

Lubricant Application, Solid Film, Heat Cured, Potable Water,
Hydraulic, and Other Fluid Systems

RATIONALE

This document has been revised to add AC7108/1 Nadcap Audit Checklist, to transfer film thickness from AS6449 to AS6450 paragraph 5.4.2, to clarify handling procedures after coating, and to change mechanic recertification interval.

1. SCOPE

This SAE Aerospace Standard (AS) establishes the surface pretreatment, temperature, and baking time required to cure AS6449 Type I and Type II solid film lubricant (SFL) when it is applied over the surfaces of manufactured parts of various metals. Application method may be dipping or spraying.

2. REFERENCES

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 724-776-4970 (outside USA), www.sae.org.

AMS2486	Conversion Coating of Titanium Alloys Fluoride-Phosphate Type
AMS2488	Anodic Treatment - Titanium and Titanium Alloys Solution pH 13 or Higher
AMS2700	Passivation of Corrosion Resistant Steels
AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
AS6449	Solid Film Lubricant for Fluid Fittings in Oxygen, Potable Water, Hydraulic, and Other Systems

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<http://www.sae.org/technical/standards/AS6450A>**

2.2 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 D1125 Standard Test Methods for Electrical Conductivity and Resistivity of Water

ASTM D2510 Standard Test Method for Adhesion of Solid Film Lubricants

ASTM D6123 Standard Specification for Pressure-Sensitive Tape for Light-Duty Packaging and General Purpose Masking

ASTM F22 Standard Test Method for Hydrophobic Surface Films by the Water-Break Test

2.3 PRI Publications

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

PD2101 Aerospace Quality Assurance , Product Standards Qualification Requirements - Fluid Distribution System

AC7108/1 Nadcap Audit Criteria for Painting and Dry Film Coating

AC7112/2 Nadcap Audit Criteria for Fittings and Other Machined Components

AC7112/4 Nadcap Audit Criteria for Hose Assemblies

2.4 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-9495, <https://assist.daps.dla.mil/quicksearch/>.

MIL-A-8625 Anodic Coatings, for Aluminum and Aluminum Alloys

3. REQUIREMENTS

3.1 Manufacturer Qualification

A manufacturer coating product in accordance with this specification shall be controlled to requirements of PD2101 and AC7112/2 or AC7112/4 as applicable. Accreditation shall implement AC7108/1 requirements as applicable.

NOTE: Applicators must be certified to Company Specifications. The applicators must be proficient and have a good knowledge of materials, tools, methods, and processes. The applicator must know the critical areas to be coated and the acceptable final appearance of the coated parts. See Appendix.

3.2 General Pretreatment and Application Instructions

Do not touch the surfaces to be coated with bare hands at any time. Stir the lubricant until thoroughly mixed, using a low shear mixing blade. A mechanical paint shaker may be used, but is not recommended for waterborne coatings as excessive foaming may occur.

Pretreatment, application, and cure requirements shall be as follows, unless otherwise specified on the drawing:

3.3 Pretreatment

3.3.1 Pretreatment for Aluminum Alloys

Coating Type I and Type II Material - Parts shall be anodized in accordance with MIL-A-8625 Type II Class 2, color optional. Unless otherwise specified on the standard, parts shall not be sealed following anodizing. Parts that have not been sealed shall be coated within 16 h. In case this is not possible they may be stored for up to 6 days in sealed plastic bags until coating. They must be re-anodized if they have not been coated within 6 days after anodizing.

Preclean the surfaces to be coated with any environmentally safe cleaner that sufficiently cleans surfaces to pass ASTM F22, but does not harm the metal surface (i.e., pitting, etching, etc.).

3.3.2 Pretreatment for CRES

Passivated per AMS2700 Method 1 and appropriate Class.

Preclean the surfaces to be coated with any environmentally safe cleaner that sufficiently cleans surfaces to pass ASTM F22, but does not harm the surface (i.e., hydrogen embrittlement, etc.).

3.3.3 Pretreatment for Titanium and Titanium Alloys

Parts shall be anodized per AMS2488 Type II, or Fluoride Phosphate coated per AMS2486, except that a pretreatment, a modification of the Fluoride Phosphate treatment or a post treatment shall be applied so that the final color of the parts should be approximately gray, similar to color numbers 26081 through 26293, or 36076 through 36293 per FED-STD-595 (see 3.5.4). Sealing surfaces shall not be bead or grit blasted.

Preclean the surfaces to be coated with Aliphatic Naphtha conforming to ASTM D3735 or any environmentally safe cleaner that sufficiently cleans surfaces to pass ASTM F22, but does not harm the surface (i.e., hydrogen embrittlement, etc.).

3.3.4 Pretreatment for Cadmium Plated Substrate Metal (legacy material)

Cadmium plate in accordance with AMS-QQ-P-416, Type III, Class 2. NOTE: Film adhesion, 3.5.1, is dependent on the active surface, application of AS6449 coating should take place as soon as possible following the application of the cadmium plate.

WARNING: This document references a part which contains cadmium as a plating material. Consult local officials if you have questions concerning cadmium's use.

3.4 Application

Apply the lubricant using dedicated equipment, or at a minimum, equipment that has been cleaned to remove the possibility of introducing contaminants during the coating application.

3.5 Air Drying

Coated parts shall be allowed to air dry for a minimum of 30 min at room temperature to assure complete removal of the solvent prior to heat curing. This air drying shall be in a location with relatively still air, to protect from any ignition sources.

3.6 Curing

The curing time shall be counted from the time the hardware reaches the cure temperature, not when the hardware is first placed in the curing oven. When the hardware has attained the manufacturers recommended cure temperature, not to exceed 325.4 °F (163 °C) the hardware shall be cured for 2 h minimum. At the end of the curing time, the coated parts shall be removed from the oven and allowed to air cool down to room temperature.

Be advised that for large parts and/or quantities of parts, it will take longer for the hardware to attain the recommended cure temperature, or may require an extended cure period.

3.7 Finish Requirements

3.7.1 Film Appearance

The bonded solid film lubricant, when examined as specified in 5.4.1 shall be uniform in color, smooth, free from any cracks, scratches, pinholes, blisters, bubbles, runs, sags, foreign matter, grit, rough particles, or separation of ingredients.

3.7.2 Film Thickness

3.7.2.1 Flat Surfaces

The average film thickness, based on six readings minimum, of the cured film shall be between 0.0003 in and 0.0005 in, with no single reading less than 0.0002 in or greater than 0.0007 in.

3.7.2.2 Internal threads

For internal threads the cured film for all types shall show complete coverage of the thread pressure flanks. Film thickness shall be controlled by the process and by fit check. When installed on the appropriate thread gage or a corresponding mating test bolt the coated internal threads shall permit free rotation over the full thread length specified on the standard with an AS8879 Class II maximum material condition (MMC). Thread gages shall not have flutes.

3.7.3 Film Adhesion

The bonded solid film lubricant, when tested as specified in 5.4.3 shall not lift or flake off to expose base substrate being coated. Following application there shall be no deposit or transfer of any coating material to the tape when examined by unaided eye.

- NOTE: a. Dryspray coating application may cause powdery material and transfer of material which is not acceptable.
- b. Black solid film lubricant powder on the inside of plastic shipping bags, after shipping and handling, shall not be cause for rejection.

4. PROCESS CONTROLS

4.1 Control Reference Parts (Specimens or test panels)

Control reference part(s) (CRP) when used, shall be coated with each lot of parts being coated. The CRP shall have a minimum of one dimension taken with a minimum accuracy of 0.0001 in; the measured value and location of the measurement before and after coating on the CRP shall be identified and recorded.

4.2 Procedures

The coating application, air drying, and curing procedures shall be the same for all the parts in the lot, the CRP, and any other test specimens or plate samples processed, that will be employed for qualification/conformance verification of coated parts.

5. QUALITY ASSURANCE PROVISIONS

5.1 Responsibility for Inspection

The applicator 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 applicator's own or any other facilities suitable for the performance of the inspection requirements specified herein, may be used. The purchaser 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.

5.2 Responsibility for Compliance

All items shall meet all requirements of Section 3. The inspections 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 purchaser 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.

5.3 Inspection Conditions

5.3.1 Atmospheric Conditions

Unless otherwise specified, all examinations and tests shall be performed at a temperature of $72\text{ }^{\circ}\text{F} \pm 8\text{ }^{\circ}\text{F}$ ($22.5\text{ }^{\circ}\text{C} \pm 4\text{ }^{\circ}\text{C}$) and at a relative humidity between 20% and 80%.

5.4 Methods of Inspection

5.4.1 Film Appearance

The bonded solid film lubricated parts shall be examined visually or at magnification of 10X and meet the requirements of 3.7.1.

5.4.2 Film Thickness

Film thickness is determined after the parts have been completely cured. The thickness of the film shall meet the requirements of 3.7.2 as applicable for the area being inspected; these inspections shall be conducted on actual parts (providing sufficient test surface is available), or on CRPs when employed.

NOTE: When possible, it is recommended that film thickness and adhesion be tested when lubricant has been applied to an end item. Testing with laboratory coupons or panels may not fully support lubrication performance when applied to actual end item.

5.4.3 Film Adhesion

A strip of masking tape conforming to specification ASTM D6123 Type 1 shall be pressed firmly on the coated part surfaces (providing sufficient test surface is available), or on CRPs when employed. The tape shall be removed with a sharp abrupt pull. Internal threaded surfaces shall be visually inspected after the Film Thickness verification to assure that the coating in the test area has not been removed.

5.5 Conformance Inspection Sampling

Conformance sampling inspection shall be in accordance with Table 1. Inspections shall be performed on hardware or CRPs unless otherwise agreed upon between the applicator and the purchaser, see Table 2.

TABLE 1 - SAMPLING INSPECTION

Sampling Plan: C = 0				
Lot Size	1 - 50	51 - 500	501 - 3200	3201+
Sample Size for all Inspections	6	13	20	32
If less than 6 parts are in the lot; then all parts are to be inspected				

TABLE 2 - INSPECTION METHODS FOR AS6450 COATING

PART	ASPECT	INSPECTION METHOD
COUPLING NUTS	THREAD FLANKS	5.4.1 – FILM APPEARANCE
		5.4.2 - ASSEMBLE A CLASS II MMC PLUG GAGE OVER THE ENTIRE THREAD LENGTH USING FINGER FORCE ONLY
	SHOULDER OR WIRE GROOVE	5.4.1 – FILM APPEARANCE
	HEX	5.4.1 – FILM APPEARANCE
5.4.3 – FILM ADHESION		
THRUST WIRE	DIAMETER	5.4.1 – FILM APPEARANCE
		5.4.2 - RECORD BEFORE AND AFTER COATING THICKNESS
		5.4.3 – FILM ADHESION

6. HANDLING AFTER COATING

6.1 Stocking

SFL parts shall not be bulk packaged. Coated parts should be transported in individual compartments such as egg cartons.

6.2 Shipping

Coated parts or assemblies with coated parts shall be individually packaged for shipment. If an assembly, components should have restricted movement.

7. ACKNOWLEDGMENT

An applicator shall mention this specification number in all quotations when acknowledging contract or purchase orders.

8. NOTES

8.1 MMC, Maximum Material Condition

Maximum material condition (MMC) may be considered as the condition when the part weighs the most. The MMC of a shaft is at the maximum size of the tolerance and the MMC of the hole is at the minimum size of the hole. For instance, the MMC of the hole of Dia. 4+/- 0.02 mm is Dia. 3.98 mm. MMC of shaft of Dia. 10 +0/-0.005 mm is Dia. 10.00 mm.

8.2 LMC, Minimum Material Condition

Least material condition (LMC) may be considered as the condition when the part weighs the least. The LMC of a shaft is at the minimum size of the tolerance and the LMC of the hole is at the maximum size of the hole. For instance, the LMC of the hole Dia. 4+/- 0.02 is Dia. 4.02 mm. LMC of shaft Dia. 10 +0/-0.005 is Dia. 9.995 mm.