, or can even cause the engine harm.

LET ME GIVE YOU SOME EXAMPLES.

Most of the additives on the market have been developed for the automotive market, where conditions are much different to those found in aircraft engines. In automotive engines, cylinder head temperatures are much lower, the fuel is unleaded, the piston diameter to length ratio is much smaller, the mean power setting is much lower etc. I could go on, but you get the idea.

These and other factors put different demands on the oil and have lead to aviation engine oils being much different to their automotive cousins. If we take the cylinder head temperature for instance, aviation engines typically run around 100 oC hotter than automotive engines and this leads to aviation oils needing to have specialised additives which do not form ash - hence the name ashless dispersant oils. If we were to use an additive which has been developed for the automotive market, then it is likely to be an ash forming compound which can cause combustion chamber deposits, leading to pre ignition which normally rapidly leads to a hole being burned through the piston and you looking at a stationary propeller and somewhere to land.

Other additives, such as the Teflon type "anti wear" additives, are sold as being able to improve engine lubrication. This type of additive is of dubious benefit and just coat the whole engine with a layer of Teflon, regardless of where it is needed. This can, at worst,

restrict oil ways and limit lubricant flow, and at best is an expensive way of putting an unnecessary coating on your oil filter. If they were useful, ask yourself why the oil companies do not blend them onto their oils already? These additives are not approved for use in aircraft engines, so using them is not only potentially dangerous, but also invalidates any engine warranty that you may have.

ADDITIVES IN W100 PLUS

Moving onto W100 Plus, the load carrying additive works in a more subtle way. The compound is blended into the oil and does not react until it is needed. The way this works is that if two moving parts start to make contact, then friction causes heat to be produced - this heat causes the additive to alter its chemical structure and it then reacts with the metal surfaces, coating them with a protective layer. If the two moving parts then try to make contact again, then they are separated by a layer of the additive even if no oil is present. In this way the additive is only deposited where it is needed.

You will appreciate that this is particularly useful in limiting wear when lubrication is marginal, such as on engine start up and on components which experience unusually high load - typically cams and cam followers.

This form of load carrying / anti wear additive is so effective that the same type of compound used in all modern jet engine oils to improve their performance; without it these oils would not meet the demands put on them. This has also been recognised by Lycoming; they have adopted the additive under the name LW16702, and is mandated for use in their O-320H, O-360E's and TIO-541 series engines. Therefore using AeroShell Oil W100 Plus means that no additional additive needs to be used if you operate one of these engines.

Not only does AeroShell Oil W100 Plus have this anti wear additive, but it also contains a "metal passivator" and a corrosion inhibitor. What does this mean?

Metals such as Copper are normally a problem for oils as they cause oil to degrade quicker than they would otherwise. This can be a problem as many General Aviation engines contain Copper - the largest area is normally found on cam shafts which is left over from the manufacturing process.

When cams are manufactured the cam face is often hardened using a process called Nitriding. This leaves a hard, but brittle, surface - ideal for the cam face, but not for the rest of the shaft. The rest of the shaft does not need to be hardened and it performs better if the surface is not brittle from the Nitriding process. So to protect the rest of the shaft, a thin layer of Copper plating is used to cover all the areas which do not need to be hardened. Once the cam has been manufactured this Copper serves no useful purpose, but it is not removed. This can be a problem for the oil in an engine because, as I have mentioned, the copper acts as a catalyst to make the oil degrade faster than normal - and a degraded oil does not make a good lubricant.

This is where the "metal passivator" comes in. This additive reacts with the surface of Copper components forming a protective layer which separates them from the oil, thus preventing the Copper from degrading the oil.

One more additive is used in AeroShell Oil W100 Plus and that is a corrosion inhibitor. This inhibits the formation of rust in the engine - a common root cause of engines not reaching TBO. Rust is often found in engines as used oil is acidic and, combined with dissolved water from the atmosphere, causes corrosion. If you are wondering why this problem is more pronounced than in automotive engines, it is all due to how often they are used. The average General Aviation aircraft flies for around 100 hours per year. Compare that to your own car which is probably 4 times that figure and you start to appreciate how under utilised aircraft engines generally are.

FINAL NOTES

I should make it clear that AeroShell W100 Plus is not a preservative oil, but an improved operational oil which has the ability to help prevent the common causes of engine damage by making use of modern additive technology. If you know that your aircraft is not going to be flown for a month or more, you should consider using a preservative oil such as AeroShell Fluid 2F.

The final thing to notice is that AeroShell Oil W100 Plus is a monograde oil - not a multigrade - and is therefore subject to the same ambient temperature limitations of all SAE 50 grade oils, such as AeroShell Oil W100. You should check your Pilot's Operating Manual to see what temperature range is suitable for SAE 50 grade

oils in your aircraft, but if you want to move to a multigrade, then similar benefits to those highlighted above can be gained from using our semi-synthetic multigrade AeroShell Oil W 15W-50.

Whilst advanced additives can be very useful in helping your engine reach its full overhaul life, they actually account for only a small proportion of the total oil formulation. Less than 10% of the total formulation is additives, the remainder being base oil and this is where Shell Aviation has another advantage over most of the competition. Shell Aviation is an integrated supplier, meaning that it wholly controls the whole process from crude oil selection, extraction from the ground, refining, blending and bottling. It may surprise you to know that most of the piston engine oil suppliers in the market, including many of the big-named competing oil majors, are not integrated suppliers: many buy their base oils from third parties and most don't even blend and bottle their own oils.

By being an integrated supplier Shell Aviation can carefully control the whole process which, combined with over 80 years of experience in supplying piston engine oils to this market, ensures that you, the customer, can rely on the fact that the oil in the bottle is ideally suited for the job in hand. In this way you have the reassurance of not just relying on the performance of additives, but you are also safe in the knowledge that everything in the bottle is carefully specified and controlled by a dedicated team who are experts in this field. We like to think that this careful attention to detail and intimate technical knowledge are some of the reasons that the AeroShell brand is the world's best selling and most trusted range of aviation piston engine oils.

Happy flying

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