



AEROSPACE STANDARD

AS81934™**REV. C**Issued 1998-04
Revised 2019-09

Superseding AS81934B

(R) Bearings, Sleeve, Plain and Flanged, Self-Lubricating

RATIONALE

This document includes limited scope changes to the following sections in response to comments from the approved Rev. C ballot (April 2019): 3.6.2, 4.3.1, 4.3.3, 4.6.6.2, and Figure 1. Previously approved changes from Rev. B to Rev. C: Updating the high/sub-zero temperature test methods, room temperature break-in cycles, qualification requirements by similarity to AS81820 for CRES substrates, and test pin and housing tolerances. Adding/updating fluid contaminants and specifying type and concentration of anti-icing fluid to be used for testing. Adding retention of qualification requirements for aluminum substrate. Clarifying tables and text to address conflicting requirements for number of qualification test samples required. Clarifying when LN₂ exposure is required.

NOTICE

The initial SAE publication of this document was taken directly from U.S. Military Standard MIL-B-81934B. This SAE Standard may retain the same part numbers established by the original military document.

1. SCOPE

1.1 Scope

This standard covers plain and flanged sleeve bearings which are self-lubricating by incorporating polytetrafluoroethylene (PTFE) in a liner in the bore for use in the temperature range of -65 to +325 °F.

2. REFERENCES

2.1 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.

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Documents
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2.1.1 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 1
AMS2417	Plating, Zinc-Nickel Alloy
AMS2700	Passivation of Corrosion Resistant Steels
AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
ARP5448/9	Plain Bearing Lined Inside Diameter Plug Gaging
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft
AS14101	Bearing, Plain, Self-Lubricating, Self-Aligning, Low Speed, Narrow, Grooved Race, -65 to +325 °F
AS81820	Bearings, Plain, Self-Aligning, Self-Lubricating, Low Speed Oscillation
AS81934/1	Bearing, Sleeve, Plain, Self-Lubricating, -65 to +325 °F
AS81934/2	Bearing, Sleeve, Flanged, Self-Lubricating, -65 to +325 °F

2.1.2 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 A967	Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts
ASTM C794	Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
ASTM D1655	Standard Specification for Aviation Turbine Fuels
ASTM D3951	Standard Practice for Commercial Packaging
ASTM F25	Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Clean Rooms and Other Dust-Controlled Areas
ASTM F50	Standard Practice for Continuous Sizing and Counting of Airborne Particles in Dust-Controlled Areas and Clean Rooms Using Instruments Capable of Detecting Single Sub-Micrometre and Larger Particles

2.1.3 ASME Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 973-882-1170 (outside North America), www.asme.org.

ASME B46.1	Surface Texture (Surface Roughness, Waviness and Lay)
ASME Y14.100	Engineering Drawing Practices

2.1.4 U.S. Government Publications

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

MIL-A-8625	Anodic Coatings, For Aluminum and Aluminum Alloys
MIL-DTL-197	Packaging of Bearings, Associated Parts and SubAssemblies
MIL-DTL-5541	Chemical Conversion Coatings on Aluminum and Aluminum Alloys
MIL-DTL-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-83133	Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37)
MIL-HDBK-1599	Bearings, Control System Components and Associated Hardware Used in the Design and Construction of Aerospace Mechanical Systems and Subsystems.
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base; Aircraft; Missile and Ordnance
MIL-PRF-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537
MIL-STD-2073-1	Standard Practice for Military Packaging

2.2 Definitions

2.2.1 PROCESSING PROCEDURES

All bonding, curing, and postcuring procedures.

2.2.2 VOID

A void is an area where the metal substrate is directly visible with no visible adhesive after peeling the liner.

2.2.3 UNBONDED AREA

An unbonded area is where the adhesive remaining on the metal substrate is smooth and shiny indicating a lack of bonding pressure.

3. REQUIREMENTS

3.1 Aerospace Standard (AS) Sheets

The individual item requirements shall be as specified herein and in accordance with the applicable AS sheets. In the event of any conflict between the requirements of this standard and the AS sheet, the latter shall govern.

3.2 Qualification

Products furnished under this standard shall be products which are authorized by the qualifying activity for listing on the applicable Qualified Products List (QPL-AS81934) at the time of award of contract (see 4.3, 6.3, and 6.3.1). See Qualified Products Database (QPD) at <https://assist.dla.mil>, <https://qpldocs.dla.mil>, or <https://quicksearch.dla.mil>.

3.2.1 Product Change

Any change in product design, description, materials, processing procedures, or plant location shall be reported to the qualifying activity and may require requalification of the product to an extent determined by the qualifying activity. Any other specific changes, which must be brought to the qualifying activity's attention, shall be identified in the qualification activity letter.

3.2.2 Product Manufacture

Except for the bonding operations, the manufacturer is permitted to subcontract manufacturing operations without violating the requirements of 3.2.1. The bonding operations shall be performed in the plant listed on the Qualified Products List. Manufacture of the self-lubricating liner material may also be subcontracted. Any change in (1) the liner manufacturer, (2) the liner manufacturing procedures, or (3) the materials used in manufacture of the liner will require requalification to an extent determined by the qualifying activity. The manufacturer is responsible for meeting all requirements of the standard and for the quality of the end product, whether it is manufactured totally in-house or some of the operations are performed by a subcontractor. Inherent in the responsibility for the end product is the responsibility to verify that the subcontractor's processes meet standard requirements.

3.3 Materials

Material for the sleeve and liner shall conform to the applicable AS sheet. PTFE shall be included in the liner in such a manner that the bearing will conform to all requirements of this standard.

3.3.1 Corrosion Resistant Steel Finishes

Corrosion resistant steel (CRES) sleeve bearings shall be finished by cadmium plating, zinc-nickel plating, or passivating in accordance with 3.3.1.1 or 3.3.1.2, and as defined with the finish option in the part number.

3.3.1.1 Cadmium or Zinc-Nickel Plating

When required by the part number, plating of the outside diameter of CRES sleeve bearings shall be in accordance with AMS-QQ-P-416, Type II, Class 2, or AMS2417, Type 2, Grade A or B, and the applicable AS sheet. The 23-hour bake time of the plating specification shall be waived to prevent over-curing of the liner adhesive. Hydrogen embrittlement testing is not required. Dimensions in AS81934/1 and AS81934/2 apply. For the AMS2417 plating, only Grade B shall be permitted on bearings after June 1, 2016.

3.3.1.2 Passivation

When required by the part number, exposed metallic surfaces of unplated CRES sleeve bearings shall be passivated per AMS2700, Method 1 (Nitric Acid) or Method 2 (Citric Acid), or passivate in accordance with ASTM A967, citric acid passivation, using CITRIC 1, CITRIC 2, or CITRIC 3 solutions after all metal removal operations, regrinding inclusive, have been completed. Passivation may be performed before or after bonding, at the bearing manufacturer's option. A permissible method for determining passivity is the copper sulfate test defined in ASTM A967 or AMS2700.

3.3.2 Aluminum Finishes

Aluminum sleeve bearings shall be anodized per MIL-A-8625, Type I or II, or chemical film treated per MIL-DTL-5541.

3.4 Design

Bearing design shall conform to that shown on AS81934/1 and AS81934/2.

3.5 Construction

The liner shall be so secured that all relative motion will be between the liner and the shaft. Once the liner is installed, a gap of 0.025 inch maximum between the ends of the liner where they meet on the inside diameter of the bearing is allowed. This 0.025 inch maximum gap shall have resin covering the full gap area so no substrate is exposed.

3.5.1 Dimensions and Tolerances

Dimensions and tolerances shall be as specified on the applicable AS sheet. Dimensions not shown shall be at the option of the manufacturer. Lined IDs shall be inspected per ARP5448/9.

3.5.2 Surface Texture

The surface texture shall be in accordance with the applicable AS sheet and ASME B46.1. Bearings shall be free of any surface defects which may be detrimental to satisfactory installation, performance or bearing life as defined in this standard. Unless otherwise specified, liner surfaces are exempt from surface texture measurements.

3.5.3 Lubrication

Initial grease or oil lubrication by the manufacturer will not be permitted.

3.5.4 PTFE Liner Condition

3.5.4.1 Visual Examination

The visual appearance of the bonded liner shall exhibit a degree of workmanship consistent with proper manufacturing process controls, as checked per 4.6.6.1. The liner shall be uniform in texture and shall contain no embedded contaminants. The liner setback shall meet the applicable drawing requirements. There shall be no separation or lifting of the liner at any of the edges. Unraveling and fraying is not permitted outside the setback area. Molded liners shall not contain embedded contaminants, cracks, or bubbles.

3.5.4.2 Bond Integrity and Peel Strength

When tested in accordance with 4.6.6.2, the liner shall be tightly adherent to the metallic substrate over at least 90% of the contact area and shall exhibit an average peel strength of 2 pounds per inch or greater. The adhesive remaining on the metal substrate shall have no void or unbonded area which cannot be included within a circumscribing circle with a diameter equal to 25% of the lined sleeve length or 0.25 inch, whichever is smaller.

3.5.4.2.1 Processing Controls

All fabrication of the PTFE liner involving application or mixing of adhesive, and all liner bonding procedures involving application of adhesive, shall be conducted in a controlled area.

3.5.4.2.1.1 Controlled Area

The controlled area shall be maintained at a temperature of 75 °F ± 10 °F with a maximum relative humidity of 75%. The enclosed atmosphere of the work area shall be well ventilated and maintained so that the particle count is 2500/ft³ maximum for particles 5 µm or larger when measured per ASTM F25 or ASTM F50. The particle count measurement shall be performed annually as a minimum. There shall be no eating or smoking in the controlled area and no process which produces uncontrolled spray, dust, fumes, or particulate matter.

3.5.4.3 Liner Peelability

Each manufacturer shall establish during qualification testing whether the liner is peelable or non-peelable. If peelable, the manufacturer shall determine the mean and standard deviation peel strength values for the liner based upon a minimum of six peel strength tests conducted in accordance with 4.6.6.2. Prior to peel testing, three of the six parts must undergo LN₂ exposure per 4.6.7. Liners are to remain bonded after the LN₂ exposure test. This data shall be recorded in the qualification test report. A liner originally qualified as peelable shall remain peelable in production. A liner originally qualified as non-peelable shall remain non-peelable in production.

3.6 Performance

3.6.1 Radial Static Limit Load

After the radial static limit load listed in Table 1 has been applied as specified in 4.6.1, the permanent set shall not exceed 0.002 inch.

Table 1 - Load values

Part No. 1/	Radial Static Limit Load (pounds)	Oscillation Load (pounds)	Loaded Breakaway Torque 2/ (in-lb max)
M81934/1-08A012	6900	6300	79
M81934/1-08C012	10800	6300	79
M81934/1-16A016	20000	16500	410
M81934/1-16C016	31400	16500	410
M81934/1-24A016	30000	22500	840
M81934/1-24C016	47100	22500	840

1/ Load ratings apply to Type A bearings also.

2/ Loaded breakaway torque is measured after completion of the oscillation under radial load test specified in 4.6.2, using the oscillation load specified in Table 1. The listed loaded breakaway torque values were calculated based on loaded bearings with a coefficient of friction of 0.05.

3.6.2 Oscillation Under Radial Load

The total liner wear of the bearing shall not exceed 0.0035 inch after 1000 cycles, 0.0040 inch after 5000 cycles, and 0.0045 inch after 25000 cycles, when tested at room temperature in accordance with 4.6.2. Additionally, if Type A bearings, the maximum wear limit is 0.0045 inch after 100000 cycles. Visual examination of the liner after test shall indicate no loss of bonding to the metal substrate in the loaded area. Loaded rotational breakaway torque shall not exceed the values in Table 1 after the oscillation under radial load test.

3.6.3 Fluid Compatibility

When tested in accordance with 4.6.3, the bearings shall be compatible with the fluids listed in 4.6.3 and the total liner wear shall not exceed 0.006 inch. Visual examination of the liner after test shall indicate no loss of bonding to the metal substrate in the loaded area.

3.6.4 High Temperature

When tested in accordance with 4.6.4 under the dynamic load specified in Table 1, the total liner wear shall not exceed 0.006 inch. Visual examination of the liner after test shall indicate no loss of bonding to the metal substrate in the loaded area.

3.6.5 Sub-Zero Temperature

When tested in accordance with 4.6.5, the bearings shall be capable of operating at a temperature of -65 °F. The liner wear shall not exceed 0.008 inch. Visual examination of the liner after test shall indicate no loss of bonding to the metal substrate in the loaded area.

3.7 Interchangeability

All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other and with respect to installation and performance. The drawing number requirements of ASME Y14.100 shall govern documentation of and changes in the manufacturer's part numbers. At the discretion of the end user, a Type A bearing listed on the QPL may be substituted for the same non-Type A bearing on the QPL. Non-Type A bearings shall not be substituted for Type A bearings.