AEROSHELL PISTON ENGINE OILS

For many years the performance of aircraft piston engines was such that they could be lubricated satisfactorily by means of straight mineral oils, blended from specially selected petroleum base stocks. However, demand for oils with higher degrees of thermal and oxidation stability necessitated 'fortifying' them with the addition of small quantities of non-petroleum materials. The first additives incorporated in straight mineral piston engine oils were based on the metallic salts of barium and calcium. In highly-rated engines the performance of these oils with respect to oxidation and thermal stability was excellent, but the combustion chambers of the majority of engines could not tolerate the presence of the ash deposits derived from these metal containing additives.

To overcome the disadvantages of harmful combustion chamber deposits, a non-metallic, i.e. non-ash forming, polymeric additive was developed which was incorporated in blends of selected mineral oil base stocks, to give the range of AeroShell W Oils.

Following extensive operational success in a wide range of civil engines, military specifications based on the general characteristics of AeroShell W Oils were prepared and issued.

AeroShell W Oils were in service with the world's airlines and aircraft operators for many years when they operated big transport piston engined aircraft, during which time these oils became virtually the standard for all aircraft piston engines. Nevertheless, supplies of straight AeroShell Oils remained available primarily for running-in the aircraft piston engine and for the few operators who required them. Today these oils (both AeroShell W Oils and AeroShell Oils) are still required for the smaller piston engined aircraft flying in air taxi operations or flying clubs or flown by private pilots.

More recently a semi-synthetic multigrade W oil for piston engines (AeroShell Oil W 15W-50) has been added to the range. This grade has become very popular amongst engine manufacturers and operators alike. In order to cater for those Lycoming engines which need improved load carrying (i.e. those engine models which require the addition of Lycoming Additive LW 16702) AeroShell Oil W 15W-50 was upgraded in 1986 to include an anti-wear additive.

In recent years utilisation of piston engine aircraft has decreased resulting in the aircraft spending more time on the ground. This led to an increase in corrosion being seen inside the engine and in order to combat this AeroShell Oil W 15W-50 was further upgraded in 1993 to include a very effective anti-corrosion additive package.

For those operators who prefer a straight grade but still want anti-wear and anti-corrosion benefits of the multigrade oil, AeroShell Oil W100 Plus has recently been added to the range.

SPECIFICATIONS

Since the 1940s, piston engine operators have relied on two U.S. Military Specifications for defining piston engine lubrication requirements. Beginning with the old standby non-dispersant MIL-L-6082 oils and continuing through the MIL-L-22851 Ashless Dispersant products, the U.S. Military Specifications were the standards for oil performance worldwide. In military circles Grades 1065 and 1100 as well as Type II and III were familiar grade identifications, whilst in civil use Grades 65, 80, 100 and 120 were common. However, that has all changed.

The SAE Fuels and Lubricants Technical Committee 8 – Aviation Piston Engine Fuels and Lubricant Committee has been working very closely with the U.S. Navy to convert these Military Specifications into SAE Standards. Also involved were oil manufacturers, engine builders, test laboratories and the American FAA. In due course agreement was reached on a new set of performance standards for piston engine oils. These new SAE Standards are J-1966 Lubricating Oil, Aircraft Piston Engine (Non-Dispersant) and J-1899 Lubricating Oil, Aircraft Piston Engine (Ashless Dispersant), both of which have now been adopted for use. The adoption of these new SAE Standards means that the two Military Specifications (MIL-L-6082 and MIL-L-22851) are now obsolete.

These new specifications include upgraded and improved tests and have been designed to meet current technology, and include the latest test methods and precision limits.

The most obvious change for users is the move from the old Grade or Type Number system to the more common SAE viscosity classification. Thus products in both SAE specifications are defined as SAE 30, 40, 50 or 60. In addition for the first time, multigrade aviation oils are included in the new specifications.

The U.K. has now cancelled DERD 2450 and DERD 2472 and adopted the SAE specifications.

FUNCTION OF PISTON ENGINE OIL

A piston engine oil's function inside a piston engine is to:-

- reduce friction between moving parts
- provide necessary cooling to internal areas
- cushion moving parts against shock and help seal piston rings to cylinder walls
- protect highly finished internal parts of the engine from rust and corrosion
- keep interior of engine clean and free of dirt, sludge, varnish and other harmful contaminants

APPLICATION

AeroShell Oils and AeroShell W Oils are intended for use in four-stroke cycle aircraft reciprocating piston engines. They are not recommended for use in automotive engines converted for use in aircraft, and in these cases the conversion shop should be consulted for proper oil recommendations.

The term "ashless dispersant" was given to aviation oils to distinguish them from straight mineral aircraft piston engine oils. Automotive and heavy duty truck engine oils contain ashless dispersants and ash-containing detergents. They were traditionally called detergent oils (some aircraft operators incorrectly refer to ashless dispersant oils as "detergent oils").

Because of the negative effect of ash on aircraft engine performance, it is very important that ash-containing oils are NOT used in an aircraft piston engine.

The reverse is also true. Never use an aircraft piston engine oil in a modern automobile or heavy duty truck engine.

Due to differences in metallurgy, operating conditions and fuel specifications, an aircraft oil will not meet all of the automobile/heavy-duty engine's requirements. In addition, the aviation oils are not qualified for this application and their use could result in voiding the warranty and/or reduction in engine life.

Thus automobile oils MUST NOT be used in aircraft engines which use or specify SAE J-1899 or J-1966 oils. Similarly aviation oils MUST NOT be used in automobile engines.

SELECTION OF RIGHT GRADE OF OIL

For the majority of aircraft piston engines the selection of the right grade is important to maximise engine performance and engine life.

Running-in	use	AeroShell Oils
Normal operation	use	AeroShell W Oils

SELECTION OF CORRECT VISCOSITY GRADE

AeroShell Oils and AeroShell W Oils are each available in four grades. The grades differ only by viscosity and thus cover the needs of all reciprocating engines now in airline and general aviation operation. There is no general rule by which the correct grade for every engine type can be chosen, but the following table provides approximate guidance for selecting the most suitable grade, based on the average ambient outside air temperature at engine start-up.

AeroShell Oil	**65 and W65**	**80 and W80**	**100, W100 and W100 Plus**	**120 and W120**
Outside air temperature °C	Below –12	–17 to 21	15.6 to 32	Above 26
Corresponding SAE No.	30	40	50	60

Note: This table does not apply to AeroShell Oil W 15W-50.

N.B. For large engines the choice depends greatly upon the operator's preference and past experience. Traditionally the choice seems to be associated with climatic zones: AeroShell Oil W100 or W100 Plus is preferred for temperate regions and AeroShell Oil W120 for warmer climates.

ENGINE CONVERSION

Elaborate precautions are not needed when changing from straight mineral oil to AeroShell W Oils, since both types of oil are compatible with each other.

Experience has shown that AeroShell W Oils do not loosen or affect the hard carbonaceous material already deposited in high-time engines, and may therefore be introduced at any time during the operational life of an engine.

The easiest and possibly the best way of converting a fleet of engines to an AeroShell W Oil is to 'top-up' with the oil commencing from a given date, and the majority of operators use this method following procedures recommended by the engine manufacturers concerned.

However, other operators have drained engines and refilled them with AeroShell W Oil. If this procedure is adopted, the oil filters should be checked after a ground run and at short intervals during initial operation, because the fresh charge of AeroShell W Oil may disperse 'pockets' of partly oxidised straight mineral oil which may have bound together and retained flaky carbonaceous material during previous operation.

OIL CHANGE INTERVAL

Almost all oil change recommendations specify not only an engine hour time limit, but also a calendar time limit. On low usage aircraft the calendar time limit is usually more critical than the engine hour limit. The need for frequent oil changes in aircraft is not caused by the oil wearing out, but rather by the oil becoming contaminated with by-products of combustion, dirt, water (both atmospheric as well as from condensation inside an engine) and unburnt fuel. This contamination can cause corrosion in the oil wetted areas of an engine and thus changing the oil removes these contaminants and helps to minimise corrosion. In order to minimise this corrosion inside low usage engines, calendar time changes are important.

OIL CHANGE EXTENSION

Many operators are interested in extending oil change intervals. As a general rule extensions are not recommended for the following reasons:-

- many engine manufacturers do not approve extended intervals
- possibility of losing engine manufacturers' warranty on engine
- possibility that extended intervals will shorten engine life

The initial enthusiasm in the U.S. for extended intervals has declined due to problems associated with lead sludge found in engines. Many operators have now reverted back to the engine manufacturers' oil change recommendations and found that these problems disappear.

Operators are urged to follow the engine manufacturers' or rebuilders' recommendation for oil change interval.

BREAK-IN PROCEDURE

Some aircraft engine manufacturers and rebuilders/overhaul agencies suggest in their service bulletins the use of straight mineral oil in new or newly overhauled engines for break-in. These straight mineral oils are usually recommended for the first 25 to 50 or even 100 hours of operation, or until the oil consumption stabilises. Other rebuilders or manufacturers, especially for such engines as the Lycoming O-320H, recommend an ashless dispersant oil for break-in. Operators should check with engine manufacturers or rebuilders for the correct recommendation for the specific engine and application.

STABILITY IN STORAGE

AeroShell W Oils are inherently stable and providing they have been stored and handled correctly prolonged storage does not have any effect on their quality, properties or performance.

RADIAL ENGINES

Radial engines utilise special parts and, depending upon the type of aircraft, application and climate are often subject to specific problems not seen in other types of piston engines.

In a radial engine each bank of cylinders has all of the cylinders in the same plane and transmits power through a single master rod bearing to the crankshaft. This master rod bearing is subjected to high loading and absorbs the shock and vibration from the cylinders and thus requires very good protection from the lubricant. Generally radial engines have greater piston and bearing clearances and thus require a high viscosity oil.

As a result of all this heavy duty stress, it is recommended that for radial engines used in normal operation (all operations except agricultural spraying), an oil such as AeroShell Oil W120 is used in moderate to temperate climates and AeroShell Oil W100 in cooler climates (if breaking-in then AeroShell Oil 120 and 100 respectively). Alternatively AeroShell Oil W 15W-50 could be used in those radial engines for which it is approved. None of these oils contain zinc additives which if used would quickly destroy the master rod bearing.

Agricultural operations represent a special problem for an oil used in radial engines. This is because of problems with high dirt and overspray ingestion into the oil. The best way to combat this is proper maintenance, good flying procedures and frequent oil changes.

VINTAGE AIRCRAFT

Vintage aircraft piston engines, including vintage radial engines, were approved on oils available when the engine was originally manufactured, such oils being no longer available. If the engine was approved on an aviation oil other than a MIL-L-6082 or a MIL-L-22851 oil then operators should consult with either the engine rebuilder or oil supplier. On no account assume that present oils are direct replacements for old vintage aircraft applications.

OIL ANALYSIS

Routine oil analysis is now seen as a valuable part of a good maintenance programme. Increasingly, operators are adopting oil analysis programmes in order to help discover problems before they turn into major failures. Typically these programmes consist of spectrometric wear metal check, together with a few simple oil tests such as viscosity and acidity. Shell Companies can offer this service to operators.

It is important to note that the information gained is only as good as the sampling procedure. A single test is not enough to reveal trends and significant changes, it can only tell an operator if there is already a serious problem. Operators should therefore:-

- **Take samples properly**

  For best results, take the sample about midway through the draining of hot oil from the sump. A sample pulled off the bottom may be dirtier than normal. The sample should be taken the same way every time. An improperly taken sample can lead to mistaken conclusions about engine problems.

- **Rely on a series of consistent tests over time**

  Operators should look for significant changes or trends over time, not just absolute values.

- **Take samples properly**

  Always take the sample the same way at the same time interval. Always properly label the sample so that its identity is known.

It is likely that higher wear metal levels will occur during break-in or following some maintenance procedures.

NON-AVIATION USE OF AEROSHELL PISTON ENGINE OILS

In selecting an AeroShell piston engine oil for a non-aviation application the properties of the oil must be examined. This will only give an approximate indication as to the expected performance in the specific application. However, such data must be regarded as guidance only. There is no laboratory test that can give a complete prediction of performance in actual use, and the final stage in any decision must involve performance tests in either the actual equipment or in the laboratory/test house under conditions expected in service.

AEROSHELL OILS 65, 80, 100 and 120

AeroShell straight mineral oils are blended from selected high viscosity index base stocks. These oils do not contain additives except for a small quantity of pourpoint depressant (which is added when improved fluidity at very low temperature is required) and an anti-oxidant.

APPLICATIONS

AeroShell Oils are available in four different viscosity grades:

AeroShell Oil 65 – AeroShell Oil 80
AeroShell Oil 100 – AeroShell Oil 120

The suffix for each grade corresponds to the viscosity of the oil at 210°F in Saybolt Universal Seconds.

The appropriate grades of these AeroShell Oils are approved for use in four-stroke cycle certified aircraft reciprocating piston engines (except Porsche) and other aircraft radial engines which use oil to specification SAE J-1966 (MIL-L-6082) and which do not require use of an oil containing a dispersant additive. AeroShell Oils are used primarily during break-in of most new or recently overhauled four-stroke cycle aviation piston engines. The duration and lubrication recommendations for break-in vary, so operators should refer to the original engine manufacturer and/or overhaul facility for specific recommendations.

SPECIFICATIONS

The U.S. Specification SAE J-1966 replaces MIL-L-6082E.

Although it was planned to replace the British Specification DERD 2472 with a DEF STAN specification this has now been put into abeyance and instead the SAE specification has been adopted.

AEROSHELL OIL	65	80
U.S.	Approved J-1966 SAE Grade 30	Approved J-1966 SAE Grade 40
British	—	Approved J-1966 SAE Grade 40
French	(AIR 3560/D Grade SAE 30)	(AIR 3560/D Grade SAE 40)
Russian	—	MS-14
NATO Code	O-113 Obsolete	—
Joint Service Designation	OM-107 Obsolete	OM-170

Continued

AEROSHELL OIL	100	120
U.S.	Approved J-1966 SAE Grade 50	Approved J-1966 SAE Grade 60
British	Approved J-1966 SAE Grade 50	—
French	(AIR 3560/D Grade SAE 50)	—
Russian	MS-20	—
NATO Code	O-117 Obsolete	—
Joint Service Designation	OM-270	OM-370 Obsolete

( ) indicates the product is equivalent to specification.

Typical Properties		65	80	100	120
SAE viscosity grade		30	40	50	60
Colour ASTM		4.5	5.0	5.0	6.0
Density @ 15°C	kg/l	0.887	0.892	0.896	0.898
Kinematic viscosity @ 100°C @ 40°C	mm^2/s	11.8 –	14.6 150	19.7 230	24.8 –
Viscosity Index		94	Above 94	Above 94	94
Pourpoint	°C	–20	Below –17	Below –17	–11
Flashpoint Cleveland Open Cup	°C	230	Above 240	Above 250	250
Carbon residue	% m	0.2	0.3	0.4	0.5
Total acidity	mgKOH/g	<0.1	<0.1	<0.1	<0.1
Sulphur	% m	0.1	0.13	0.13	0.15
Copper corrosion	@ 100°C	1	1	1	1
Ash content	% m	0.006	0.006	0.006	0.006

These products are made in more than one location and the approval status and typical properties may vary between locations.

AEROSHELL OILS W65, W80, W100 and W120

AeroShell W Oils were the first non-ash dispersant oils to be used in aircraft piston engines. They combine non-metallic additives with selected high viscosity index base stocks to give exceptional stability, dispersancy and anti-foaming performance. These additives leave no metallic ash residues that can lead to deposit formation in combustion chambers and on spark plugs, which can cause pre-ignition and possible engine failure.

APPLICATIONS

AeroShell W Oils are available in four different viscosity grades:

AeroShell Oil W65 – AeroShell Oil W80
AeroShell Oil W100 – AeroShell Oil W120

The suffix for each grade corresponds to the viscosity of the oil at 210°F in Saybolt Universal Seconds.

AeroShell W Oils are intended for use in four-stroke cycle certified reciprocating piston engines, including fuel-injected and turbocharged engines. AeroShell W Oils are not recommended for use in automotive engines. For automotive engines converted for use in aircraft, the specific engine manufacturer or the conversion agency should be consulted for proper oil recommendation.

Most radial engine operators use AeroShell Oil W120 in warm weather operations with AeroShell Oil W100 or AeroShell Oil W 15W-50 being used in cooler ambient temperatures.

AeroShell Oil W100 or AeroShell Oil W 15W-50 are the common choices for most operators of Lycoming and Continental flat engines but, during colder parts of the year, use of AeroShell Oil W80 in place of AeroShell Oil W100 would be an excellent choice.

Although some engine manufacturers and overhaulers suggest in their service bulletins the use of a straight mineral oil in new or recently overhauled engines for break-in, other rebuilders and manufacturers especially for engines such as the Lycoming O-320H recommend use of an AeroShell W Oil for break-in. Operators should therefore check with engine rebuilders or manufacturers for the correct recommendations for the specific engine.

AEROSHELL W OILS

- Promote engine cleanliness
- Help keep engines sludge free
- Help reduce oil consumption
- Help engines reach TBO (Time Between Overhaul)
- Protect highly stressed engine parts against scuffing and wear

SPECFICATIONS

The U.S. specification SAE J-1899 replaces MIL-L-22851D

Although it was planned to replace the British Specification DERD 2450 with a DEF STAN specification this has now been put into abeyance and instead the SAE specification has been adopted.

AEROSHELL OIL	W65	W80
U.S.	Approved J-1899 SAE Grade 30	Approved J-1899 SAE Grade 40
British	—	Approved J-1899 SAE Grade 40
French	—	(AIR 3570 Grade SAE 40)
Russian	—	MS-14
NATO Code	—	O-123 Obsolete
Joint Service Designation	—	OMD-160

AEROSHELL OIL	W100	W120
U.S.	Approved J-1899 SAE Grade 50	Approved J-1899 SAE Grade 60
British	Approved J-1899 SAE Grade 50	Approved J-1899 SAE Grade 60
French	(AIR 3570 Grade SAE 50)	(AIR 3570 Grade SAE 60)
Russian	MS-20	—
NATO Code	O-125 Obsolete	O-128 Obsolete
Joint Service Designation	OMD-250	OMD-370

( ) indicates the product is equivalent to specification.

EQUIPMENT MANUFACTURERS APPROVALS

AeroShell W Oils are approved for use by the following engine manufacturers:

Textron Lycoming	301F
Teledyne Continental	MHS 24B
Pratt & Whitney	Service Bulletin 1183-S
Curtiss Wright	Various Service Bulletins – refer to relevant Bulletin
Franklin Engines	Various Service Bulletins – refer to relevant Bulletin

AEROSHELL OIL

Typical Properties	**W65**	**W80**	**W100**	**W120**
SAE viscosity grade	30	40	50	60
Colour ASTM	2.0	4.0	4.0	5.0
Density @ 15°C kg/l	0.886	0.887	0.889	0.894
Kinematic viscosity mm^2/s @ 100°C @ 40°C	 11.0 84	 14.5 126	 20.2 213	 24.8 288
Viscosity Index	115	115	110	120
Pourpoint °C	–25	Below –22	Below –18	Below –18
Flashpoint Cleveland Open Cup °C	227	Above 240	Above 260	Above 240
Carbon residue % m	0.2	0.3	0.2	0.25
Total acidity mgKOH/g	0.01	<0.1	<0.1	<0.1
Sulphur % m	0.1	0.13	0.14	0.18
Copper corrosion @ 100°C	1	1	1	1
Ash content % m	0.006	0.006	0.006	0.006

A viscosity/temperature chart is shown at the end of this section.

These products are made in more than one location and the approval status and typical properties may vary between locations.

AEROSHELL OIL W 15W-50

AeroShell Oil W 15W-50 is a unique blend of high quality mineral oil and over 50% synthetic hydrocarbon base stocks, plus the AeroShell Oil W ashless dispersant additive system. This semi-synthetic blend offers high performance in a wide variety of applications and conditions. The synthetic base stock performance provides for better cold temperature pumping and protection than single grade oils. In addition, the blend of synthetic and high quality mineral base stocks provide high temperature performance superior to that of other fully approved aircraft piston engine oils. The mineral base stocks help disperse lead by-products of combustion, thereby keeping engines free of "grey paint" or lead sludge that can be a problem with some fully synthetic oils.

The anti-wear additive system in AeroShell Oil W 15W-50 provides outstanding wear protection for critical camshafts, lifters and other high wear components.

The anti-corrosion additive package in AeroShell Oil W 15W-50 helps protect low usage engines and engines in high humidity climates against rust and corrosion of critical engine parts such as camshafts and lifters.

AeroShell Oil W 15W-50 provides superior anti-corrosion protection for all types of certified aircraft piston engines. When used with proper maintenance procedures, the product provides maximum protection and improves the likelihood that aircraft engines will reach TBO. In addition, this product provides outstanding high temperature oxidation protection for hot running engines. It is designed to keep engines cleaner with less sludge and varnish build-up in critical ring belt and other areas.

APPLICATIONS

AeroShell Oil W 15W-50 is intended for use in certified four-stroke cycle aircraft piston engines. AeroShell Oil W 15W-50 is superior to single grade oils in almost every application. It offers easier starting, better lubrication after start-up, reduced wear, reduced corrosion and rusting, and improved cleanliness, with oil pressures and temperatures equal to that of single grade SAE 50 oils at fully warmed up conditions.

The anti-corrosion additive system is designed to prevent rust or corrosion in all types of aircraft piston engines. In comparative testing of camshaft rusting under high humidity conditions, AeroShell Oil W 15W-50 was almost entirely rust free while other camshafts conditioned on other oils showed sometimes heavy rusting on cam lobes and bearing surfaces.

These results indicate that AeroShell Oil W 15W-50 can provide maximum anti-corrosion protection for aircraft piston engines, when combined with proper maintenance practices and proper operating conditions.

Because of the improved flow characteristics of AeroShell Oil W 15W-50, operators may observe slightly lower oil temperatures in some aircraft. On larger aircraft, the oil cooler flap will normally compensate for this change. However, in small aircraft, oil temperature could be reduced slightly. Operators should always check the oil temperature to ensure that they are in the range specified by the manufacturer. Most manufacturers recommend cruising oil temperatures between 82 to 93°C (180 to 200°F). Oil temperatures significantly below this range can result in excessive water and fuel contamination in the crankcase.

AEROSHELL OIL W 15W-50

- Provides unsurpassed rust and corrosion protection for aircraft engines
- Promotes engine cleanliness, fights wear, offers excellent anti-foam properties
- Helps reduce oil consumption by up to 50% and provides superior oil flow at low temperatures
- Compatible with other approved aircraft piston engine oils
- Functions as an all season oil, no seasonal changes needed
- Reduces fuel consumption by up to 5% over straight grades
- Provides unequalled high temperature oxidation stability

Refer to General Notes at the front of this section for information on oil change recommendations and engine break-in.

AeroShell Oil W 15W-50 is not recommended for use in automotive engines. For automotive engines converted for use in aircraft, the specific engine manufacturer or the conversion agency should be consulted for proper oil recommendation.

SPECIFICATIONS

AeroShell Oil W 15W-50 was developed in co-operation with Textron Lycoming and Teledyne Continental Motors and conforms to their specifications 301F and MHS-24A respectively. This oil is also approved under Military Specification MIL-L-22851 which is now obsolete and has been replaced by the SAE J-1899 specification. AeroShell Oil W 15W-50 is also approved for use in all Pratt & Whitney radial aircraft engines. In addition AeroShell Oil W 15W-50 meets the provisions of Lycoming Service Bulletin 446C and 471, plus Service Instruction 1409A and meets the American FAA Airworthiness Directive 80-04-03 which specifies special anti-wear requirements for certain engine models.

AeroShell Oil W 15W-50 already contains, in the correct proportions, an anti-wear additive equivalent to the Lycoming additive LW 16702; operators who use AeroShell Oil W 15W-50 **DO NOT** need to add this Lycoming additive to the oil.

AeroShell Oil W 15W-50 is qualified for use in all Teledyne Continental Motors' liquid cooled and air cooled aircraft piston engines.

U.S.	Approved SAE J-1899 Grade Multigrade
British	Approved SAE J-1899 Grade Multigrade
French	–
Russian	–
NATO Code	0-162 Obsolete
Joint Service Designation	OMD-162

EQUIPMENT MANUFACTURERS APPROVALS

AeroShell Oil W 15W-50 is approved for use by the following engine manufacturers:

Textron Lycoming	301F Service Bulletins 446C and 471 Service Instruction 14909A
Teledyne Continental	MHS 24A SIL 99-2
Pratt & Whitney	Service Bulletin 1183-S
FAA	Airworthiness Directive 80-04-03

Properties		**SAE J-1899 Multigrade**	**Typical**
Oil Type		–	Mixed synthetic hydrocarbon and mineral
SAE Viscosity Grade		Multigrade	Multigrade
Colour ASTM		–	4.0
Density @ 15°C	kg/l	Report	0.86
Kinematic Viscosity @ 100°C @ 40°C	mm^2/s	 – –	 19.6 122
Viscosity Index		100 min	160
Pourpoint	°C	Report	–36
Flashpoint Cleveland Open Cup	°C	220 min	238
Total Acidity	mgKOH/g	1.0 max	0.01
Carbon Residue Ramsbottom	% m	–	0.14
Sulphur	% m	0.6 max	0.1
Copper corrosion 3 hrs @ 100°C 3 hrs @ 205°C		 1 max 3 max	 1 2
Ash content	% m	0.011 max	0.006
Trace sediment		Must pass	Passes
Foaming tendency		Must pass	Passes
Elastomer compatibility AMS 3217/1 72 hrs @ 70°C swell % AMS 3217/4 72 hrs @ 150°C swell %		 Must pass Must pass	 Passes Passes
Trace metal content		Must pass	Passes
Compatibility		Must pass	Passes

A viscosity/temperature chart is shown at the end of this section.

This product is made in more than one location and the approval status and typical properties may vary between locations.

AEROSHELL OIL W100 PLUS

AeroShell Oil W100 Plus is a new single grade oil that combines the single grade, ashless dispersant performance found in AeroShell Oil W100 and the anti-wear/anti-corrosion additives of AeroShell Oil W15W-50 Multigrade. It's the oil for pilots who prefer a single grade but who also want the extra protection and performance.

APPLICATIONS

The advanced additives in AeroShell Oil W100 Plus provide better rust and wear protection than conventional single grades. The additives work as a protective barrier to prevent critical parts from being slowly degraded by rust or wear, especially when an aircraft sits idle. This protection helps keep the camshaft and lifters coated, reducing the likelihood of premature damage and helping operators reach TBO.

AeroShell Oil W100 Plus

- Blended from selected high viscosity mineral base oils
- Contains AeroShell's proven W Oils additive package
- Additional anti-wear additives (containing Lycoming additive LW 16702)
- Additional anti-corrosion additives
- Fully compatible with other approved aircraft piston engine oils

SPECIFICATIONS

Approved SAE J-1899 SAE Grade 50

AeroShell Oil W100 Plus already contains, in the correct proportions, an anti-wear additive equivalent to the Lycoming additive LW 16702; thus it already complies with FAA Airworthiness Directive 80-04-03. Operators who use AeroShell Oil W100 Plus **DO NOT** need to add this Lycoming additive to the oil.

AeroShell Oil W100 Plus is qualified for use in all Teledyne Continental Motors liquid cooled and air cooled aircraft piston engines.

EQUIPMENT MANUFACTURERS' APPROVALS

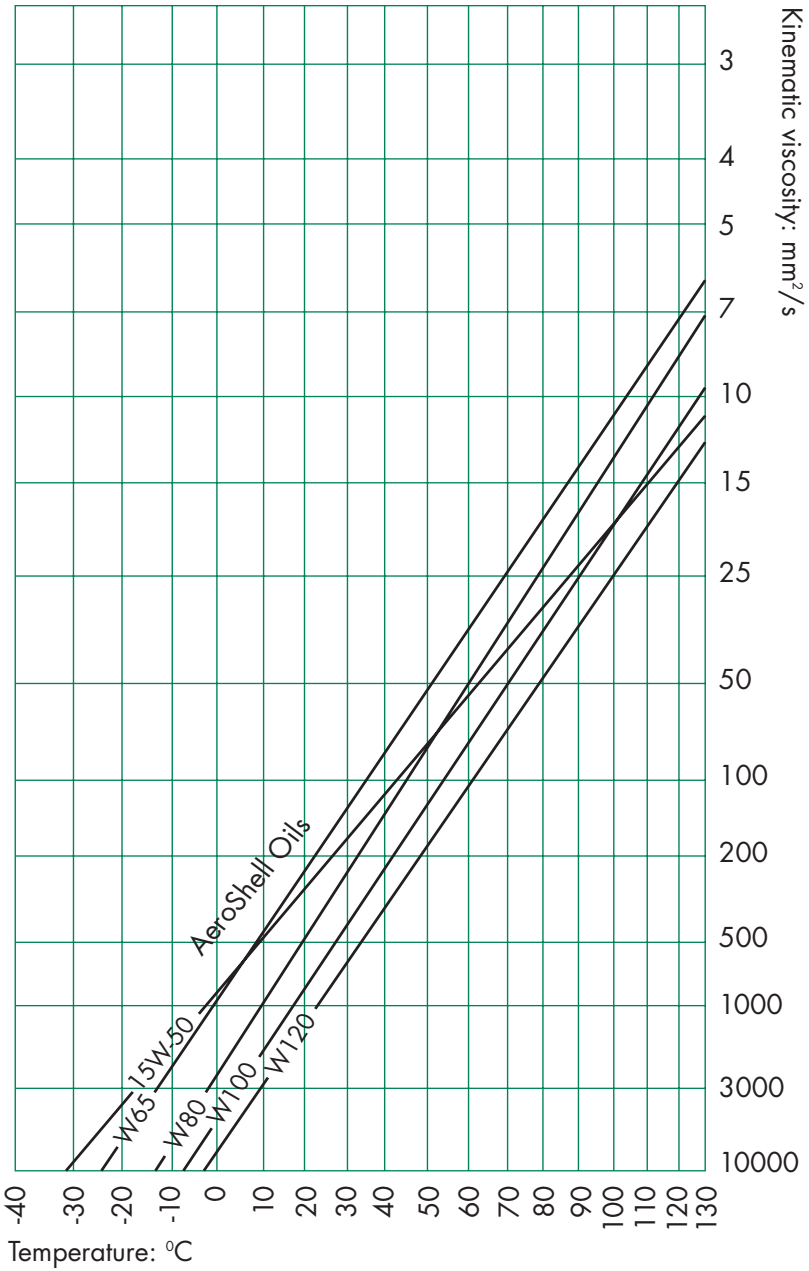
AeroShell Oil W100 Plus is approved for use by the following engine manufacturers:

Textron Lycoming	Service Bulletin 446C
Teledyne Continental	SIL 99-2
FAA	Airworthiness Directive 80-04-03R2

Properties		**SAE J-1988 SAE 50**	**Typical**
Colour ASTM		–	<3.0
Density @ 15°C	kg/l	Report	0.893
Kinematic Viscosity @ 100°C @ 40°C	mm^2/s	 16.3-21.9 Report	 19.96 195
Viscosity Index		95 min	116
Pourpoint	°C	–18 max	–21
Flashpoint Cleveland Open Cup	°C	243 min	288
Total Acidity	mgKOH/g	1.0 max	0.02
Sulphur	% m	1.0 max	0.26
Copper corrosion		1 max	1B
Ash content	% m	0.011 max	0.002

A viscosity/temperature chart is shown at the end of this section.

TYPICAL TEMPERATURE/VISCOSITY CURVES OF AEROSHELL W OILS



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