AEROSPACE STANDARD

AS8942

Issued 2014-03

Bearings, Plain and PTFE Lined, Self - Aligning

RATIONALE

This procurement document and its corresponding parts sheets are being updated and re-formatted from MIL-B-8942 to the SAE standard.

NOTICE

This document has been taken directly from U.S. Military Specification MIL-B-8942 (Rev A including amendments) and contains editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial SAE publication of this document is intended to replace MIL-B-8942. This SAE Standard may retain the same part numbers established by the original military document.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format. Under Department of Defense policies and procedures, any requirements associated with Qualified Products List may continue to be mandatory for DoD contracts. Requirements relating to QPLs have not been adopted by SAE for this standard and are not part of this SAE document.

FOR US DEPARTMENT OF DEFENSE CONTRACTS AS8942 SHALL NOT BE USED. SEE AS81820 AS A SUGGESTED REPLACEMENT FOR AS8942 AT THE POINT OF DESIGN. DESIGNERS ARE CAUTIONED TO EVALUATE AS81820 FOR THEIR PARTICULAR APPLICATION.

1. SCOPE

This SAE Aerospace Standard (AS) establishes the requirements for self-aligning, self-lubricating plain spherical bearings incorporating polytetrafluoroethylene (PTFE) in a liner between the ball and the outer race for use in a temperature range of -65 to +250 °F (-54 to +121 °C).

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.

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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AS8942

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.

AMS1424 Deicing/Anti-Icing Fluid, Aircraft, SAE Type I

AMS2460 Plating, Chromium

AS21230 Bearing, Plain, Self-Aligning, Grooved Outer Ring, PTFE Lined, Wide

AS21231 Bearing, Plain, Self-Aligning, PTFE Lined, Wide

AS21232 Bearing, Plain, Self-Aligning, Grooved Outer Ring, PTFE Lined, Narrow

AS21233 Bearing, Plain, Self-Aligning, PTFE Lined, Narrow

2.2 ANSI/ASME Publications

Available from American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ASME B46.1 Surface Texture (Surface Roughness, Waviness and Lay)

ANSI/ASME Y14.100 Engineering Drawing Practices

ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes

2.3 U.S. Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, http://quicksearch.dla.mil/.

MIL-STD-2073-1 Standard Practice for Military Packaging

MIL-DTL-197 Packaging of Bearings, Associated Parts and Subassemblies

MIL-PRF-5606 Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance

MIL-DTL-5624 Turbine Fuel, Aviation, Grades JP-4, JP-5 and JP-5/JP-8ST

MIL-PRF-7808 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

MIL-STD-129 Standard Practice Military Marking for Shipment and Storage

MIL-STD-810 Environmental Engineering Considerations and Laboratory Tests – Method 507.5 Humidity resistance

3. REQUIREMENTS

3.1 Aerospace Standard (AS) Sheets

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

3.2 Qualification

The bearings furnished under this specification shall be a product which is in accordance with the applicable Aerospace Standard (AS) and which has been subjected to and which have passed the qualification tests specified herein, and which also have been listed on or approved for listing on the applicable Qualified Products List (QPL).

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 activities attention, shall be identified in the qualification notification 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 it is the responsibility of the manufacturer to verify that the subcontractor's processes meet standard requirements.

3.3 Materials

Material for the ball, outer race and liner shall be in accordance with the applicable AS product standard. PTFE shall be included in the liner in such a manner that the bearing will conform to all requirements of this specification.

3.3.1 Plating

Plating of the ball will be permitted, at the option of the manufacturer, and shall be per AMS2460.

3.4 Design,

Bearing design shall conform to that shown on AS21230, AS21231, AS21232, and AS21233.

3.5 Construction

The liner shall be so secured that all relative motion shall be between the wear surface of the liner and the ball. The bearing shall not have loading slots. Except as otherwise specified on the applicable AS product standard, the details of the design shall be optional.

3.5.1 Dimensions and Tolerances

Dimensions and tolerances shall be as specified on the applicable AS product standard. Dimensions not shown shall be at the option of the manufacturer.

3.5.2 Surface Texture

The surface texture shall be in accordance with the applicable AS product standard 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 specification. Unless otherwise specified, liner surfaces are exempt from surface texture measurements.

3.5.3 Lubrication

Initial lubrication by the manufacturer will be permitted. Relubrication will not be permitted.

3.6 Performance

3.6.1 Radial Static Limit Load

After the radial load listed on the applicable AS product standard has been applied as specified in 4.6.1, the total deflection of the bearing and fixture shall be less than 0.010 inch for bearings with a bore of 0.3750 inch or less, 0.015 for 0.4375 and 0.5000 inch, 0.017 for 0.5625 and 0.6250 inch and 0.020 for 0.7500 inch and up. The permanent set shall be less than 0.003 inch.

3.6.2 Axial Static Limit Load

After the axial load listed on the applicable AS product standard has been applied as specified in 4.6.2, the permanent set shall be less than 0.005 inch.

3.6.3 Ultimate Load

No fracture of the race or ball, or push-out of the ball shall occur when 1.5 times the radial or axial limit load is applied as specified in 4.6.1 or 4.6.2.

3.6.4 Oscillation under Radial Load

The total liner wear of the bearing shall not exceed 0.006 inch when tested in accordance with 4.6.3 with the radial unidirectional load listed on the applicable AS product standard. Visual examination of the liner after test shall indicate no loss of bonding to the metal substrate in the loaded area.

3.6.5 Self-Alignment

The bearing shall be self-aligning and permit the angular displacement specified in the applicable AS product standard

3.6.6 No-Load Breakaway Torque

When tested in accordance with 4.6.4, the no-load breakaway torque shall be within the limits of the values specified on the applicable AS product standard.

3.6.7 Fluid Compatibility

When tested in accordance with 4.6.5, the bearings shall be compatible with the fluids listed in 4.6.5 and the total liner wear shall not exceed 0.006 inch.

3.6.7.1 Corrosion Resistance

Corrosion resistance shall be determined in accordance with Method 507.5 (Humidity resistance) of MIL-STD-810. Superficial tarnish which can be removed with a damp cloth shall not be cause for rejection.

3.6.8 High Temperature

When tested in accordance with 4.6.7, under the oscillating load specified in the applicable AS product standard, the total liner wear shall not exceed 0.006 inch.

3.6.9 Low Temperature

When tested in accordance with 4.6.8, the no-load breakaway torque shall not be more than twice the maximum value specified on the applicable AS product standard.

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 ANSI/ASME Y14.100 shall govern changes in the manufacturer's part numbers and also how the part numbers are to be called out.

3.8 Identification of Product

Each bearing shall be permanently and legibly marked with the manufacturer's CAGE code, manufacturer's lot number, and Aerospace Standard part number as a minimum. Where feasible, identification shall appear on the side face of the outer race; otherwise identification shall appear on the periphery of the bearing outer race. Metal impression stamping is prohibited.

3.9 Workmanship

The bearings shall be free of toolmarks, chatter waves, rust, grinding scratches, pits, or other defects that may adversely affect their serviceability.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the manufacturer, may utilize his/her own facilities or any other commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the standard where such inspection are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Qualification Test Records

The manufacturer shall maintain a record showing quantitative results for all tests required by this specification. This record shall be available to the purchaser and shall be signed by an authorized representative of the manufacturer or the testing laboratory, as applicable.

4.2 Classification of Tests

The inspection and testing of the bearings shall be classified as:

a. Qualification tests (4.3)

b. Quality conformance tests (4.4)

4.3 Qualification Tests

4.3.1 Sampling Instructions

Qualification test samples shall consist of 30 bearings conforming to MS21232-8 and 9 each of all other sizes upon which qualification is desired. All bearings necessary for tests specified herein shall be furnished by the manufacturer. Samples shall be identified as required and forwarded to the activity designated in the letter of authorization (see 6.3).

4.3.2 Certified Test Report

The manufacturer shall furnish a certified test report showing that the manufacturer's product satisfactorily conforms to the part standard and this specification. The test report shall include, as a minimum, actual results of the tests specified herein. When the report is submitted, it shall be accompanied by a dated drawing which completely describes the manufacturer's products by specifying all dimensions and tolerances, outer race and ball material, coating or plating, and heat treatment. The manufacturer's part number for each size shall be included on the drawing.

4.3.3 Tests

Qualification tests shall include all the examinations and tests specified in Table 1 of this standard. The minimum number of samples per test shall be in accordance with Table 1.

TABLE 1 - QUALIFICATION TEST SAMPLES

Examination and Tests	Requirement Paragraph	Samples to be tested
Examination of product	4.5.1	5
Preparation for delivery	4.5.2	5
Axial static limit load	4.6.2	3
Radial static limit load	4.6.1	3
Oscillating radial load	4.6.3	3
No-load breakaway torque	4.6.4	3
Fluid compatibility	4.6.5	1/ 3
Corrosion resistance	4.6.6	1/ 3
High temperature	4.6.7	1/ 3
Low temperature	4.6.8	1/ 3

1/ Nominal size 8 only

4.4 Quality Conformance Tests

The quality conformance testing of the bearings shall consist of the following examinations and tests to determine conformance of the bearings to the requirements of this specification and the applicable AS product standard with regard to:

a. Dimensions (3.5.1) (4.5.1)

b. Identification of product (3.8) (4.5.1)

c. Workmanship (3.9) (4.5.1)

d. Preparation for delivery (4.5.2)

e. No-load breakaway torque (4.6.4)

4.4.1 Tests

The bearing manufacturer shall be responsible for accomplishing the quality conformance tests specified herein.

4.4.2 Inspection Lot

The inspection lot shall consist of finished bearings, having a single part number, manufactured according to same procedures as the parts originally qualified and produced as one continuous run or order or portion thereof.

4.4.3 Sampling

The sample bearings shall be selected from each inspection lot in accordance with ANSI/ASQC Z1.4, inspection level II, acceptable quality level of 1.0%, except that inspection for no-load rotational breakaway torque (3.6.6) shall be 100%.

4.5 Examinations

4.5.1 Examination of Product

The bearings shall be examined to determine conformance to the requirements of this specification and the applicable AS product standard for material, plating, dimensions, finish, identification of product, workmanship, and requirements not covered by tests.

4.5.2 Preparation for Delivery

Cleaning, preservation, packaging, packing, and marking shall be inspected to determine conformance to Section 5.

4.6 Test Methods

Unless otherwise specified, all tests shall be conducted at room temperature.

4.6.1 Radial static limit load

The bearings shall be installed in a test fixture as shown on Figure 1, using a 0.000 to 0.001 inch loose fit for the shaft and housing. The use of differential temperatures for installation is not permitted. A preload of 4 to 6% of the radial static load shall be applied to the bearing for 3 minutes, and the measuring device set at zero. The load shall then be increased at the rate of 1% of the specified load per second until it equals the radial static load limit. The total deflection shall be the reading at the radial static limit load after 2 minutes. The load shall then be reduced at the same rate to the preload value. The permanent set shall be the reading at this preload. The ultimate radial load shall be applied at the rate of 1% of the specified load per second.

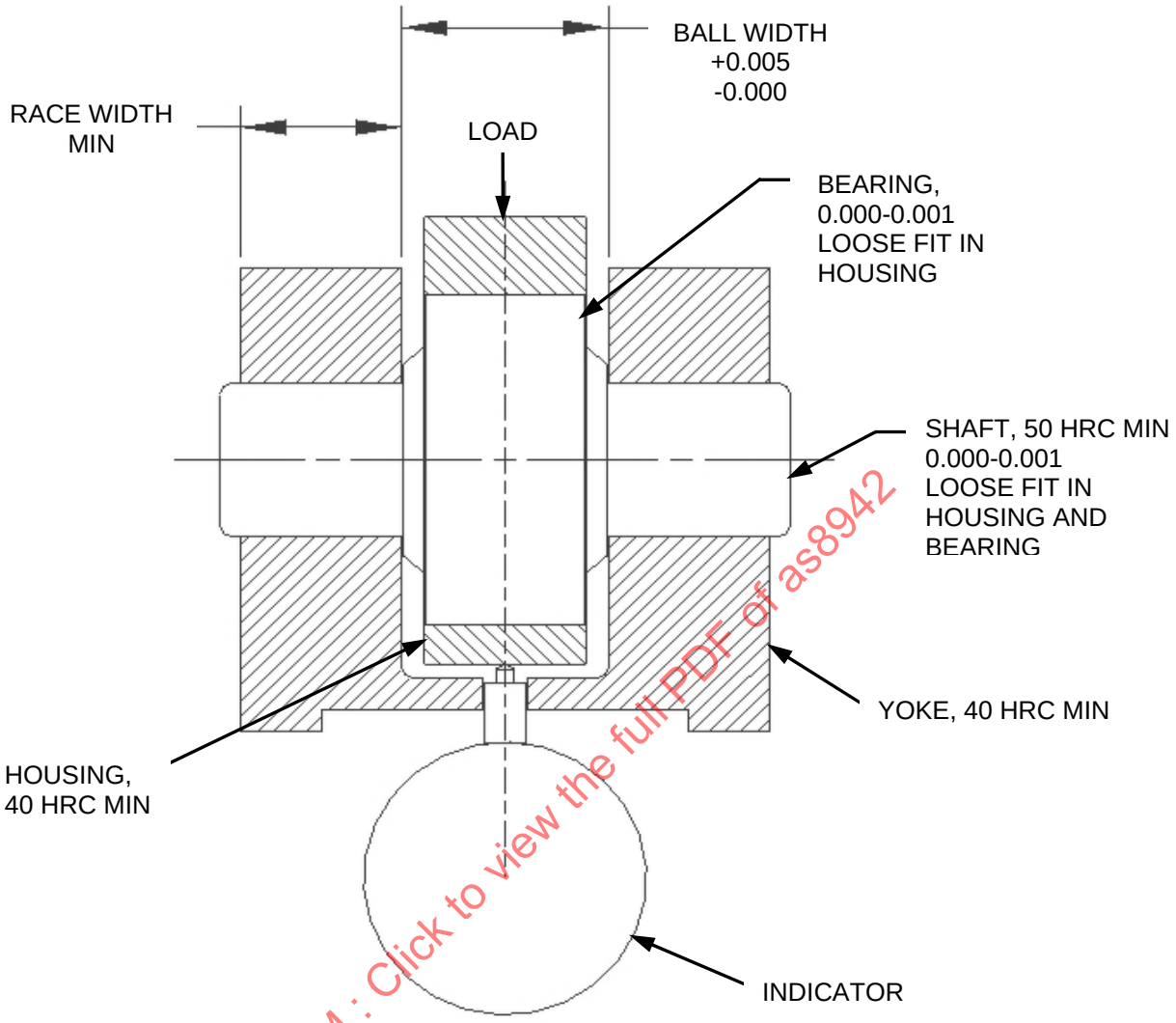

FIGURE 1 – RADIAL TEST FIXTURE

4.6.2 Axial Static Limit Load

The bearing shall be installed in a test fixture as shown in Figure 2. Bearings shall fit in the housing with a 0.000 to 0.001 inch loose fit. The hole in the support fixture for clearance of the ball shall be the nominal diameter of the ball plus double the thickness of the liner. A preload of 4 to 6% of the axial static limit load shall be applied to the bearing for 3 minutes, and the measuring device set at zero. The load shall then be increased at the rate of 1% of the specified load per second until it equals the axial static load limit. It shall be held for 2 minutes, then reduced at the same rate to the preload value. The permanent set shall be the reading at this preload. The ultimate axial load shall be applied at the rate of 1% of the specified load per second.

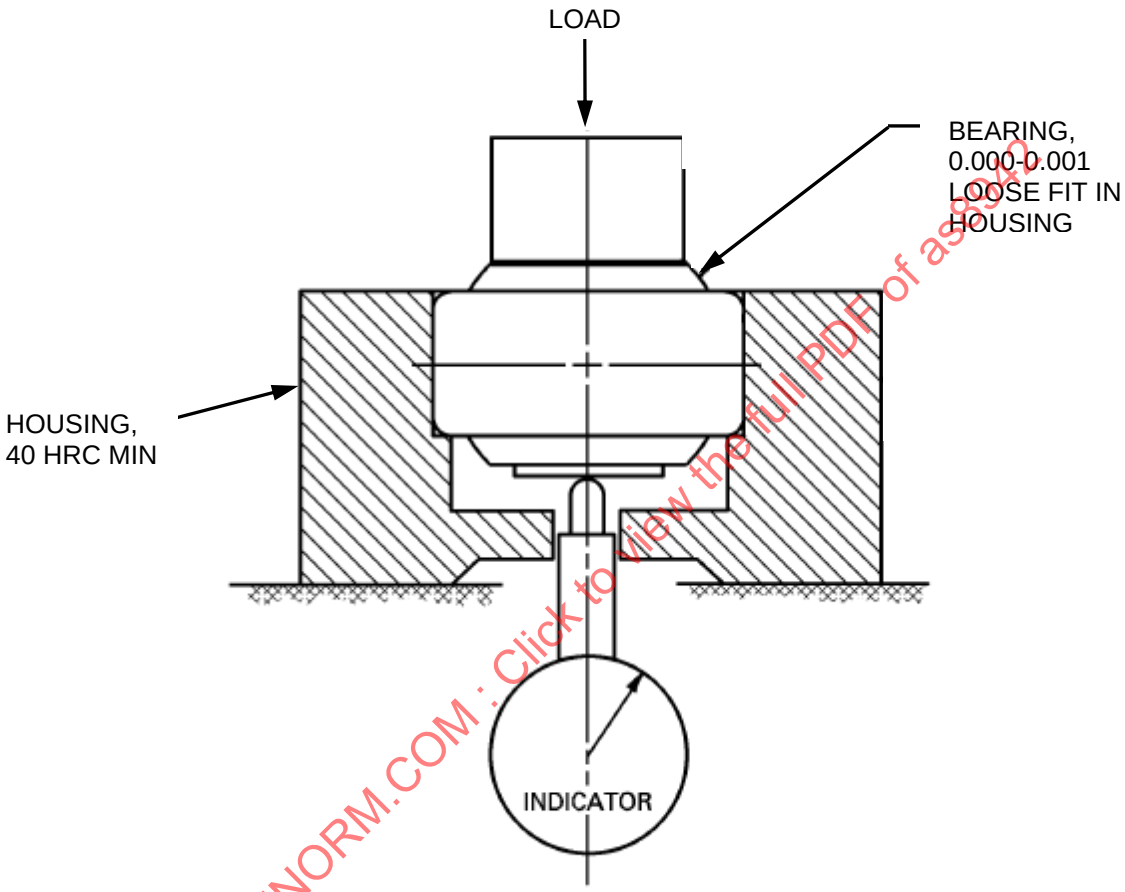

FIGURE 2 - AXIAL TEST FIXTURE

4.6.3 Oscillation under Radial Load

The bearing shall be installed in a steel housing, using a slip fit, with a hardened shaft (50 HRC minimum) pressed into the bore with a 0.0000 to 0.0005 inch interference fit. The bearing shall be installed so as to place the pin in double shear with a minimum of pin bending and to permit rotation of the ball with respect to the race. A dial indicator or electronic pickup shall be mounted to permit measurement of any radial movement of the ball with respect to the race. The oscillating load specified on the applicable AS product standard shall be applied and held statically for 15 minutes. At the end of this time, the indicating device shall be set at zero and the oscillation test shall be started. Wear readings shall include the wear from the first cycle onward. The test shall be run in such a manner that the ball is oscillated at ±25 degrees from the zero position (50 degrees inclusive angle, or 100 degrees total travel per cycle) at 10 cycles per minute for 5000 cycles. One cycle shall consist of rotation from zero degrees to +25 degrees, return through zero degrees to -25 degrees and return to zero degrees. The wear within the bearing shall not exceed 0.006 inch at the end of 5000 cycles. Sufficient intermediate readings during the test shall be recorded to plot a graph or wear (thousandth of an inch) versus life (cycles). In addition, upon completion of the test, the loaded breakaway torque shall be measured and shall be as specified in Table 2.

4.6.3.1 High Speed Oscillation

A bearing shall be installed in a fixture as specified in 4.6.3 The test shall be run in such manner that the pin is oscillated at ±10 degrees from the zero position (20 degrees included angle, or 40 degrees total travel per cycle) at 200 cycles per minute for 1 000 000 cycles while the bearing is loaded to one-third of the oscillating load specified in the applicable AS product standard.

TABLE 2 - LOADED BREAKAWAY TORQUE TEST (IN-LB MAX)

Size	AS Product Standard	
	AS21230 AS21231	AS21232 AS21233
3, 4	50	30
5	70	50
6	115	70
7	185	105
8	265	160
9	375	235
10	445	345
12	690	630
14	970	900
16	2550	1525

4.6.4 No-Load Breakaway Torque

The no-load breakaway torque shall be determined by holding the outer race of the bearing fixed while rotating the ball about the bearing axis. The outer race shall be held in such a manner to minimize bearing distortion and the resultant effect on bearing preload torque. Torque shall be applied gradually to the ball; the maximum torque required to start the ball moving shall be recorded. The no-load breakaway torque shall be as specified on the applicable AS product standard. The ball shall be hand rotated through several revolutions immediately prior to testing.

4.6.5 Fluid Compatibility

Fifteen bearings conforming to MS21232-8 (3 for each fluid) shall be immersed for 24 hours in each of the following fluids at 160 °F ± 5 °F, except for (b) which shall be at 110 °F ± 5 °F:

a. Skydrol 500A hydraulic fluid

b. MIL-DTL-5624, turbine fuel grades JP-4 or JP-5

c. MIL-PRF-7808 lubricating oil

d. MIL-PRF-5606 hydraulic oil

e. AMS1424 Deicing/Anti-Icing Fluid, Aircraft, Type I

Within ½ hour after removal from the test fluid the bearing shall be tested in accordance with 4.6.3. The load for (e) shall be 80% of that listed in the applicable AS product standard for oscillating load.