GreasoloGy

By Light Plane Maintenance Staff

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Maintenance

Elbow grease, grease the skids, greasy kid's stuff; grease makes the world go 'round -- literally. The earliest forms of grease were various and sundry animal extrusions and leftovers.

Today still, numerous organically based greases give excellent service -- although their origins are more from lithium and calcium than bears. Synthetics have largely replaced organics in many markets, with wide temperature-stability being their biggest advantage.

Bewildering Array

A brief check of any lubricant supplier will demonstrate a bewildering number of choices. The Shell Company certainly has a near monopoly in the aviation grease arena, notwithstanding the popularity of Mobil 28 synthetic grease, similar in applications to Shell 22.

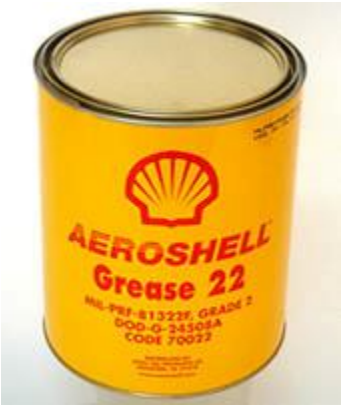
Because of their wide availability, we will concentrate on Shell products. Shell can be reached at **this Web site** for consumer questions on their lubricant use and availability. They have a 196-page booklet available for download that has specs for all their aviation products. Shell uses the name "Aeroshell" for its aviation products, but we'll stick to the general name "Shell" for this article.

We felt an overview of greases was necessary, since we get frequent questions on what lubricants to use.

One reader even commented that after reviewing the choices at the Shell web site, he felt little enlightenment as to the proper choice, since the word "general purpose" is the primary description used in most grease categories. We will make some definite recommendations later.

One Choice

There is still no perfect grease for all occasions. You could get away with one choice -- probably with Shell 22, a wide-temperature-range synthetic -- but we prefer to make two recommendations. You will still only need one grease gun, as one of our two recommendations is strictly for wheel-bearing use.



Aeroshell Grease 22 -- a good, multi-purpose grease

Interestingly, the use of automotive needs is not a major element in selecting aviation greases. In the auto world, everything is punctuated with extreme pressure (EP) additives such a molybdenum disulfide.

Could you get away with using auto grease in an airplane? It's done every day, but considering the low cost of grease on a relative basis for the individual, why not go with the established and recommended products?

Aviation greases are definitely different from the automotive brands, particularly when they are based on specific standards of cleanliness and what is in the product.

Planes that fly high or in cold weather should definitely stick with the proper selections, since improper grease can become like glue when it's cold enough. Try hitting the tarmac at 100 knots with frozen grease in the wheel bearings for a life-shortening experience in wheel-assembly components.

That squeal you hear is not a pig on the runway, but your bearings pleading for mercy. Fly low and slow and park in nice, dry, warm weather and you might get away with Crisco in the Zerks -- not recommended.

Composition

Grease is nothing more than a thickened oil designed to do one or more of the following tasks: seal, protect, cushion and, in general, provide long service-life of components. Since there is a spectrum of performance criteria, compromise is still the order of the day.

If you looked at the proportions of the basic ingredients in grease, you would find the base oil makes up about 70 to 95 percent, the thickener about 5 to 15 percent and performance additives from 0 to 5 percent. The base oil is the lube carrier, while the thickener provides resistance to water washout and mechanical stability.

The additive package provides antirust and anti-wear ingredients. EP ingredients are in the additive package as well, as are oxidation inhibitors. So, while the additive package makes up a small proportion, it can represent a significant part of the characteristics of the grease package.

Grease is often classified by the thickeners used in the product. Calcium is an old standby in the organically based greases and an example is Shell 14 with a moderate temperature performance and the least resistance to water washout of all Shell greases. Shell advises to verify seal compatibility first with Shell 14 (as it advises with most of their greases).

Shell 14's forte is it's the recommended grease for helicopter main and tail rotor bearings due to its superior anti-fretting properties.

An example of today's aero greases employing lithium is Shell 33, which has a high melting point but is the next least-water-resistant of the current Shell greases. This is a characteristic the airlines are willing to trade for its superior versatility.

Shell 15 is an extreme-temperature-range grease with silicone and Teflon, used in turbine engine bearings. Shell 16 is a multipurpose synthetic grease suitable for high-speed wheel bearings. On the other hand, Shell 17 is simply an EP version of Shell 7, with five-percent molybdenum disulfide. It meets MS 21164D.

Inorganic gels (synthetics) used in other Shell aero greases such as Shell 22 (MS-81322D) and Shell 5 (mineral based, MS-3545C -- obsolete reference) have excellent and good high-temperature performance respectively, as well as excellent water-washout resistance.

Shell 22CF is a variation on Shell 22 with similar capabilities; however, the "microgel" thickener is replaced with a clay thickener. It meets the same mil-spec as the Shell 22 and additional requirements of other standards. Shell 23C is a clay-thickened synthetic hydrocarbon that should only be used on steel surfaces.

The big advantage of a synthetic is that it won't soften at high temperatures and run off the surfaces it is designed to protect. Other additives are used in small quantities such as bentonite (clay) to enhance a particular trait.

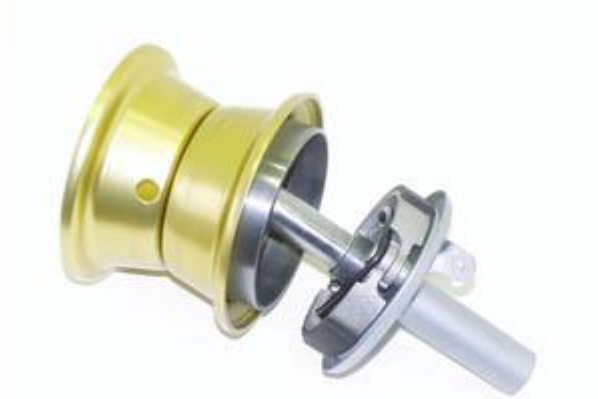
The second major component of grease is oil, which may be either synthetic or mineral-oil based. Shell 5, 6 and 14 use mineral oil. There are no duplicates in the combinations of base oil and thickener, with water washout and temperature range being big differentiators.

Either Shell 22 or Shell 5 is a first-rate choice for GA wheel bearings. If you have a high performance airplane that is a high flier, Shell 22 is probably the better bet because it has the best temperature range. Shell 5, on the other hand, has better corrosion resistance, but a significantly lower range of useful temperatures. It is also cheaper.

Primary Uses

First, high-speed roller bearings require clean grease, in the manufacture as well as storage and handling. Next, is thermal stability, because in roller bearings the balls tend to push the grease out of the way. If the grease melts, the race fills and churns the thinned grease, adding to friction.

If the grease is too thick, it will be displaced to the side and provide no real lubrication. Proper thickness is imperative, and the great temperature extremes of the inorganic gels like Shell 22 are one reason why they are so effective at this task.



Landing gear wheel bearing

Buying greases in overly large amounts makes sense only if you will use it in a reasonable amount of time, or if you have some way to assure it is kept clean. All the efforts of getting the right stuff are negated by inadvertent contamination by careless handling and storage. This can be a particularly vexing problem in a shop environment with multiple users, big containers and people in a hurry.

Moly or EP lubes are better suited for low-speed, high-pressure sliding surfaces, as they form a solid film on the parts that resists evaporation, water washout and corrosion. This can be counterintuitive somewhat, as one might think that this sticky, high-pressure stuff is the perfect grease for wheel bearings. It is what you tend to find in the automotive markets as the universal solution.

Mixing

Do you need to clean out the old stuff before using the new? Yes, particularly when changing from an organic-based product to an inorganic. There may be adverse chemical reactions that lessen the grease effectiveness.

For example, if you switch from Shell 5 to Shell 22, cleaning the bearings becomes particularly important. Even more so in applications such as in prop hubs, where corrosion damage can be very expensive to fix.

When repacking bearings, it's a good idea to clean them for other reasons as well, such as for inspection of the metal surfaces. Any good solvent will work fine, and as always recommended, don't spin dry bearings with shop air.

For grease fittings, you are obviously not going to disassemble the joints just to clean out old grease. The only thing you can do is be sure to run enough new grease into the fitting to displace as much old grease as possible, and stick with one type of grease (and the same brand).

Be sure to clean off the old, expelled grease, as it's not healthy for paint if left on for prolonged periods. Air loads can spread it everywhere.

Our Picks

First, look in your aircraft maintenance manual for the manufacturer's recommendations. Normally you will find a chart or diagram with all the fittings/locations and recommended lubricant or protectant products. (Some fitting locations may be virtually invisible without a diagram.) Schedules for lubrication will also be there. Hopefully, mil-spec. numbers will be included, which makes selection easy.

Don’t forget such things as gearboxes and gear motors, some of which take oils and others greases.

Barring specific recommendations from the manufacturer, we like Shell 22 for the wheel bearings of jets and other high-performance aircraft and Shell 5 for all others in wheel-bearing applications. Shell 5 has the greatest oil viscosity by orders of magnitude over all other Shell greases. Shell 5 is also recommended for magnetos, starters, and generators.

For the grease gun and airframe lube, we like Shell 6. Again, for high-performance aircraft and turbines, Shell 7, with its synthetic base oil, has a greater temperature range both high and low. Shell 7 is the product recommended by Shell for turbine applications of all types.

If you are determined to use only one grease for all applications, then go with Shell 22, but we strongly recommend you adhere to the mil-spec recommendations in your maintenance manual as the prime directive.

Grease has a shelf life of three years according to Shell's recommendations. After that it may start to break down into its component parts, and no longer do a good job or meet its specifications. Any stocks should be retested.

Gearboxes and Motors

While gearboxes generally use specialized fluids, when you are greasing, it's a good idea to check the manual for motor and gearbox servicing requirements. On Bonanzas it's every 300 hours, and not only includes the gear-actuator box, but also the gear motor itself with Shell 22. Judging from our inspections, these motors are frequently neglected. Don't say we didn't warn you if the gear fails to come down one day.

Servicing Fittings

First, if your airplane does not have plastic, protective, grease-fitting caps, go out and get some, as they are your first line of defense against grease-fitting contamination. They are cheap and effective and are carelessly yanked off and not replaced.

For Zerks that don't want to take grease, this device gives a shot of high pressure air with a hammer. It works to a limited degree.

If you have your plane serviced and this happens, you might use this as a barometer of the care your plane receives in areas you can't see. Taking care to do things right tends to extend to the little things as well as big.

Be sure to give the fitting a light wipe with a solvent dampened rag to be sure you don't start service by injecting dirt into the fitting. Unfortunately, constipated, dried out fittings are very common on fittings not greased regularly, and it leads to a cycle of neglect. Occasionally, disassembly is the only solution, but most times, they can be convinced to cooperate.

Taking the weight off the joint is a good idea anyway to help greasing. Sometimes, exercising the joint helps, as does doing the greasing in warm weather. A little heat from a hair drier (no higher temperatures) has been known to help make a fitting cooperative, as does cursing.

Increasing the pressure of the grease gun, if an option, can be a mixed bag; if the fitting is indeed clogged, you may only succeed in blowing the fitting off the assembly.

In addition, there is a hammer-struck tool that imparts a sudden, high-pressure air stream to the fitting for stuck Zerks. Use with great care and don't expect miracles. Lastly, a blast of WD-40 in the fitting and around the joint edges helps in some very limited applications, along with exercising the joint. The longer you let greasing go the harder to ultimately fix the fitting/joint.

Gun Talk

The typical hand-cranked grease gun will work fine on free-flowing fittings. They typically put out around 1500 psi. It normally will do just about all fittings on the plane with the stock connector. The first thing you should consider is a flexible hose to replace the rigid pipe. It makes maneuvering easier. Use a hand to hold the connector from popping off.

A light duty grease gun with air supplied from a compressor or tank is cheap and makes greasing far easier, faster and more effective.

Please take the pressure off guns with a plunger handle after use. Leaving the plunger engaged keeps pressure on the grease and tends to press all the oil out of the grease over time. What you have left is only the thickener -- not a good thing for the joint or ease of injection. An alternative is a compressed-air-assisted gun (not the expensive shop-type) with a built-in pressure multiplier. **Harbor Freight Tools** is a good source for low-cost ($15 - $25) guns. These imported guns are in the low-use, modest-quality category and will not stand up to commercial duty.

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