Shell Aviation

THE ANSWER BOOK

AeroShell

ENGINE OILS

BREAK-IN OIL*

AeroShell Oil 65, 80, 100, 120

- High-quality straight mineral oil
- Aids engine break in
- Prevents cylinders glazing
- Clean burning

*AeroShell oils are used primarily during the break in of many new or recently overhauled four-stroke aviation piston engines and in a few engines that require them for normal operations.

SPARK-IGNITION ENGINES

AeroShell Oil W 15W-50

- Reduced maintenance costs
- Fast-acting protection
- Climatic versatility
- Fuel saving

Greater temperature range and advanced corrosion protection

AeroShell Oil W 80 Plus, W100 Plus

- Added wear protection
- Added corrosion protection
- Proven ashless additive technology

Enhanced wear and corrosion protection

AeroShell Oil W 80, W 100, W 120

- Improved performance
- Proven ashless additive technology

DIESEL ENGINES

AeroShell Oil Diesel Ultra

- Promotes long engine life
- Reduced maintenance
- Developed with equipment manufacturers
- The only oil designed for diesel aero-engines burning jet fuel

LIGHT SPORT 4-STROKE ENGINES

AeroShell Oil Sport Plus 4

- Aviation-quality oil
- Multigrade climatic versatility
- Developed with ROTAX

The most commonly asked aviation questions

Pilots and mechanics rely on the full line of AeroShell® aviation products to protect their aircraft engines. As a leading supplier of aviation lubricants, we take our role seriously. No matter what the changing customer requirements are, we are committed to responding quickly and to providing a quality product to ensure a consistent standout performance. That is why, over the years, our team of lubricants experts has continued to welcome your comments and questions about our products. This information has helped the engineers at Shell to improve AeroShell® products to give you outstanding performance. On the following pages, you will find answers to some of the most frequently asked aviation questions.

Paul Royko – The Shell Aviation Guru

The *AeroShell® Answer Book* contains a collection of answers to the questions most frequently asked by pilots and mechanics and gathered by Paul Royko and the AeroShell® team. Paul, a pilot himself, joined Shell in 1997. He held several technical roles in the industrial lubricants segment before joining the aviation lubricants team in 1999.

With years of experience in aviation research and development for AeroShell®, Paul and the rest of the AeroShell® team are constantly working to create lubricants that can improve piston engine performance and make aircraft maintenance easier for pilots and mechanics. The AeroShell® team's experience, dedication and extensive knowledge of aircraft help to make AeroShell® the world's best-selling piston engine oil.

Known throughout the aviation industry as the "Shell Aviation Guru" for piston engine oils, Paul travels around the globe conducting technical training. In the USA, Paul presents recurrent FAA education seminars for mechanics and pilots alike. He is also a former FAA safety counsellor.

The AeroShell® Answer Book

Name_____

Address_____

AeroShell® product experience		
Type	Product used	Flying conditions
Piston engine oils		
AeroShell® Oil W 80/100 Plus		
AeroShell® Oil W 15W-50 Multigrade	✔	ALL TEMPERATURES
AeroShell® Oil W single grades		
Fluids		
AeroShell® Fluid 41		
AeroShell® Fluid 4*		
AeroShell® Fluid 31 Synthetic		
Greases		
AeroShell® Grease 5*		
AeroShell® Grease 6		
AeroShell® Grease 7		
AeroShell® Grease 14		
AeroShell® Grease 22		
AeroShell® Grease 33		
AeroShell® Grease 64		

* Only available in the Americas

AeroShell® ratings and benefits	
Breaking in	✔
Cold temperature starts	✔
Extended oil-change intervals	✔
Single and multigrade oils available	✔
Rust and corrosion protection	✔
SAE J-1899	✔
SAE J-1966	✔
Clean and free of sludge	✔
Excellent oxidation protection	✔
Wide range of temperatures	✔
Extreme pressure and heavy loads	✔
Extra protection and performance	✔
Multipurpose	✔
Tough conditions	✔
For new aircraft	✔

Certificates held	
Student pilot	
Recreational pilot	
Private pilot	
Commercial pilot	
Flight instructor	
Airline transport pilot	
Aviation technician	
Ground instructor	

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I fly only 50 hours a year, live in a relatively humid climate and my oil temperature is below 160°F (70°C). Will any oil protect my engine?

No. However, some companies would like you to believe their products will protect your engine under all conditions. In reality, oils with anti-rusting properties, such as AeroShell® Oil W 15W-50 and AeroShell® Oil W 100 Plus, need to be part of a good maintenance and flying programme.

02 What is the best way to judge an aviation oil?

Over the years, oils have come and gone. Most new products perform great in one bench test or another, or even in a short-term engine test, but the laboratory conditions may not duplicate real-world conditions. The best way to judge an oil is to see how it performs in actual service under real-world conditions. Some of these conditions may include sitting for weeks at a time, starting in less than ideal conditions and flying on days when your mother would have told you to stay at home. Oils with a proven track record like AeroShell® oils can be counted on to deliver top performance year after year.

03 I am not going to use my plane for some time. Should I use a different oil?

It is important that an aircraft be properly prepared if it is going to be inactive for a protracted length of time. This extends to the oil you use.

When an aircraft sits unused, especially in humid conditions, it rusts. Rust forms in the engine on cams, lifters and cylinder bores. Rusting can cause pitting and the rust particles may act as a very fine grinding compound in your oil. This can lead to increased wear and reduced engine life.

If your plane is going to be stored for the winter or if you are in the middle of a major restoration or repair project, it makes sense to use a special preservative such as AeroShell® Fluid 2XN.

AeroShell® Fluid 2XN can be used without blending for long-term engine inhibition or blended in the ratio of one part of AeroShell® Fluid 2XN to three parts of fresh AeroShell® straight mineral (break-in) oil (65, 80, 100, 120) to be used as an inhibited flyaway oil. (When using AeroShell® Fluid 2XN in radial engines, you cannot use the product as flyaway oil; it should only be used for ground running.) This resulting mix is excellent for use in engines that are going to be inactive for several months, as is often the case over winter. This blend of AeroShell® Fluid 2XN and AeroShell® straight mineral oil can be used in any certified aviation engine, although it is not recommend for use in two-stroke or automotive-derived engines.

Please note that AeroShell® Fluid 2XN has replaced another AeroShell® product, AeroShell® Fluid 2F. AeroShell® Fluid 2F was also a preservative fluid; however, this product was pre-mixed with AeroShell® Oil 100 and was only available in that viscosity. AeroShell® Fluid 2XN is more versatile, and can be used in conjunction with all AeroShell® straight mineral oils to accommodate different climates.

Using AeroShell® Fluid 2XN is easy. Once the AeroShell® Fluid 2XN has been mixed with AeroShell® straight mineral oil, the normal operational oil can be drained and replaced with this blend. You should run the engine for about 15 minutes, either on the ground or in the air*, to circulate the oil then shut the engine down and follow the normal storage procedure.

For additional protection, this oil can also be sprayed into the cylinders and other areas. Once the engine has cooled, it is worth blocking off the intake and exhaust, if possible, to reduce the flow of air (and therefore moisture) through the engine. However, you should remember to placard the cockpit to remind yourself and other pilots that this has been done.

*As mentioned on the previous page, it is important to remember that when you blend AeroShell® Fluid 2XN for radial engines, you should only use this mix for ground running.

Once you are ready to change back to your normal oil, you must first run the engine (for radial engines, only ground run). Run the engine to its normal operating temperature, then let the engine and oil cool down to a temperature that is safe to proceed with the oil change. Next, drain the preservation oil and refill the engine with the correct grade of AeroShell aviation oil.

Many operators with low-utilisation aircraft are currently taking advantage of the anti-wear and anti-corrosion additives found in AeroShell® Oil W 15W-50 multigrade and W Plus products. They often ask whether to use dedicated inhibiting oil such as AeroShell® Fluid 2XN and the answer lies in the utilisation of their aircraft.

If you intend to carry on flying throughout the year, but may have a few periods of several weeks' inactivity, you should use AeroShell® Oil W 15W-50, AeroShell® Oil W 100 Plus or AeroShell® Oil W 80 Plus. However, if you intend to lay the aircraft up for several months (winter or summer) and perhaps enjoy the occasional flight during this period, you should use AeroShell® Fluid 2XN mixed with AeroShell® straight mineral (break-in) oil. The engine can only be flown for a maximum of two hours when using AeroShell® Fluid 2XN per storage, and a total of 50 hours over the life of the engine when using AeroShell® Fluid 2XN.

04

I like to use multigrade oil for better cold starts, but like the protection of single-grade oil in the warmer summer months. Which oil is right for me?

The old adage that one should never change oil types was based on problems with some oils with very "unusual" technology that were in the marketplace over 50 years ago. Current oils are compatible. Therefore, many pilots use AeroShell® Oil W 15W-50 multigrade in the winter months and then switch to AeroShell® Oil W 100 Plus or AeroShell® Oil W 100 single grade in the summer months. You may see small changes in oil temperature or consumption with this change, but it will not hurt your engine.

05 Are multigrade and single-grade AeroShell® oils compatible?

The compatibility question covers two issues: mixing one grade of AeroShell® oil with another, and the effects on the engine of changing from one AeroShell® grade to another. If you typically run on AeroShell® multigrade and find yourself in a place where only AeroShell® single grades are available, you can safely add the AeroShell® single grade to your engine. They are completely compatible.

If you run on an AeroShell® single grade during the summer, but want to switch over to AeroShell® Oil W 15W-50 multigrade for the winter, you can safely replace the straight weight with the multigrade oil at your regular oil-drain interval. The idea that you have to stick with the type of oil you started with comes from the days of unusual chemistry when the resultant oils were incompatible. All approved SAE J-1899 (former MIL-L-22851) and SAE J-1966 (former MIL-L-6082) AeroShell® oils are compatible. For example, if you have a high-run-time engine using ashless dispersant oils and need to replace a cylinder, you can switch to a mineral oil for 50 hours or so to break in the new cylinder. The only time Shell recommends against switching is in a high-run-time engine using straight mineral oil exclusively. Here, a switch to ashless dispersant oil can loosen the deposits left behind by the mineral oil.

06 Will my oil temperature be higher or lower with a multigrade oil?

In most cases, the multigrade oil will run cooler. For a hot-running engine, such as turbocharged, high-performance or aerobatic aircraft engines, this is good, but for a cool-running engine, it can be disadvantageous. If the engine runs too cool, it cannot boil off excess moisture and unburned fuel, so there may be a tendency for acid build-up. For cooler-running engines, pilots should use a winterising kit or check with their mechanics on how to keep the oil temperature up.

07 When I drain my oil, should the engine be hot?

Yes. This can be very difficult on some aircraft, but it is recommended. The reason for changing oil when the engine is hot is to avoid the settling of dirt and water in a cold engine. When the engine is fully warm when it is drained, a higher percentage of contaminants is drained away with the old oil. When the engine is drained cold, more of these contaminants remain in the oil in the bottom of the pan, which results in more contaminants mixing with the new oil.

08 Is it necessary to change the oil filter at every oil change?

Yes. If you do not change the filter each time, the new oil will automatically start with 0.26 gal (1 L) of contaminated used oil. (Remember, the primary purpose for changing oil is to remove contaminants.) Old filters can serve as an excellent indicator of engine condition. An old filter that has been removed and cut open can indicate the engine's condition by the amount and size of the particles in the filter. If your engine is not equipped with an oil filter, the pressure screen should be monitored.

09

Does an oil change just include draining the hot oil, changing and inspecting the filter, and refilling the crankcase with the proper oil?

No. The pilot or mechanic should always review the manual for the proper procedures. For example, an inspection of the oil pan's suction screen is recommended at each oil change for most engines. Although one rarely finds anything during a maintenance check, it is not worth taking the risk.

10 Why does oil turn black between oil changes and why does the time it takes to change colour vary?

When a straight mineral oil turns dark or black, it usually means that the oil is starting to oxidise and needs to be changed. Because mineral oil does not absorb much of the dirt and sludge in your engine, the oil stays clean and the inside of your engine gets dirty. Ashless dispersant oils, however, are designed to get dirty so that the engine will stay clean. Just how quickly the oil turns black depends on several factors, including the condition of the engine, the dirt load, the oil temperature, the normal air/fuel mixture, the type of fuel, the time since the last service and the frequency and duration of your flights. The important thing to remember is to change your ashless dispersant oil on the calendar date and engine time, not according to its colour. In addition, oil analysis can help ensure that the oil is still in good condition, even though it may have turned black.

11 What can I do to ensure the accuracy and value of an oil analysis?

Oil analysis can help you to discover engine problems before they turn into major failures. However, the analysis information is only as good as the sampling procedure. A single test is not enough to reveal trends and significant changes, and can only tell you if there is already a serious problem, such as a scuffed piston. Take oil samples properly. For best results, take the sample about midway through draining the hot oil from the sump. A sample from the beginning or the end of the oil change may appear dirtier than it really is. Sample the oil the same way every time. An improperly taken sample can lead to some seriously inaccurate conclusions about engine malfunctions. Rely on a series of consistent tests over time. You are looking for significant changes or trends over time, not absolute values.

People want to label the results of a single test as good or bad, but the system does not usually work that way. Say you are buying a used aircraft. Do not rely on just one very good result from just one report; it could have come from a 5- or a 10-hour sample. Relatively constant numbers from the last six oil changes are a far better indicator that the engine is in good condition. Your record of regular oil changes and analyses is also helpful when selling an aircraft. Be consistent. If you change your oil after 50 hours and then after 25 hours the next time, the first sample may show twice the wear metals. (Expect higher wear metals during break-in or after some maintenance procedures, such as a cylinder replacement.) Finally, always remember that oil analysis should be part of a good maintenance programme not a replacement for one.

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Can I switch from a straight AeroShell® mineral oil to a single-grade ashless dispersant oil or even a semi-synthetic multigrade oil?

All AeroShell® oils are compatible and can be mixed with each other. Many single-grade customers try AeroShell® Oil W 15W-50 during the colder part of the year and then convert to using it year round. Others, however, alternate between single grade and multigrade, depending on the time of year. Either system works well because AeroShell® oils are entirely compatible and can be interchanged as desired. In addition, if you need to replace a cylinder on a mid-time engine, you can switch from AeroShell® Oil W single grade or AeroShell® Oil W 15W-50 to a straight AeroShell® mineral oil for one or two changes to break in the new cylinder. Then you can switch back to the ashless dispersant oil after the rings are properly seated.

If you have a mid-time engine that has been run exclusively on a straight mineral oil and wish to try an ashless dispersant oil, use caution. The introduction of an ashless dispersant oil into your engine could loosen some of the carbon deposits. So check your oil screens and filters often to guard against oil starvation and/or oil screen collapse.

13 Will the oil temperature affect the oil pressure in an aircraft engine?

Yes. The thickness, or viscosity, of an oil is directly affected by the temperature. Therefore, if an engine's oil temperature is increased, there will also be a small, but proportional, drop in the oil pressure.

14 How can I determine which oil is qualified for my aircraft engine?

Both Lycoming and Continental recommend oils qualified under the following specifications for use in their engines:

- SAE J-1899 former MIL-L-22851 (for ashless dispersant oils)
- SAE J-1966 former MIL-L-6082 (for straight mineral oils intended primarily for break-in).

Military and SAE specifications are the same except for some additional packaging requirements for the military. In the future, the military specification may be dropped, although oil containers will still probably refer to the former military specification. AeroShell® straight mineral oils, AeroShell® Oil W single-grade oil and AeroShell® Oil W multigrade oils all qualify under their respective specifications. The oil requirements for other aircraft engines such as Pratt & Whitney are less defined. All AeroShell® and AeroShell® Oil W oils are qualified for use in Pratt & Whitney radial piston engines. The oils for engines no longer in production may be listed by military specification or by product name. For more information, talk to an overhaul or repair shop that specialises in a particular engine, or call the Shell Technical Information Centre on +1 800 237 8645.

The selection of a proper grease is clearly defined. For each grease point on a certified aircraft, the military specification or the qualified product is listed. AeroShell® greases are qualified under the following specifications:

- AeroShell® Grease 5 former MIL-G-3545-C
- AeroShell® Grease 6 MIL-G-24139A, former MIL-G-7711A
- AeroShell® Grease 7 MIL-PRF-23827C, TYPE II
- AeroShell® Grease 14 MIL-G-25537C
- AeroShell® Grease 22 MIL-PRF-81322F, Grade 2 DOD-G-24508A
- AeroShell® Grease 33 MIL-PRF-23827C, TYPE I BMS-3-33B
- AeroShell® Grease 64 MIL-G-21164D (formerly AeroShell® Grease 33MS).

15 My oil temperature seems to be running low. Is this a problem?

Yes, low oil temperature can lead to excessive rusting and corrosion of critical engine parts. When an aircraft sits on the ramp or in a hangar, the engine heats up during the day and cools down at night. While the engine is cooling, some of the moisture in the air condenses on the engine walls and drops into the oil. This can form rust on internal engine components. The moisture can also react with by-products of combustion in the oil to form acids that may cause corrosion. The best way to remove this water is for the engine to boil it off during flight. Studies have shown that the temperature of your engine oil increases by about 50°F (33°C) as it circulates through the engine.

Therefore, unless the oil temperature reaches 170–180°F (77–82°C) during flight, the engine will not boil off the water that has accumulated in the crankcase. The result is rust and corrosion. Note that an excessively high oil temperature will also cause problems. Here are some tips to help avoid oil temperature problems:

- Check your oil temperature gauge for accuracy. It should read about 212°F (100°C) when the sensor is placed in boiling water.
- Monitor the oil temperature during flight. It should be about 180°F (82°C), even in winter. If it is lower, you may need a winterisation kit. Otherwise, check with your mechanic to see what is causing the excessively low oil temperature.
- The unique additive feature in anti-corrosion/anti-wear AeroShell® Oil W 15W-50 and AeroShell® Plus oils can also help to control problems caused by rust and corrosion.

16 Will the synthetic portion of semi-synthetic AeroShell® Oil W 15W-50 harm an aircraft engine?

Several pilots have asked this question. The answer is no. When Shell first started evaluating multigrade aviation piston-engine oils over 25 years ago, testing proved that multigrade oils formulated only with mineral base oils did not have adequate base oil viscosity (thickness) to properly lubricate all the high load points in the engine. Then we tested and flight evaluated a formulation made with all-synthetic base oils. This formulation had excellent anti-wear characteristics in all tests run. However, in the flight evaluations, some engines would reach 600 to 900 hours then lose oil consumption control and/or compression. When the engines were disassembled, we found that the piston rings were covered with a grey tacky substance that was primarily made up of the lead by-products of combustion (from the use of leaded aviation gasoline). Although synthetic oils are excellent lubricants with good high-temperature stability and very good low-temperature flow characteristics, they are relatively poor solvents.

In an aircraft engine, the lead by-products of combustion must be dissolved by the base oil so they can be carried away from the ring belt area and removed from the engine when the oil is changed. Anti-corrosion, anti-wear AeroShell® Oil W 15W-50 is formulated with 50% synthetic base oils to give it the excellent low-temperature flow needed for quick lubrication during cold starting. The synthetic base oils, along with the unique anti-wear additive system, give it anti-wear protection unequalled by any other product on the market. In addition, its mineral base oils provide lead absorbency to guard against ring sticking and excessive sludge. The bottom line is that the synthetic component of AeroShell® Oil W 15W-50 will not harm your engine. Instead, it gives you the best of both oils.

17 How can I safely dissipate a static charge generated when refuelling?

Whenever fuel is poured, pumped or moved from one container to another, a static charge is generated. The same principle is in effect when you walk across a carpet in the winter and get a shock from a doorknob. The charge level and the distance that can be jumped or arced depend on several factors: pump rate, temperature, humidity and containers. Static electricity is why a ground wire is always connected to commercial airliners and transport trucks whenever fuel is being transferred. When you transfer fuel into your car or light aircraft, the hose has a built-in ground wire that acts as an electrical path to dissipate any static charge. As an added precaution, there is usually an excessively rich air/fuel ratio in the fill pipe that will not burn. There are two primary areas where a pilot should exercise caution when transferring fuel. The first is draining an aircraft tank. For example, if you are draining a wing tank, you should always connect a jumper cable from the plane to the fuel container. This will dissipate the charge and eliminate the chance of a spark jumping from plane to container and causing a fire. Remember, when you are draining fuel, there may be enough air circulation so that the air/fuel ratio is in the burnable range.

The second area of concern is the filling process. Many FBOs use a ground wire when filling an aircraft, but in some cases, fuel is transferred from a drum or can into an aircraft. Here, a jumper wire is a good safety precaution to ensure that the charge is dissipated. If you use a metal funnel with metal cans, make sure that the can, funnel and plane are always touching during transfer. With metal containers, the electrical charge is dissipated to the conductive container where it can be discharged by a ground wire or contact. In plastic containers, there is no good electrically conductive path to dissipate the charge. Although some people put metal strips into the plastic container, I would recommend the use of metal containers with a good jumper wire. It is the safer way.

18 Do straight mineral oils have the same low-temperature flow as straight ashless oils?

No. The additive technology in ashless dispersant lubricants such as the AeroShell® Oil W range gives these oils flow characteristics that are roughly equivalent to the next highest grade straight mineral oil. For example, AeroShell® Oil W 100 will flow at about the same low temperatures as AeroShell® Oil 80.

19 As straight mineral oils do not have the same low-temperature flow as straight ashless oils, what does this mean to the average pilot or aircraft owner?

First, if you are breaking in your engine on mineral oil during the winter, always take extra precautions to ensure that the engine is properly preheated before flight. For example, if your service bulletins recommend preheating the engine whenever the temperature is below 20°F (–7°C), you may want to increase that to 30–35°F (1–2°C) when using straight mineral oil. Another concern is that mineral oil is more prone to oil cooler plugging at low temperatures. This is especially critical on aircraft used for high-altitude flight where the temperatures are even lower. If an aircraft is going to be broken in during the winter or at high altitudes, you should consider using a winterisation kit. The kit will reduce airflow through the oil cooler and the chance of oil cooler freeze-up. (However, be sure to remove the winterisation kit when it is no longer needed.) During winter break-in and high-altitude flight, pilots should also be especially observant of the oil temperature and pressure. If the oil pressure or oil temperature moves significantly up or down in flight, you may be experiencing oil cooler plugging or bypassing. If this occurs, you should take appropriate action.

20 If my aircraft engine has a supplemental type certificate for automotive gasoline, can I break in a new engine with it?

No. Most of the metallurgy in the valve train of aircraft engines was designed to be operated on leaded fuels. Even 80/87 engines were designed for fuels with 0.5 g/gal (13 mg/L) lead. Experience has shown that the lead level in aviation gasoline is especially critical during break-in. So, if you are breaking in a new or an overhauled engine, make sure you use a leaded 80/87 or 100/130 low-lead aviation gasoline for at least the first 50 hours of operation. Some fuel suppliers sell an unleaded 80/87, so make sure you are getting leaded gasoline for breaking in your engine.

21 Do all AeroShell® oils meet SAE specifications?

Yes. AeroShell® straight mineral oils meet the SAE J-1966 former MIL-L-6082 specification. AeroShell® Oil W single grade and anti-wear, anti-corrosion AeroShell® Oil W 15W-50 and AeroShell® Plus oils meet the SAE J-1899 former MIL-L-22851 specification. The AeroShell® containers are labelled with both the new SAE specifications and the “former” military specifications.

22 Why does my engine rust even though I fly often and with the gauges showing the correct temperature?

Pilots are always taught to "trust your gauges," which is a critical lesson especially when flying instrument flight rules. Most of us apply this lesson to our engine as well. However, another part of this lesson should be to check the calibration of all instruments periodically, including the oil temperature, tachometer and pressure gauges. Remember that quite a few general aviation aircraft are over 20 years old. So it is not surprising to hear numerous report of tachometers being off by several hundred revolutions per minute and temperature gauges being off by 5, 10, even 15 degrees. It is important to have your gauges checked and calibrated periodically. One method used is to put marks on the oil temperature gauge so that the "preferred" range can be easily seen. (The "green" band on many oil temperature gauges starts at just over 38°C (100°F), which is okay for taking off but too low for normal cruising.) Remember, oil temperature is one of the most critical parameters to be measured and controlled.

As a rule, many naturally aspirated engines will run even at an oil temperature that is too low. This can lead to excess moisture in the crankcase and rusting or corrosion of critical engine parts. Conversely, many turbocharged engines run too hot and care must be taken to keep the cylinder and oil temperatures down. In most cases, a cruising oil temperature of 82–93°C (180–200°F) is preferred. Temperatures below 77°C (170°F) usually do not provide proper boiling off of water, which can lead to rusting. At the other extreme, cruising oil temperatures significantly above 100°C (220°F) can be an indication of inadequate cooling.

23 What is the recommended oil consumption rate for my aircraft?

This is a question without a definitive answer. Oil can be consumed or lost by three different routes in an engine: the rings, leaks and the valve guides. In a good, tight engine, there should be very little oil consumption or loss via the guides and none through leaks. That leaves the rings as your primary concern. The amount of oil going past the rings will depend on the cylinder type and the break-in process. Assuming that the cylinders were broken in properly, the oil consumption may still vary according to the type of service and how the aircraft is flown. Even two identical engines (such on a twin-engine aircraft) operated in the same way may have different oil consumption rates. So what is right? Engine manufacturers state that oil consumption of up to a 0.26 gal/h (1 L/h) is acceptable on some models. (Some manuals for large radial engines say that anything over 6 gal/h (23 L/h) is excessive.) The best answer is that oil consumption will be at a certain level for each engine. Consumption changes should not be compared with an absolute level, but rather with the level that your engine sets historically.

Is lower oil consumption better?

Not necessarily. Oil consumption due to leaks and loose guides is certainly bad. However, some oil consumption past the rings is beneficial. When the piston moves down on the intake stroke, the ring leaves a very thin layer of oil on the cylinder wall. This film helps the compression rings to seal properly. If the oil consumption is too low, the seal may be inadequate, which leads to increased blow-by, higher cylinder wall temperatures and accelerated cylinder bore wear. If you have a large or turbocharged engine, you will probably be better off if your engine uses a little oil past the rings.

25 Do AeroShell® Oil W 15W-50 and AeroShell® Oil W 100 perform the same in an engine?

The oils are similar, but they do have some differences. The biggest difference is in cold-flow characteristics. AeroShell® Oil W 100 is up to 10 times thicker at cold temperatures than AeroShell® Oil W 15W-50. However, at normal operating temperatures (about 200°F, 93°C,), both oils will have the same thickness or viscosity. Another major difference is that AeroShell® Oil W 15W-50, AeroShell® Oil W 100 Plus and AeroShell® Oil W 80 Plus contain the LW 16702 anti-wear additive that is not found in AeroShell® Oil W 100. This additive, along with the semi-synthetic base oils, helps to reduce friction and improve flow in AeroShell® Oil W 15W-50. These additives improve lubrication and reduce oil consumption past the oil rings. Conversely, the improved flow can increase oil loss through leaks or loose intake valve guides. Therefore, your oil consumption may go up or down if you switch from AeroShell® Oil W 100 to AeroShell® Oil W 15W-50.

The improved flow and reduced friction characteristics of AeroShell® Oil W 15W-50 will also help to reduce oil temperatures unlike using AeroShell® Oil W 100. This is particularly important in engines that run hot, such as turbocharged, high-performance or aerobatic aircraft engines. Pilots should always remember to monitor the oil temperatures to ensure that they are not too high.

In cold weather, you should also make sure that the engine temperature is high enough to boil off the water that naturally accumulates in the crankcase. Temperatures in the 180–200°F (82–93°C) range are recommended for most applications. Understanding these differences can help you select the grade of AeroShell® that is right for your plane.

26 Does the W in AeroShell® Oil W stand for winter?

No. The W is just a model designator to differentiate between AeroShell® ashless dispersant oils (Oil W) and straight mineral AeroShell® oils, which have no letter designator.

27 How often should I change my oil?

A good rule of thumb for changing piston engine oil is to change it every four months. Of course for every rule, there are at least two exceptions.

Exception 1: If you are able to fly frequently with the proper oil temperature, you should adjust the four-month rule accordingly. Change your oil after 50 hours if you have flown the hours in less than four months. If your engine does not have an oil filter, change it after 25 hours. Always remember: the four-month rule is the most critical.

Exception 2: In recent years, the annual flight hours of many private planes have decreased, and where there is an idle plane, there is rust. When a plane engine sits too long, especially in humid climates or if there is excess moisture in the oil because the oil temperature is too low, rust will form on parts such as cams, lifters and cylinders. Then, once the plane has been started, the iron oxide will run through the entire engine oil system. Although some of the larger pieces will filter out, many of the smaller pieces will remain in the oil and may act as grit on critical wear surfaces. If you plan to not fly your aircraft for four months or more, be sure to use a storage or preservative oil such as AeroShell® Fluid 2XN to protect your engine.

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How can I make sure my oil temperature is shown accurately and identify the correct oil temperature range?

Placing a permanent reference mark at 180°F (82°C) on the green band of your oil gauge is a good way to get accurate readings. To do this, simply place your sending unit and an accurate, referenced thermometer in a steel container filled with oil and slowly heat it to 180°F (82°C) with a hot plate. You may not be able to hold 180°F (82°C) constantly, so first mark your gauge with a pencil as the oil temperature passes 180°F (82°C). Then let the oil cool back to 180°F (82°C). Repeat the process to ensure accuracy. Be extra careful with the hot oil. In a naturally aspirated aircraft engine, a cruising oil temperature significantly below 170–180°F (77–82°C) will not ensure that the moisture in the oil boils off, especially during short flights. As oil goes through the engine, the highest instantaneous temperature will be about 50°F (28°C) higher than the oil sump temperature. So, if you have an oil temperature of only 150–160°F (65–70°C), the oil will not get above the 212°F (100°C) necessary to boil off the water that can accumulate from condensation. The result is increased moisture and acid build-up in the crankcase, which will probably lead to rust and corrosion. This is especially critical if your aircraft is not flown regularly and sits in a humid climate for weeks at a time. If your oil runs well below the 180°F (82°C) mark, have your mechanic check your oil cooler system and the vernatherm. Also ask about a winterisation kit.

Conversely, the concern with the typical turbocharged piston engine is excessive heat. In many of these engines, the instantaneous oil temperature can increase by 70°F (39°C) or more at its hottest point compared with the sump temperature. These high temperatures can cause deposit build-up and increased wear due to improperly cooled components or low oil viscosity. (All oils, especially single-grade oils, thin as the temperature increases.) If your cruising oil temperature is well above 180°F (82°C) (especially if it is significantly above 200–210°F, 93–99°C), have your baffles and seals checked. Keep a close eye on your cylinder head temperature, exhaust gas temperature, leaning procedure and other operating conditions. The oil you choose is as important to your plane's performance as regular maintenance. AeroShell® Oil W 15W-50 and AeroShell® Plus oils offer anti-corrosion and anti-wear protection for all kinds of aircraft engines.

29 How important is preheating my engine?

Preheating your engine makes a lot of difference. This procedure heats the oil so that it is thin enough to flow through the engine and properly lubricate all the critical wear surfaces. Preheating also heats the metal parts in the engine. That is important because aluminium crankcases have a higher coefficient of thermal expansion than iron crankshafts. This means as your engine cools down, the clearance is reduced, and as a result, you may not have sufficient oil film thickness for proper hydrodynamic lubrication at very cold temperatures. In other words, the wear rate goes up.

If you are using a pan type heater, make sure it is a system that heats the whole engine, not just the oil. Some "oil pan" heaters can also raise the oil pan surface temperatures to over 300°F (150°C) which, over time, may reduce the performance of the oil. One final note of caution on heaters: Do not plug in a heater and leave it on for extended times. If you have moisture in your oil, the heater will increase the vaporisation, which will condense on the cool, nonheated engine parts and increase rusting.

Plane air/oil separators are also worthy of discussion. Separators are designed to remove the oil from the blow-by gas and return it to the crankcase. This reduces oil consumption and keeps the belly of the plane clean. Properly installed, separators work well. However, if the system is installed with parts in the cool area under the engine cowling, it may condense all the water evaporated from the oil and return it to the crankcase.

If you have a separator, make sure it is properly installed with the exit tube in a low-pressure area that will evacuate the water vapour and not force it back into the crankcase. Although preheating and the proper air/oil separator are essential to long engine life, they are no more essential than the oil you use. AeroShell® Oil W 15W-50 and AeroShell® Plus oils offer unsurpassed anti-corrosion and anti-wear protection for all kinds.

30 How important are baffles and seals to cylinder temperature?

Baffles and seals are critical to keeping an engine cool, yet they are often overlooked. When you are flying, air enters the cowling and creates static pressure above the engine. This pressure forces cool air down through your cylinders and oil cooler to the lower-pressure areas below and behind the engine. From there, the air travels out through the flaps or other flaring openings. What is important to consider is that there is only a given amount of air coming in through the cowling at any one time. If your baffles are broken or misshaped, the amount of air going past a particular cylinder or area will increase, and, if you increase airflow in one area, the airflow past the other cylinders and the oil cooler will decrease, which will lead to higher temperatures in some parts of the engine than others.

Seals can create similar problems. If your seals are not in good condition or not properly adjusted, they will allow air to bleed out, which can reduce static pressure and cooling. So what can you do? Whenever you install a new engine, always have the baffles checked. Also, as part of your periodic inspections, check all the seals for fit and condition. If the seals are not soft and pliable, replace them. Do this if your oil or cylinder temperatures seem abnormally high as well. In addition, check how the seals fit against the cowling. If there are noticeable gaps, adjust the seals to reduce air leakage. Be sure to inspect the holes at the rear of the cowling for excessive leakage. If your cylinder heads still run hot, it may be necessary for you or your mechanic to check the static air pressure above the engine during flight. The specification should be available from your airframe manufacturer.

31 Do I need more than one grease for my plane?

For most aircraft, yes. It is easy to think that all greases are the same, but using the wrong grease in the wrong application can cause serious problems. In fact, the correct selection and application of grease to the airframe is one of the most important choices a pilot, owner or mechanic can make. Grease is vital in preventing metal-to-metal contact so that mechanisms resist wear and operate smoothly. Grease also provides excellent protection against corrosion, one of the aviation industry's biggest concerns. Grease is truly unique as a lubricant because, unlike oil, it stays where it is put. It seals against dust and dirt, and enables additives to be held in dispersion. Generally, grease is composed of a base oil, thickeners and performance additives. Each of the ingredients lends its own inherent properties, and precise consistencies are necessary for the specific operating conditions in which the grease will be used. Never mix greases. It is also inadvisable to substitute one type of grease for another.

Just any grease may not satisfy the high- or low-temperature demands of icy wings and hot landings or meet seal compatibility or high load carrying requirements. Applying inappropriate grease to an operation can cause softening of the seals, grease leakage or ingress of dirt and water to the bearings. How do you determine the proper grease for a given application? Become informed: read the guides, airworthiness manuals and service bulletins put out by manufacturers. Remember that the grease recommended by the manufacturer is the only product approved by the FAA for use in that application. For older aircraft, it may be necessary to consult the original airframe manufacturer for specific product recommendations. If the manufacturer is no longer in business, check the rebuilder, the supplier or call the Shell Technical Information Centre on +1 800 237 8645.

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