SAE INTERNATIONAL

AEROSPACE STANDARD

AS5272™ REV. F

Issued 1997-03
Reaffirmed 2016-04
Revised 2021-04

Superseding AS5272E

Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting, Procurement Specification

RATIONALE

Editorial clarifications added for product source availability (1.2 and 3.1), update reference for FED-STD-595, general editorial updates.

1. SCOPE

This SAE Aerospace Standard (AS) establishes the requirements for heat cured solid film lubricants. For other general or high temperature applications, refer to AS1701. This document requires qualified products.

1.1 Application

For applications where temperatures may range from -90 to 400 °F (-68 to 204 °C).

1.2 Type

This specification establishes the following types:

Type I: A lubricant capable of being cured within 60 minutes at 302 °F ± 27 °F (150 °C ± 15 °C) with an endurance life of 250 minutes minimum. See 6.4 for related product information.

Type II: A lubricant capable of being cured within 60 minutes at 400 °F ± 27 °F (204 °C ± 15 °C) with an endurance life of 450 minutes minimum. See 6.4 for related product information.

Type III: A low volatile organic compound (VOC) content lubricant capable of being cured within 120 minutes at 302 °F ± 27 °F (150 °C ± 15 °C) or within 60 minutes at 400 °F ± 27 °F (204 °C ± 15 °C) with an endurance life of 450 minutes minimum. Type III shall be used when performance is satisfactory for the desired application to meet VOC emission regulations.

Color 1 - Natural product color.
Color 2 - Black color. See 3.7.

See 6.4 for related product information.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

For more information on this standard, visit
https://www.sae.org/standards/content/AS5272F/

1.3 Safety - Hazardous Materials

While the materials, methods, applications, and processes described or referenced in this specification may involve use of hazardous materials, this specification does not address the hazards which may be involved in such use. The product manufacturer shall prepare Materials Safety Data Sheets (MSDS) in accordance with AMS2825 and abide by MSDS requirements to ensure familiarity with the safe and proper handling of hazardous materials used and take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS1424	Fluid, Aircraft Deicing/Anti-Icing, SAE Type I
AMS2825	Material Safety Data Sheets
AMS-QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet
AMS-STD-595	Colors Used in Government Procurement
AS1701	Lubricant, Solid Film
AS5528	Lubricant Application, Solid Film, Heat Cured, Corrosion Inhibiting
AS9100	Quality Management Systems - Requirements for Aviation, Space, and Defense Organizations

2.2 AIA Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NAS850	General Packaging Standard
NAS854	Hazardous Material Packaging and Safety Data Sheet Preparation

2.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A108	Standard Specification for Steel Bars, Carbon, Cold-Finish, Standard Quality
ASTM A167	Standard Specification for Stainless and Heat-Resisting Chromium-Nickel-Steel Plate, Sheet and Strip
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Test Apparatus
ASTM B244	Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy Current Instruments

ASTM B499	Standard Test Method for Measurements of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
ASTM D56	Standard Test Method for Flash Point by Tag Closed Tester
ASTM D1141	Standard Practice for Preparation of Substitute Ocean Water
ASTM D1186	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base
ASTM D1193	Standard Specification for Reagent Water
ASTM D1400	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base
ASTM D2510	Standard Test Method for Adhesion of Solid Film Lubricants
ASTM D2511	Standard Test Method for Thermal Shock Sensitivity of Solid Film Lubricants
ASTM D2625	Standard Test Method for Endurance (Wear) Life and Load-Carrying Capacity of Solid Film Lubricants (Falex Pin on Vee Method)
ASTM D2649	Standard Test Method for Corrosion Characteristics of Solid Film Lubricants
ASTM D2832	Standard Guide for Determining Volatile and Nonvolatile Content of Paint and related Coatings
ASTM D3735	Standard Specification for VM&P Naphthas
ASTM D3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D4017	Standard Test Method for Water in Paints and Paint Materials by Karl Fischer Method
ASTM D4457	Standard Test Methods for Determination of Dichloromethane and 1,1,1-Trichloroethane in Paints and Coatings by Direct Injection into a Gas Chromatograph
ASTM E1252	Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis
ASTM F22	Standard Test Method for Hydrophobic Surface Films by the Water-Break Test

2.4 ISO Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ISO/IEC 17025	General Requirements for the Competence of Testing and Calibration Laboratories

2.5 OSHA Publications

Available from U.S. Department of Labor/OSHA, 200 Constitution Avenue, Washington, DC 20210, Tel: 800-321-6742, www.osha.gov/pls/publications/pubindex.list.

HSC 29 CFR 1910.1200	Hazard Communication, Toxic and Hazardous Substances

2.6 PRI Publications

Available from Performance Review Institute, 161 Thorn Hill Road, Warrendale, PA 15086-7527, Tel: 724-772-1616, www.pri-network.org.

PD2001	Qualified Product Management Council Procedures for Qualified Products Group
PRI-QPL-AS5272	Qualified Products List (QPL) of Products Qualified Under SAE Aerospace Specification AS5272 - Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting

2.7 U.S. Government Publications

Copies of these documents are available online at https://quicksearch.dla.mil.

FED-STD-791	Lubricants, Liquid Fuels, and Related Products, Testing Methods of
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-C-81302	Cleaning, Compound, Solvent, Trichlorotrifluoroethane
MIL-DTL-16232	Phosphate Coatings, Heavy, Manganese or Zinc Base (for Ferrous Metals)
MIL-DTL-83133	Turbine Fuel, Aviation, Kerosene Types
MIL-L-46000	Lubricant, Semi-Fluid, (Automatic Weapon)
MIL-PRF-14107	Lubricating Oil, Weapons, Low Temperature
MIL-PRF-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Number 0-156
MIL-PRF-372	Cleaning Compound, Solvent for Bore of Small Arms and Automatic Aircraft Weapons
MIL-PRF-46010F	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting
MIL-PRF-63460	Lubricant, Cleaner and Preservative for Weapons and Weapon Systems
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537
MIL-T-81533	Trichloroethane 1,1,1, (Methyl Chloroform) Inhibited, Vapor Degreasing
VV-D-1078	Damping Fluid, Silicone Base (Dimethyl Polysiloxane)

3. REQUIREMENTS

3.1 Qualification

The lubricants furnished under this specification shall be products, which are listed or approved on the applicable qualified product list, PRI-QPL-AS5272. This QPL requirement shall be in effect on June 30, 2008. No change in product formulation, raw material, basic methods of manufacturing, or plant site shall be made without notification and prior approval from the Performance Review Institute (PRI). Requalification or testing and revised supplier designation may be required. For all specified types (as defined in 1.2), users should verify product source availability in PRI-QPL-AS5272. Users and suppliers seeking new approved product sources should contact PRI.

3.1.1 Manufacturer Qualification

A manufacturer producing a product in conformance to this procurement specification shall be accredited in accordance with AS9100.

3.1.2 Product Qualification

All lubricants shall conform to the requirements of this specification and shall be approved in accordance with the requirements of PD2001, for listing in a PRI Qualified Products List (QPL) PRI-QPL-AS5272.

3.1.3 Qualification Testing

All qualification testing shall be conducted by a laboratory which is accredited per ISO/IEC 17025 with a relevant scope. If qualification tests are performed at the manufacturer's facility or at a test facility without ISO/IEC 17025 accreditation with a relevant scope, test shall be witnessed by a QPG member, designated QPG representative, PRI auditor, or verified by OEM qualification test.

3.2 Materials

Component materials used in the manufacture of this lubricant shall consist essentially of finely powdered lubricating solids dispersed in a suitable liquid binder. The lubricant shall contain no graphite, powdered metal, or ozone depleting substances. Recycled materials may be used provided the lubricant meets the requirements of the specification. The lubricant shall be suitable for application by brushing, dipping, or spraying. The applied film for Type I shall be capable of being cured within 60 minutes at 302 °F ± 27 °F (150 °C ± 15 °C). The applied film for Type II shall be capable of being cured within 60 minutes at 400 °F ± 27 °F (204 °C ± 15 °C). The applied film for Type III shall be capable of being cured within 60 minutes at 400 °F ± 27 °F (204 °C ± 15 °C), or within 120 minutes at 302 °F ± 27 °F (150 °C ± 15 °C), and be of such a nature that it shall conform to the requirements of this specification when cured at either temperature. All reference cure temperatures reflect the temperature that the part must obtain prior to the start of the cure cycle. Type III shall be a low VOC material in accordance with 3.4.11. The contractor shall certify that if any carcinogenic or potentially carcinogenic constituents are present as defined under the Hazard Communication Standards (HCS) 29 CFR 1910.1200, appropriate warnings (refer to HCS 29 CFR 1910.1200) shall be included on the product label.

3.3 Film Appearance and Thickness

The bonded solid film lubricant, when examined as specified in 4.6.2, shall be uniform in color, smooth, free from any cracks, scratches to base metal, pinholes, blisters, bubbles, runs, sags, foreign matter, grit, rough particles, or separation of ingredients. The average thickness, based on six readings minimum, of the cured film for all Types shall be between 0.0003 inch (0.008 mm) and 0.0005 inch (0.013 mm), with no single reading less than 0.0002 inch (0.005 mm) or greater than 0.0007 inch (0.018 mm).

3.4 Performance Characteristics

3.4.1 Film Adhesion

The bonded solid film lubricant, when tested as specified in Table 2, shall not be lifted to expose any bare metal surface. A uniform deposit of powdery material clinging to the tape is acceptable.

3.4.2 Resistance to Fluids

The bonded solid film lubricant, when tested as specified in Table 2, after immersion in each of the fluids as specified in Table 3, shall not be lifted by the tape to expose any bare metal surface; nor shall the solid film lubricant lift, blister, crack, or peel. A uniform deposit of powdery material clinging to the tape is acceptable.

3.4.3 Thermal Stability

The thermal stability of the bonded solid film lubricant shall be such that, when tested as specified in Table 2, the film shall not flake, crack, or lift and shall conform to the requirements for film adhesion (see 3.4.1).

3.4.4 Endurance Wear Life

When tested in four trials in accordance with Table 2, the bonded solid film lubricant shall have an average endurance life at 1000 lbf as follows:

Type I: 250 minutes with no single test less than 210 minutes.

Type II and III: 450 minutes with no single test less than 390 minutes.

3.4.5 Load Carrying Capacity

When tested in two trials in accordance with Table 2, the bonded solid film shall have the following average capacity:

Type I and III: 2500 lbf (11120 N) with no single test less than 2250 lbf (10000 N).

Type II: 2000 lbf (8900 N) with no single test less than 1750 lbf (7780 N).

3.4.6 Aluminum Corrosion Resistance (Type I and III)

When subjected to heat and humidity conditions as specified in 4.5, the bonded solid film lubricant on anodized aluminum panels as specified in 4.5.2.1 shall not show or cause discoloration, pitting, formation of white deposits, or other evidence of corrosion.

3.4.7 Sulfurous Acid-Salt Spray (Type I and III)

When applied to steel panels as specified in 4.5.2.2 and exposed to sulfurous acid-salt spray in accordance with Table 2, there shall be no resultant pitting, visible corrosion, or staining.

3.4.8 Salt-Spray (Fog) Test (Type II and III)

The lubricant, after being applied to steel panels as specified in 4.5.2.2 shall show no more than three rust spots per panel, none greater than 0.039 inch (1.0 mm) in diameter after 100 hours exposure to a 5% salt spray solution in a salt fog cabinet in accordance with ASTM B117 and Table 2.

3.4.9 Solids Content

The lubricant shall contain not less than 40% by weight when tested as specified in 4.6.3.

3.4.10 Storage Stability

The fluid lubricant, after a minimum storage period as specified in 4.6.4, shall conform to the requirements for endurance life (see 3.4.4) and the sulfurous acid-salt spray (see 3.4.7) for Type I and III or the salt-spray (fog) test (see 3.4.8) for Type II and III when tested as specified in 4.6.

3.4.11 Volatile Organic Compound (Type III)

The lubricant shall contain no more than 250 g/L of volatile organic content when tested as specified in 4.6.5.

3.5 Toxicity

The lubricant shall have no adverse effects on human health when it is used as intended. Questions on toxicology shall be referred by the procuring activity to the appropriate departmental medical service after consulting the qualifying activity. A Material Safety Data Sheet shall be submitted as specified in 1.3.

3.6 Application, Manufactured Parts

The lubricant shall be applied in accordance with AS5528, unless otherwise specified by the purchaser.

3.7 Color (Type III)

The lubricant supplied in Color 2 shall closely match color no. 37038 of FED-STD-595, but shall not be lighter than gray no. 36076 of AMS-STD-595.

3.8 Restricted Materials (Type III)

The lubricant shall not contain lead, lead-containing compounds, graphite, powdered metal, or ozone-depleting substances in either liquid or cured form (see 4.6.1).

3.9 Chemical Characterization Analysis

The lubricant shall be subject to chemical characterization in accordance with 4.7.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The manufacturer is responsible for performing all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, and unless disapproved by the purchaser, the manufacturer's own or any other facilities suitable for the performance of the inspection requirements specified herein, may be used. The procuring activity reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to assure supplies and services conform to the prescribed requirements.

4.1.1 Responsibility for Compliance

All items shall meet all requirements of Sections 3 and 5. The inspection set forth in this specification shall become part of the manufacturer's overall inspection system or quality program. The absence of any inspection requirements in this specification shall not relieve the manufacturer of the responsibility of assuring that all products or supplies submitted to the procuring activity for acceptance comply with all requirements of the contract or purchase order. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the procuring activity to acceptance of defective material.

4.2 Classification of Inspections

The inspections specified herein are classified as follows:

a. Qualification inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.3 Qualification Inspection

The qualification inspection performed by the qualification laboratory and/or as noted in 3.1.3 shall consist of approval of the manufacturer's submitted report, subjecting the qualification sample, 4.3.1, to examination and testing for all the requirements of this specification.

4.3.1 Qualification Samples

The qualification samples shall consist of 4 quarts (4 L) of lubricant from one batch, and two copies of the supplier's report for the product for which qualification is desired. The report shall show the product inspection results for all the requirements of this specification and shall refer specifically to the applicable paragraphs in the specification. The samples, reports, and Material Safety Data Sheets (see 1.3) for the product shall be forwarded in accordance with Section 5.

Sample for qualification inspection
Lubricant, solid film, heat cured, corrosion inhibiting, Type I, Type II, or Type III, as applicable
Name of manufacturer
Product code/batch number
Date of manufacture
Copy of the Fourier Transform Infrared analysis report (see 4.7)
Submitted by (name) (date) for qualification inspection in accordance with AS5272 including revision letter, under authorization of (reference authorizing letter)

4.3.2 Retention of Qualification

In order to retain qualification of a product approved for listing on the qualified products list (QPL), the manufacturer shall verify by certification to PRI that the manufacturer's product complies with the requirements of this specification. The time of periodic verification by certification shall be in 5-year intervals from the date of original qualification. The PRI in conjunction with the Qualified Products Group (QPG) reserves the right to re-examine the qualified product whenever deemed necessary to determine that the product continues to meet any or all of the specification requirements.

4.4 Quality Conformance Inspection

The quality conformance inspection shall consist of inspection of samples for tests (see 4.4.2) for all of the tests specified in Table 2, except for resistance to fluids (see 3.4.2), thermal stability (see 3.4.3), aluminum corrosion resistance (see 3.4.6), storage stability (see 3.4.10), and chemical characterization analysis (see 3.9) and inspection of samples of filled containers (see 4.4.3) for compliance to Section 5. Samples shall be labeled completely with information identifying the purpose of the sample, name of the product, specification number, batch number, date of sampling, and contract or purchase number.

4.4.1 Batch

A batch is defined as the end product of all the raw materials mixed or blended in a single operation.

4.4.2 Samples for Tests

The sample for test shall consist of four separate quarts (liters) of lubricant selected at random from each batch of lubricant. The lot shall be unacceptable if a sample fails to meet any of the test requirements specified.

4.4.3 Sample for Examination of Filled Containers

A random sample of filled containers shall be selected from each batch of lubricant in accordance with Table 1. Acceptance quality shall be based on zero defectives.

Table 1 - Sample size

Batch Size (No. of Containers)	Sample Size (No. of Containers)
1	1
2 to 8	2
9 to 15	3
16 to 25	5
26 to 50	8
51 to 90	13
91 to 150	20
151 to 280	32
281 to 500	50
501 to 1200	80

4.5 Inspection Conditions

4.5.1 Atmospheric Conditions

Unless otherwise specified, all examinations and tests shall be performed at a temperature of 77 °F ± 5 °F (25 °C ± 3 °C) and at a relative humidity between 30% and 70%.

4.5.2 Preparation of Test Panels

4.5.2.1 Preparation of and Application to Test Panels for Type I and Type III Solid Film Lubricant (Aluminum and CRES)

The panels shall be made from aluminum alloy conforming to AMS-QQ-A-250/5, condition T6X or T8XX, anodized to conform to MIL-A-8625, Type II sulfuric acid anodize, and measuring approximately 0.020 inch (0.05 cm) by 3.00 inch (7.6 cm) by 6.00 inch (15.2 cm); and corrosion resistant steel conforming to ASTM A167, and measuring approximately 0.035 inch (0.09 cm) by 3.00 inch (7.6 cm) by 6.00 inch (15.2 cm). The panels shall be pre-cleaned with aliphatic naphtha conforming to ASTM D3735 that sufficiently cleans surfaces to pass ASTM F22. This cleaner shall not cause damage; i.e., pitting, etching, etc., to the surface being cleaned. The corrosion resistant steel panels shall have both faces and all edges grit-blasted with 180 to 220 grit aluminum oxide. Only one side of each panel shall be fully coated, except for two of the anodized aluminum panels which shall have the lubricant applied to a 1.00 inch (2.54 cm) wide strip to enable measurement of the film thickness. A spray application technique shall be used to coat the panel for the tests specified herein. The solid film lubricant average thickness, based on six readings minimum, after cure, shall be 0.0003 inch (0.008 mm) to 0.0005 inch (0.013 mm), with no single reading less than 0.0002 inch (0.005 mm) or greater than 0.0007 inch (0.018 mm). Three coats shall be the maximum number required to obtain the desired film thickness. Air drying at 77 °F ± 5 °F (25 °C ± 3 °C) for 10 minutes between coats is allowed. After the final coat has been applied, the coated specimens shall be allowed to air dry for 30 minutes minimum for Type I and 60 minutes minimum for Type III, a flash cure at 149 to 174 °F (65 to 79 °C) for 10 to 30 minutes until dry to the touch is also permitted. The coated specimens shall then be placed in an air circulating oven at 302 °F ± 27 °F (150 °C ± 15 °C) for 1 hour for Type I, or 2 hours for Type III. The coated specimens shall be removed from the oven and allowed to cool to room temperature. At least two test panel specimens shall be used in each test method. A total of 30 aluminum panels and two corrosion resistant steel panels are required for testing in accordance with performance requirements of this specification.

4.5.2.2 Preparation of and Application to Test Specimens for Type I, Type II, and Type III Solid Film Lubricant (Steel)

The steel panels shall be approximately 0.126 inch (0.32 cm) by 3.00 inch (7.6 cm) by 6.00 inch (15.2 cm) conforming to ASTM A108. The panels shall be pre-cleaned with aliphatic naphtha conforming to ASTM D3735 that sufficiently cleans surfaces to pass ASTM F22. This cleaner shall not cause damage; i.e., hydrogen embrittlement, etc., to the surface being cleaned. The steel panels shall have both faces and all edges grit-blasted with 180 to 220 grit aluminum oxide. Phosphate the panels, weight should be 11 to 22 g/m^2, in accordance with MIL-DTL-16232, using ASTM B499 or ASTM D1186 to measure the thickness of the phosphated panels. The steel panels shall be dipped or sprayed to the same thickness as specified for the aluminum panels (see 4.5.2.1). After air drying 30 minutes minimum for Type I and II or 60 minutes minimum for Type III, a flash cure at 149 to 174 °F (65 to 79 °C) for 10 to 30 minutes until dry to the touch is also permitted, bake the panels in an air circulating oven at 302 °F ± 27 °F (150 °C ± 15 °C), Type I, or 400 °F ± 27 °F (204 °C ± 15 °C), Type II and III for 1 hour. The coated specimens shall be removed from the oven and allowed to cool to room temperature. At least two test panels shall be used in each test method. A total of two steel panels and six sets of pins and vee-blocks (3.4.4 and 3.4.5) are required for testing in accordance with the performance requirements of this specification.

4.6 Methods of Inspection

Methods of inspection shall be in accordance with Table 2 and 4.6.1 through 4.6.5.

4.6.1 Restricted Materials (Type III)

The contractor shall submit for PRI approval, certification that no graphite, powdered metal, lead or lead containing compounds, or ozone depleting substances are present in the product furnished under this specification.

4.6.2 Film Appearance and Thickness

The bonded solid film lubricant specimens shall be examined visually and microscopically at magnification of 12 to 15X for uniformity in color, smoothness, evidence of cracks, scratches, pinholes, blisters, bubbles, runs, sags, foreign matter, grit, rough particles, and separation of ingredients. Film thickness shall be in accordance with Table 2.

4.6.3 Solids Content

Stir the lubricant thoroughly, weigh 5.0 g ± 0.5 g into a disposable weighing dish (Fisher Scientific catalog number 08 to 732, or equivalent). Place the dish and contents into a forced draft oven maintained at a temperature of 120 °F ± 5 °F (49 °C ± 3 °C) for 18 hours ± 1 hour. Remove from oven and place in desiccator. Raise temperature of oven to 400 °F ± 5 °F (204 °C ± 3 °C) and replace dish with residue into 400 °F ± 5 °F (204 °C ± 3 °C) oven for 1 additional hour. Remove dish and contents and cool in a desiccator. When cool, weigh dish and contents. Calculate percent by weight of solids in fluid lubricant as shown in Equation 1:

$$\text{Percent total solids} = \frac{\text{Weight of solid materials (grams)}}{\text{Weight of sample (grams)}} \times 100 \qquad \text{(Eq. 1)}$$

Table 2 - Quality performance inspection tests

Characteristic	Test Methods Government	Test Methods ASTM	Requirement Paragraph
Film Thickness[1]			3.3
Aluminum		D1400 or B244	
Steel		D1186 or B499	
Film Adhesion		D2510[7] Procedure A	3.4.1
Resistant to Fluids[2]		D2510[7] Procedure C	3.4.2
Thermal Stability[3]		D2511	3.4.3
Endurance Wear Life[4]		D2625[7] Procedure A	3.4.4
Load Carrying Capacity[4]		D2625[7] Procedure B	3.4.5
Aluminum Corrosion[5]		D2649	3.4.6
Sulfurous Acid/Salt Fog[6]	FED-STD-791[7]		3.4.7
Salt Spray (Fog)[5]		B117	3.4.8
Solid Content (see 4.6.3)			3.4.9
Storage Stability	FED-STD-791[7]		3.4.10
Volatile Organic Compound Content		D3960, D2832 D4017, D4457	3.4.11
Chemical Characterization Analysis		E1252 (see 4.7)	3.9

[1] Film thickness is determined after panels are prepared in accordance with 4.5.2.1 and 4.5.2.2.

[2] Test fluids shall be in accordance with Table 3.

[3] Any condensation shall be removed with clean, dry compressed air. The dried panel shall then be subjected to the film adhesion test.

[4] The surface of test pins and vee-blocks shall be grit blasted using 180 to 220 grit aluminum oxide to a surface roughness of 50 to 60 rms. The surface shall then be cleaned and pretreated with phosphate in accordance with MIL-DTL-16232, Type Z or Type M, Class 3 with a weight of 11 to 22 g/m^2.

[5] All lubricant film thicknesses must conform to 3.3 when prepared in accordance with 4.5.2 before placing in salt fog cabinet in accordance with ASTM B117.

[6] The panels shall be subjected to four cycles. Each cycle shall consist of 2 hours spray time and 24 hours drying time before inspection.

[7] When performing ASTM D2510, ASTM D2625, or FED-STD-791 test methods, use Aliphatic Naphtha conforming to ASTM D3735 followed by acetone or any environmentally safe cleaner that sufficiently cleans surfaces to pass ASTM F22 (MIL-C-81302, Trichlorotrifluoroethane, or MIL-T-81533, 1,1,1-Trichloroethane are not acceptable cleaners for testing or production).

NOTE: The cleaner used becomes part of the supplier's process and no change shall be made without notification and prior approval from the responsible QPL agency.

Table 3 - Test fluids

Test Fluids	Specification
Deicing/Anti-Icing Fluid	AMS1424
Cleaning Compound, Solvent for Bore of Small Arms and Automatic Weapons	MIL-PRF-372
Reagent Water	ASTM D1193, Type III
Substitute Ocean Water	ASTM D1141, Vol. 31
Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base	MIL-PRF-83282
Turbine Fuel, Aviation, Kerosene Types	MIL-DTL-83133, JP-8
Lubricating Oil, Aircraft Turbine Engine, Synthetic Base	MIL-PRF-23699
Damping Fluid, Silicone Base (Dimethyl Polysiloxane)	VV-D-1078
Lubricating Oil, Weapons, Low Temperature	MIL-PRF-14107
Lubricant, Semi-Fluid (Automatic Weapons)	MIL-L-46000
Lubricant, Cleaner and Preservative for Weapons and Weapon Systems	MIL-PRF-63460