

LUBRICANT SPECIFICATIONS

A. SPECIFICATIONS FOR LUBRICATING OIL

1. SCOPE

This document covers the technical specification of Perflourinated polyether based oil for spacecraft applications.

2. APPLICABLE DOCUMENTS

The following standards form a part of this specification to the extent specified herein.

3. APPLICABLE STANDARDS

Kinematic viscosity	D 445
Viscosity Index	D 2270
Pour Point	D5950
Density	D 4052
Vacuum Stability	ASTM E595/ NASA SP-R- 0022A

4. CHEMICAL COMPOSITION

Perflourinated polyether (PFPE) base oil.

5. APPLICATIONS

Clear water white Perflourinated polyether based oil used extensively for bearings, Harmonic drives, Spur Gear Reduction units in space application. Fortified for reduced friction and ultra-filtered for precision applications.

6. PHYSICAL, THERMAL AND THERMOVACUUM PROPERTIES

S.No	PROPERTY/DESCRIPTION	METHOD	UNIT	METRIC/SPEC.	REMARKS
1	Oil	-	-	Perfluorinated polyether base oil	-
2.	Appearance	Visual	-	Clear, water-white	-
3.	Service Temperature	-	-	-70 °C to 200 °C	-
4.	Kinematic viscosity @ -65 °F @ 100 °F @ 210 °F	ASTM D445	cSt	13,000 Max 110-170 40-50	-
5.	Viscosity Index	D2270	-	340 Min	-
6.	Pour Point	D5950	°F	-100 Max	-
7.	Density @ 60 °F, Relative	D 4052	-	1.8-1.9	-
8.	Evaporation Loss (232°C/ 450 °F, 72 Hrs)	D 972	% wt	0.3 – 0.4	-
9.	Neut. Number	PF29/48-CA	Mg KOH/gm	0.2 Max	-
10.	Knudsen Vapour Pressure @ 20 °C/ 68°F	Knudsen	torr	3.5×10^{-13} - 4.5×10^{-13}	-
11.	Knudsen Vapour Pressure @ 100 °C/ 212 °F	Knudsen	torr	1.5×10^{-9} - 2.5×10^{-9}	-
12.	Vacuum Stability Total mass loss CVC Water Vapor Recovered	ASTM E595/NASA SP-R- 0022A	% wt % wt % wt	1.0 Max 0.10 Max 0.01 typical	-
13.	Particle contamination per 100 ml (5-15 microns)	FTM 3009	No. of Particles	<200	-

7. SUPPLY CONDITION

The products shall be supplied in 3 No's of 1pound pack separately in sealed condition.

8. ACCEPTANCE CRITERIA

- Batch number reference
- Certificate of Compliance
- Certificate of analysis for following parameters:

S. No	PROPERTY/DESCRIPTION	METHOD	UNIT	METRIC/SPEC.
1	Appearance	Visual	-	Clear, water-white
2.	Density @ 60 °F, Relative	D 4052	-	1.8-1.9
3.	Viscosity @ -65 °F @ 100 °F @ 210 °F	D 445	cSt	13,000 Max 110-170 40-50
4.	Viscosity Index	D 2270	-	340 Min
5.	Pour Point	D 5950	°F	-100 Max
6.	Neut. Number	PF29/48-CA	Mg KOH/gm	0.2 Max

7.	Vacuum Stability TML CVCM Water Vapor Recovered	E 595/ SP-R- 0022A	% wt	1.0 Max 0.10 Max 0.01 Typical
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9. IDENTIFICATION

The material shall be given proper identification to ensure traceability to the test certificates.

10. PRESERVATION, PACKING AND DISPATCH

The products shall be supplied in 3 No's of 1-pound packs separately in sealed condition.

11. CERTIFICATES AND REPORTS

Supplier/manufacturer shall furnish the following certificates and test reports:

- The supplier should furnish appropriate Certificate of Compliance (CoC) indicating the purchase order number.
- Certificate of analysis with the Batch number reference as per parameters mentioned in section-8.
- Batch number reference.

B. SPECIFICATION FOR LUBRICATING GREASE

1. SCOPE

This document covers the technical specifications of grease with Perfluorinated polyether as base oil for spacecraft application.

2. APPLICABLE STANDARDS

The following standards form a part of this specification to the extent specified herein.

Test	Method
Specific gravity	CN-TM-084
Viscosity	D 445
Viscosity Index	D 2270
Pour point, °C	D 5950
Neutralization Number	PF 29/48 CA
Appearance Workmanship Material	Visual
Penetration	D 1403
Dropping Point	D 2265
Oil Separation, Evaporation	FTM 321
Rust Prevention	D 1743
Four Ball Wear Test	D2266
Four Ball Extreme Pressure Weld Point,	D 2596
Vacuum stability	ASTM E 595/ SP-R-0022A (NASA)

3. CHEMICAL COMPOSITION

A smooth, buttery, translucent, off-white, NLGI #2 grease with base oil as Perfluorinated polyether and PTFE as thickener with added corrosion inhibitor.

4. APPLICATIONS

A smooth, buttery, translucent, off-white, NLGI #2 grease with base oil as Perfluorinated polyether and PTFE as thickener with added corrosion inhibitor used extensively for Bearings, Harmonic drives, Spur Gear Reduction units in space application. Fortified for reduced friction and ultra-filtered for precision applications.

5. LUBRICANT SPECIFICATION

DESCRIPTION	METHOD	UNITS	SPECIFICATIONS
Type	-	-	Grease with Perflourinated polyether as a base oil and Polytetrafluoroethylene (PTFE) as thickener
Additive	-	-	Corrosion inhibitor
Thickener	-	-	PTFE
Temperature Range	-	°C	-80°C to 204°C
Base oil- Perflourinated Polyether			
Specific Gravity @ 68 °F	CN-TM-084	-	1.8-1.9
Viscosity @ -65°F Viscosity @ 100°F Viscosity @ 210°F	D445	cSt	13,000 Max 110-170 40-50
Viscosity Index	D2270	-	340 Min
Pour Point	D 5950	°C	-73 Max
Neutralization Number	PF29/48 CA	-	0.2 Max
Vacuum Stability Total Mass Loss, Volatile condensable material	ASTM E 595/ SP-R-0022A (NASA)	(% Wt)	1.0 Max 0.1 Max
Grease Properties			
Appearance	Visual	-	Off-White/Smooth/Buttery
Penetration (77 °F), Unworked Penetration (77 °F), Worked	D 1403	mm ⁻¹	270-295 270-295
Dropping Point	D 2265	°C	182 Min
Oil Separation, 30hrs @400°F, Evaporation	FTM 321	%	15 Max 2 Max
Rust Prevention	D 1743	-	Pass
Cu Strip Corrosion, 212°F, 24 hrs	FTM 5309	-	2e Max
Four Ball Wear Test, Average Wear Scar Diameter (AWS D)	D 2266	mm	1mm Max
Four Ball Extreme Pressure Weld Point, AWS D	D 2596	Kgf mm	800 Min 3 Max
Vacuum Stability Total Mass Loss, Volatile Condensable Material	ASTM E 595 SP-R-0022A (NASA)	(%Wt)	1.0 Max 0.1 Max

6. SUPPLY CONDITIONS

The products shall be supplied in 1 number of 1-pound pack in sealed condition.

7. ACCEPTANCE CRITERIA

- Certificate of Conformance
- Certificate of analysis for the parameters mentioned in section-6
- Batch Reference Number

8. IDENTIFICATION

The material shall be given proper identification to ensure traceability to the test certificates.

9. REPORTS AND CERTIFICATES

Supplier/manufacture shall furnish the following certificates and test reports:

- The supplier should furnish appropriate Certificate of Compliance (CoC) indicating the purchase order number.
- Certificate of analysis with the Batch number reference as per parameters mentioned in section-5.
- Batch number reference.

C. SPECIFICATION FOR LUBRICANT CLEANING AGENT

1. SCOPE

This document covers the technical specifications of a fluorinated, fast evaporating “ozone safe” solvent consisting blended fluorinated alkanes for Cleaning surface of Substrate for lubricants in section A and B.

2. APPLICABLE DOCUMENTS

The following standards form a part of this specification to the extent specified herein.

3. APPLICABLE STANDARDS

Viscosity	ASTM D 445
Boiling point	ASTM D 92
Specific Gravity	CN-TM-084
Flash Point	ASTM D 93

4. CHEMICAL COMPOSITION

An azeotrope-like fluorinated solvent blend consisting of 1,2-trans-dichloroethylene, HFC-365mfc(1,1,1,3,3-petafluorobutane). It should have Zero Ozone Depletion Potential (ODP) and very low global warming potential.

5. PHYSICAL, THERMAL AND THERMO-VACUUM PROPERTIES

S.No	PROPERTY/DESCRIPTION	TEST METHOD	UNIT	SPECIFICATIONS
1	Appearance	Visual	-	Clear and Bright
2.	Odour	-	-	Slight
3.	Specific Gravity	CN-TM-084	-	1.1 -1.3
4	Boiling Point	D 92	°C	40-45
5.	Flash Point	D 93	°C	None
6.	Water Solubility @ 20 °C		% wt	0.05-0.07
7.	Viscosity	ASTM D 445	cPs	0.60-0.70
8.	Refractive Index @ 20 °C		-	1.3-1.43
9.	Vapour Pressure @ 32 °F @ 77 °F @ 122 °F	Knudsen	Pa	250-275 600-650 1450-1500

6. SUPPLY CONDITION

The product shall be supplied in 3 numbers of 1 Quart (950 ml) bottles separately in sealed condition.

7. ACCEPTANCE CRITERIA

- Certificate of compliance
- Certificate of analysis with Batch number reference as per parameters mentioned in section-5.

- Batch number reference

8. IDENTIFICATION

The material shall be given proper identification to ensure traceability to the test certificates.

9. PRESERVATION, PACKING AND DISPATCH

The product shall be supplied in 3 numbers of 1 Quart (950 ml) bottles separately in sealed condition.

10. CERTIFICATES AND REPORTS

Supplier/manufacturer shall furnish the following certificates and test reports

- The supplier should furnish appropriate Certificate of compliance (CoC) indicating the purchase order number.
- Certificate of analysis with Batch number reference as per parameters mentioned in section-5.
- Batch number reference.

TERMS AND CONDITIONS

Applicable to products in section A, B and C:

- Lubricating oil in Section-A, Lubricating Grease in Section-B and Lubricant Cleaning agent in Section-C shall be the product of same manufacturer due to the compatibility.
- Shelf life for lubricating oil in Section-A, Lubricating Grease in Section-B, Lubricant Cleaning agent in Section-C to be provided by Vendor/ manufacturer. (Storage conditions to be specified by Vendor/ manufacturer).
- Part quotation will not be accepted.
- Vendor must provide the part name/product name/part number from the manufacturer for corresponding Oil/Grease/Cleaning agent during quotation.
- The manufacturer must have supplied same or similar items for applications mentioned above to aerospace/space faring agencies. The Vendor/manufacturer must attach documents for proof of supply along quote.
- In case of an authorised agent(s), valid authorisation certificate from the manufacturer should be provided.
- Quote from manufacturer/ Authorised agent will only be considered.