

AEROSHELL PRESERVATIVES

AeroShell Preservatives are used for the preservation and protection of aircraft, aircraft engines and aircraft components.

Two classes of corrosion preservatives are used on aircraft, those for protecting engine interiors and those for exterior application.

Corrosion protectives (internal-engines)

AeroShell Fluid 2F
AeroShell Fluid 2XN
AeroShell Fluid 2T

Piston engine corrosion protective fluids

Corrosion protection fluids are used for preventing cold corrosion which would occur during the storage or shipment of engines, principally because of the action of fuel combustion products trapped in piston engine cylinders after shut-down. In addition to the protection given by the compound they contain, these fluids neutralise the acid products of combustion resulting from the use of leaded fuel, e.g. hydrobromic acid.

British and American methods for inhibiting engines differ as is shown by the following specifications prescribing the official procedures:

	American	British
Piston engine practice:	MIL-E-6058B (Obsolete)	D.Eng.R.D. 2027 (Obsolete)
Turbine engine practice:	MIL-E-5607F (Obsolete)	D.Eng.R.D. 2028 (Obsolete)

For inhibited engine oils in piston engines the British procedure was to motor the engines cold using a 'storage' oil (DEF STAN 91-40) in the engine oil system, followed by spraying of various parts internally with a wax thickened oil/petrol mixture (DTD.791C).

The U.S. procedure differs according to whether the storage period is short term or for an extended period. For short term protection only one type of product is required and this is a 'flyaway' oil (AeroShell Fluid 2F, MIL-C-6529C Type II), which is added to the engine oil system while the engine is run-up under its own power. Immediately before shutdown it is sprayed into various parts of the engine as in the British procedure. AeroShell Fluid 2XN is the concentrate for AeroShell Fluid 2F.

Turbine Engine Corrosion Protective Fluids

Corrosion protective fluids to MIL-C-6529C Type III (AeroShell Fluid 2T) are suitable for the internal protection during storage of turbine engines which normally use mineral lubricating oil to MIL-PRF-6081D.

Corrosion protective fluids to MIL-PRF-8188D are suitable for the internal protection during storage of turbine engines which normally use synthetic lubricating oils to MIL-PRF-7808L.

More recently there has been increasing concern regarding corrosion inside turbine engines which use synthetic oils to MIL-PRF-23699 (formerly MIL-L-23699). In order to address these concerns the specification MIL-PRF-23699F has been revised to include a corrosion inhibited (C/I) grade alongside the standard (STD) grade and high temperature grade (HTS). AeroShell Turbine Oil 531 is approved to the C/I grade and full details are given in the engine oils section of this publication.

Corrosion Protectives - external

AeroShell Compound 02
AeroShell Compound 05

A variety of exterior corrosion preventatives are in current use to provide the many kinds of protection needed. The choice of protective depends upon the degree of protection necessary and ease of removal required. AeroShell Compound 02 is a temporary protective, whilst AeroShell Compound 05, which is a petroleum jelly/beeswax mixture, affords medium protection.

Corrosion protection is a big subject and whilst it is not within the scope of this handbook (there being many other publications available) the following key elements may be helpful in deciding what corrosion preventative to specify or use in any particular application. The key elements are:-

- period of protection required, i.e. short, medium or long term
- whether component or assembly is stored indoor, outdoors or undercover
- climatic conditions at point of storage if outside
- whether preservative is to be applied hot or cold
- method of application, i.e. spray, brush, dipping
- whether preservative includes a solvent as a carrier which then volatilises off
- film thickness of the preservative
- film strength i.e. hard, soft
- whether preservative is to be removed or is permanent
- whether component is to be handled (fingerprints are corrosive and some protective films cannot withstand handling)
- what other methods are used to aid or enhance preservation, for example, wrapping in grease proof paper, silica gel moisture absorbing crystals, cacooning assemblies etc.

Protectives for a wide range of applications are provided by Shell Ensis products, and Shell Vapour Phase Inhibitors, but these products are outside the scope of this publication.

AEROSHELL FLUID 2F

AeroShell Fluid 2F is an inhibited "flyaway" lubricating oil for the internal protection of piston engines during storage.

AeroShell Fluid 2F consists of three parts AeroShell Oil 100 (SAE J-1966 Grade SAE 50) with one part AeroShell Fluid 2XN (MIL-C-6529C Type I) – a corrosion preventative.

APPLICATIONS

AeroShell Fluid 2F is used as a piston engine preservative oil, also as a "flyaway" oil, in place of the normal engine oil. A period of 15 minutes engine running under idling conditions is required to ensure adequate distribution throughout the engine. It can also be applied to other parts of the engine and its accessories by spraying. The ashless anti-corrosion additive package and highly refined mineral base oils protect the engine by minimising the effects of humidity and neutralising the acidic components of engine oil oxidation and combustion by-products.

After storage and before operating the engine, rotate the crankshaft by hand and drain off the preservative oil. An additional optional precaution is to flush the engine with the correct grade of AeroShell oil before draining and re-filling with fresh oil.

Operation of engines containing "flyaway" oils is limited to 50 hours maximum. Detailed instructions for inhibiting piston engines are given in specifications MIL-E-6058B and MIL-E-6059A and in relevant engine manufacturer's publications.

AeroShell Fluid 2F may be used in conjunction with Shell VPI 260 or VPI 280 if protection for extended periods is required.

SPECIFICATIONS

U.S.	Approved MIL-C-6529C Type II
British	–
French	Equivalent to AIR 1503/B Type B
Russian	–
NATO Code	C-609
Joint Service Designation	OX-270 (obsolete)

PROPERTIES	MIL-C-6529C Type II	TYPICAL
Oil Type	–	Mineral
Kinematic viscosity mm ² /s @ 98.9°C @ 37.8°C	22.5 max –	20.0 265
Flashpoint, Cleveland Open Cup °C	204 min	257
Pourpoint °C	–12 max	Below –12
Relative Density @ 15.6/15.6°C	–	0.89
Carbon residue %m	2 max	0.45
Ash %m	0.015 max	0.01
Lead corrosion, 4 hrs @ 149°C, mg/in ²	70 max	14.3
Copper corrosion, 3 hrs @ 100°C	–	Passes
Rust protection (humidity cabinet)	–	Passes

AEROSHELL FLUID 2T

AeroShell Fluid 2T is a preservative mineral oil used for protecting certain types of turbine engine.

AeroShell Fluid 2T consists of three parts AeroShell Turbine Oil 2 (MIL-PRF-6081D Grade 1010 - a mineral turbine engine oil) with one part AeroShell Fluid 2XN (MIL-C-6529C Type I) – a corrosion preventative concentrate).

APPLICATIONS

AeroShell Fluid 2T is intended for preserving aircraft gas turbines which use engine oils to specification MIL-PRF-6081D, and in some engines using engine oils meeting specification DEF STAN 91-99 (DERD 2490). The ashless anti-corrosion additive package together with the highly refined mineral base oils protects the engine by minimising the effects of humidity and neutralising the acidic components of engine oil oxidation.

AeroShell Fluid 2T can either be purchased ready-mixed or can be blended using three parts AeroShell Turbine Oil 2 and one part AeroShell Fluid 2XN.

SPECIFICATIONS

U.S.	Approved MIL-C-6529C Type III
British	–
French	Equivalent to AIR 1504/B
Russian	–
NATO Code	C-610
Joint Service Designation	–

PROPERTIES	MIL-C-6529C Type III	TYPICAL
Oil Type	–	Mineral
Kinematic viscosity @ 40°C	mm ² /s	22.15
Flashpoint, Cleveland Open Cup °C	–	174
Relative Density @ 15.6/15.6°C	–	0.88
Carbon residue	%m	0.45
Ash	%m	0.01
Lead corrosion, 4 hrs @ 149°C,	mg/in ²	14.3
Copper corrosion, 3 hrs @ 100°C	–	Passes
Rust protection (humidity cabinet)	–	Passes

AEROSHELL FLUID 2XN

AeroShell Fluid 2XN is a corrosion preventative concentrate from which AeroShell Fluid 2F and AeroShell Fluid 2T are blended; the blending proportions are one part AeroShell Fluid 2XN to three parts AeroShell Oil 100 for AeroShell Fluid 2F and one part AeroShell Fluid 2XN to three parts AeroShell Turbine Oil 2 for AeroShell Fluid 2T.

In general, operators should obtain supplies blended ready for use in engines, unless the use of the concentrate is specified.

APPLICATIONS

AeroShell Fluid 2XN is primarily used as an ingredient of AeroShell Fluid 2F, but can be used undiluted to provide additional protection for piston engines after run-out on AeroShell Fluid 2F, by spraying exhaust ports, rocker arms, accessories.

For aircraft gas turbine engines a mixture of one part of AeroShell Fluid 2XN to three parts of AeroShell Turbine Oil 2 is required. Detailed instructions for inhibiting turbines are given in specification MIL-E-5607F.

The ashless anti-corrosion additive package together with the highly refined mineral base oil protects the engine by minimising the effects of humidity and neutralising the acidic components of engine oil oxidation and, in piston engines, the combustion byproducts as well.

SPECIFICATIONS

U.S.	Approved MIL-C-6529C Type I
British	(Has adopted MIL-C-6529C Type I) Approved DTD900/4913A (Obsolete)
French	Equivalent to AIR 1503/B Type B Concentrate
Russian	–
NATO Code	C-608
Joint Service Designation	ZX-21

Properties are controlled only for the finished blends using AeroShell Fluid 2XN.

PROPERTIES	MIL-C-6529C Type I	TYPICAL
Oil Type	–	Mineral
Kinematic viscosity mm ² /s @ 37.8°C @ 98.9°C	– –	254 20.0
Flashpoint, Cleveland Open Cup °C	–	254
Pourpoint °C	–	–17
Relative Density @ 15.6/15.6°C	–	0.9
Carbon residue %m	–	0.5
Ash %m	–	0.01
Lead corrosion, 4 hrs @ 149°C, mg/in ²	–	35
Copper corrosion, 3 hrs @ 100°C	–	Passes
Rust protection (humidity cabinet)	–	Passes

AEROSHELL COMPOUND 02

AeroShell Compound 02 is a quick drying lanolised fluid that provides temporary protection against corrosion.

The specification DEF.2331A (now obsolete) covered two grades of product namely PX-1 (Dyed) and PX-1 (Undyed) and originally AeroShell Compound 02 was dyed green and thus approved to PX-1 (Dyed). Current and future supplies of AeroShell Compound 02 to DEF STAN 80-217 will be undyed.

APPLICATIONS

AeroShell Compound 02 is intended for general use on aircraft components and metal surfaces which are liable to corrode during storage.

AeroShell Compound 02 should be well shaken before use and may be applied by spraying, brushing or dipping. It can be removed with kerosene, gasoline, white spirit, hydrocarbon solvents or suitable alkaline cleaner.

After application, the solvent evaporates to leave a thin soft film, which hardens slightly with age. The film is not hard enough to withstand handling, and the articles should be wrapped in grease-resistant wrapping if necessary. Articles should preferably be cleaned before use to remove any grit or dirt, the film itself will normally dissolve in lubricating oil.

In many cases two coats of AeroShell Compound 02 can be used in place of the obsolete grade AeroShell Compound 01 which met specifications MIL-C-16173D and DTD.663A.

SPECIFICATIONS

U.S.	Corresponding MIL-PRF-16173E Grade 2
British	Approved DEF STAN 80-217
French	Equivalent to AIR 1501
Russian	–
NATO Code	C-614
Joint Service Designation	PX-1

PROPERTIES	DEF STAN 80-217	TYPICAL
Flashpoint, SFCC °C	–	40
Total Solid Content @ 150°C %m	28 to 32	30
Water Content % vol	0.1 max	0.05
Relative Density @ 15.6/15.6°C	–	0.830
Film forming properties	Must pass	Passes
Drying time @ 20°C hr	–	1.0
Film thickness (dip application), microns	–	7.0

AEROSHELL COMPOUND 05

AeroShell Compound 05 is a petroleum jelly/beeswax mixture for protecting metal parts against corrosion under temperate and tropical conditions. Specification DEF STAN 80-85 requires the product to have the following approximate composition:

- High melting point mineral jelly (DEF STAN 91-38) 90% mass
- Beeswax (CS.2177) 10% mass.

APPLICATIONS

AeroShell Compound 05 is used for protecting piston assemblies, anti-friction bearings, chains and other small parts under temperate and tropical conditions. AeroShell Compound 05 is applied by hot dipping in melted material to give a film about 0.5 mm thick, the thickness can be controlled by the temperature and period of immersion. This gives a fairly firm, greasy film, with a slightly higher melting point, better texture and better protective qualities than plain mineral jelly. Grease resistant wrapping is necessary to protect the film from damage, but parts should be wrapped only after the film has set. The coating should be cleaned off before use, particularly to ensure freedom from grit and dirt, but meticulous cleaning is not necessary as any residual material will normally disperse harmlessly in the lubricant.

SPECIFICATIONS

U.S.	Corresponding MIL-C-11796C Class 3
British	Approved DEF STAN 80-85
French	Equivalent to AIR 8136
Russian	–
NATO Code	C-628
Joint Service Designation	PX-11

PROPERTIES	DEF STAN 80-85	TYPICAL
Melting point °C	65 min	70
Saponification value mgKOH/g	8.5 min	9.4
Ash % m	0.05 max	0.02
Inorganic Acidity	NIL	NIL
Total Acidity mgKOH/g	1.7 to 2.2	1.9