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# AEROSPACE STANDARD

SAE AS8914

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## Bearing, Roller, Self-Aligning, Airframe, Antifriction

FSC 3110

NOTICE

This document has been taken directly from U.S. Military Specification MIL-B-8914B, Amendment 3 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-B-8914B, Amendment 3. Any part numbers established by the original specification remain unchanged.

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 qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.





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1. SCOPE:

1.1 This specification covers the requirements for nonseparable antifriction roller bearings.

1.2 Classification:

Bearings shall be of the following types as specified (see 6.2):

| | |
|---|---|
| Type I | Bearing, roller, self-aligning, single row, airframe, antifriction, sealed |
| Type II | Bearing, roller, self-aligning, double row, airframe, antifriction, sealed |
| Type III | Bearing, roller, self-aligning, double row, wide inner ring, airframe, antifriction, sealed |
| Type IV | Bearing, roller, self-aligning, double row, torque tube, airframe, antifriction, sealed. |

2. APPLICABLE DOCUMENTS:

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

| | |
|---|---|
| QQ-P-416 | Plating, Cadmium (Electrodeposited) |

Military

| | |
|---|---|
| MIL-B-197 | Bearings, Anti-Friction, Associated Parts and Sub-Assemblies, Packaging of |
| MIL-E-5272 | Environmental Testing, Aeronautical and Associated Equipment, General Specification for |
| MIL-G-81322 | Grease, Aircraft, General Purpose Wide Temperature Range |

STANDARDS

Military

| | |
|---|---|
| MIL-STD-105 | Sampling Procedures and Tables for Inspection by Attributes |
| MIL-STD-130 | Identification Marking of US Military Property |
| MIL-STD-831 | Test Report, Preparation of |
| MS21431 | Bearing, Roller, Self-Aligning Single Row Anti-friction, Sealed -65° to 350°F, Type I |
| MS21446 | Bearing, Roller, Self-Aligning, Single Row, Barrel Roller, Torque Tube, Airframe, Antifriction, Sealed, Type V |
| MS28912 | Bearing, Roller, Self-Aligning, Single Row, Airframe, Anti-Friction, Sealed, Type I |
| MS28913 | Bearing, Roller, Self-Aligning, Double Row, Airframe, Anti-Friction, Sealed, Type II |

2.1 (Continued):

| | |
|---|---|
| MS28914 | Bearing, Roller, Self-Aligning, Double Row, Wide Inner Ring, Airframe, Anti-Friction, Sealed, Type III |
| MS28915 | Bearing, Roller, Self-Aligning, Double Row, Torque Tube, Airframe, Anti-Friction, Sealed, Type IV |

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications:

The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

American National Standards Institute, Incorporated

| | |
|---|---|
| ANSI B46.1 | Surface Texture, Surface Roughness, Waviness, and Lay |

(Applications for copies should be addressed to the American National Standards Institute, Incorporated, 1430 Broadway, New York, New York 10018.)

3. REQUIREMENTS:

3.1 Qualification:

The bearings furnished under this specification shall be products which have been tested and have passed the qualification tests specified herein, and have been listed or approved for listing on the applicable qualified products list at the time set for opening of bids.

3.1.1 Product change: Any change in product design, including raceway geometry or dimensions, rolling element dimensions, rolling element quantity, seals, materials or plant location shall be reported to the qualifying activity and will 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 will be identified in the qualification notification letter.

3.1.2 Product manufacture: The bearing manufacturer shall be capable of performing the preponderance of manufacturing operations in-house, but may subcontract these operations at its option. Component inspection shall be performed at the plant listed on the Qualified Products List (QPL). If manufacturing operations are performed in more than one plant, the manufacturer's additional plant(s) shall be reported to the qualifying activity and will be listed accordingly on the QPL. The manufacturer is responsible for meeting all requirements of the specification 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 specification requirements. A change in subcontractor need not be reported to the qualifying activity unless specifically identified in the qualification notification letter. (NOTE: Bearings partly or completely manufactured in foreign countries shall be subject to the laws and procurement regulations pertaining to acquisition of foreign made products.)

3.2 Materials:

The material shall conform to requirements as specified on MS28912, MS28913, MS28914, MS28915, MS21431 and MS21446, and other applicable drawings.

3.3 Design and construction:

Only factory new bearings conforming to requirements specified herein shall be used.

3.3.1 Hardness: The rings and rollers shall have a hardness of 60 to 65 on the Rockwell C scale. They shall be uniformly hardened.

3.3.2 Surface roughness:

3.3.2.1 Sides of inner ring: The sides of the inner ring shall have a smooth, machined finish that will not cut nor score the adjacent clevis or fitting, equal to or better than the surface roughness as specified on the MS or other applicable drawing.

3.3.2.2 Faces of raceway: Faces on inner and outer races shall conform to ANSI B46.1 and shall have a smooth finish that will not cut or score the fitting or clevis abutting the race face as specified on the MS or other applicable drawing.

3.3.2.3 Finish: Except when made of corrosion-resistant steel, the face and the outside diameter surfaces, excluding the bore, shall be plated. Plating shall be in accordance with QQ-P-416 as specified on the applicable MS or other applicable drawing.

3.3.3 Seals: Seals shall be of the contact type. The material shall be determined by the manufacturer to provide retention of lubricant and exclusion of environmental substances.

3.3.4 Lubrication provisions: Holes and channels shall be provided for lubrication as shown on the applicable MS or other applicable drawing.

3.3.5 Retainers: Roller retainers or separators, when applicable, shall be made of steel or beryllium copper as specified on the applicable MS or other applicable drawing.

3.3.6 Lubrication: The bearings shall be filled with grease conforming to MIL-G-81322 or MIL-G-23827 so that at least 80% of the bearing void shall be filled. Bearings shall not have been lubricated more than 24 months prior to date of delivery. The bearings shall be thoroughly cleaned and dried before being lubricated.

3.3.7 Stability: The bearing components shall be dimensionally stable for operation form -67° to +250°F.

3.4 Performance:

3.4.1 Radial strength:

3.4.1.1 Radial limit load rating: The bearings shall have a radial limit load rating of not less than the values specified on the applicable MS or other applicable drawing and shall be tested as specified in 4.5.6.

3.4.1.2 Radial fracture load: The minimum static fracture capacity shall be not less than 1-1/2 times the radial limit load rating specified on the applicable MS or other applicable drawing and shall be tested as specified in 4.5.7.

3.4.1.3 Dynamic load rating: The bearings shall have a radial dynamic load rating of not less than the values specified on the MS drawing. The average life shall be 10,000 cycles oscillating through an arc of 90 degrees and shall be tested as specified in 4.5.10.

3.4.2 Axial strength:

3.4.2.1 Axial limit load ratings: The bearings shall have an axial limit load rating of not less than the values specified on the applicable MS or other applicable drawing and shall be tested as specified in 4.5.8.

3.4.2.2 Axial fracture load: The minimum static fracture capacity shall be not less than 1-1/2 times the axial limit load rating values specified on the applicable MS or other applicable drawing and shall be tested as specified in 4.5.9.

3.4.3 Radial play: Radial play, measured before and after the radial and axial limit load rating tests (4.5.6 and 4.5.8), shall be as specified on the applicable MS or other applicable drawing and shall be measured as specified in 4.5.11.

3.4.4 Axial play: Axial play, measured before and after the radial and axial limit load rating tests, (4.5.6 and 4.5.8), shall be as specified as a function of the contact angle and the radial play, and shall be measured as specified in 4.5.12.

3.5 Dimensions and tolerances:

Dimensions and tolerances shall be in accordance with the applicable MS or other applicable drawing and shall be measured as specified in 4.5.15 and 4.5.16.

3.6 Weight:

The weight of the bearings shall be as specified on the applicable MS drawing.

3.7 Identification of product:

The bearings shall be permanently and legibly marked for identification in accordance with MIL-STD-130. The identification data applied to the bearing shall be as follows:

a. Complete MS number (on one shield)
b. Manufacturer's name or trademark, manufacturer's part number optional (on second shield)
c. U. S. (on second shield).

3.8 Workmanship:

All details of workmanship shall be of sufficient high grade to insure satisfactory operation and service life. Parts shall not contain sharp edges, burrs, loose chips, dirt, or other foreign matter.

3.9 MS sheets:

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

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to 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 a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as a part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspection and tests:

The inspection requirements specified herein are classified as follows:

a. Qualification inspection
b. Quality conformance inspection.

4.3 Qualification inspection:

4.3.1 Sampling instruction: Twenty-five bearings of each MS dash number for which qualification is desired shall be tested.

4.3.2 Test reports: The contractor shall prepare a test report in accordance with MIL-STD-831 (see 6.2.1).

4.3.3 Qualification tests: The qualification inspection shall consist of all the tests specified under 4.5. The tests shall be conducted in the order specified in Table I.

4.4 Quality conformance inspection:

4.4.1 Lot: The lot definition, formation, and size shall be in accordance with MIL-STD-105.

4.4.2 Sampling: The sample bearings shall be selected in accordance with the table titled "Master Table for Normal and Tightened Inspection (Single Sampling)" of MIL-STD-105, at inspection level II. The lots shall be accepted or rejected in accordance with acceptable quality level (AQL) of 1.0 percent defective on the basis of the tests specified in 4.4.3.

TABLE I. Qualification Inspection Samples

| Examination or test | Sample number | | | | | | | | | | | | | | | | | | | | | | | | | Test paragraph |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | |
| Examination of product | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | 4.5.1 |
| Preservation of product packing and marking | X | X | X | X | X | X | | | | | | | | | | | | | | | | | | | | 4.6 |
| Hardness | X | X | X | | | | | | | | | | | | | | | | | | | | | | | 4.5.2 |
| Surface roughness | X | X | X | | | | | | | | | | | | | | | | | | | | | | | 4.5.3 |
| Plating | X | X | X | | | | | | | | | | | | | | | | | | | | | | | 4.5.4 |
| Lubrication | X | X | | | | | | | | | | | | | | | | | | | | | | | | 4.5.5 |
| Radial play | | | | X | X | X | X | X | | | | | | | | | | | | | | | | | | 4.5.11 |
| Axial play | | | | X | X | X | X | X | | | | | | | | | | | | | | | | | | 4.5.12 |
| Stabilization | | | | X | X | X | | | | | | | | | | | | | | | | | | | | 4.5.14 |
| Seals | | | | | | | X | X | X | | | | | | | | | | | | | | | | | 4.5.13 |
| Radial limit load | | | | | | | | | | X | X | X | | | | | | | | | | | | | | 4.5.6 |
| Radial fracture load | | | | | | | | | | X | X | X | | | | | | | | | | | | | | 4.5.7 |
| Axial limit load | | | | | | | | | | | | | X | X | X | | | | | | | | | | | 4.5.8 |
| Axial fracture load | | | | | | | | | | | | | X | X | X | | | | | | | | | | | 4.5.9 |
| Radial dynamic load | | | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | X | 4.5.10 |

4.4.3 Quality conformance inspection tests: The quality conformance inspection of the bearings specified in 4.4.2 shall consist of the following tests:

| | | |
|---|---|---|
| a. | Examination of product | (4.5.1) |
| b. | Hardness | (4.5.2) |
| c. | Surface roughness | (4.5.3) |
| d. | Lubrication | (4.5.5) |
| e. | Radial play | (4.5.11) |
| f. | Axial play | (4.5.12). |

4.5 Inspection methods:

4.5.1 Examination of product: Each sample bearing shall be examined for conformance to this specification and the applicable MS with respect to dimensions, identification, finish, and workmanship.

4.5.2 Hardness: Three bearings of each MS size submitted shall be disassembled and tested for hardness on inner race, outer race, and on three rollers. Using a standard Rockwell hardness tester, the test shall be made on a rolling contact area. Readings for rollers shall be taken on a flat surface. The rings and rollers shall have a hardness of 60 to 65 on the Rockwell C scale or the bearing shall be rejected.

4.5.3 Surface roughness: Surface roughness shall be measured in accordance with ANSI B46.1. Test shall be made on the bearings disassembled for 4.5.2. Any failure to comply with the MS shall be cause for rejection.

4.5.4 Plating: Cadmium plating shall be tested for conformance with 3.2.2.3 and the applicable MS. Three bearings of each MS part number submitted shall be tested. Any failure to comply with the MS shall be cause for rejection.

4.5.5 Lubrication: The lubricant shall be inspected for quantity and cleanliness and shall be in conformance with the type of grease specified in 3.3.6.

4.5.6 Radial limit load: Three bearing sizes of each MS shall be tested for radial limit load. The bearing shall be mounted in a rigid support as shown on figure 1 and rotated manually to determine operational smoothness before testing. The starting friction torque shall be measured. The appropriate load specified on the applicable MS shall be applied for 1 minute. The load shall be removed and the bearing inspected for evidence of failure. If starting friction torque has increased 100 percent or more, the bearing shall be considered to have failed.

4.5.7 Radial fracture load: Three bearing sizes of each MS shall be tested for radial fracture load. The radial fracture load of 1-1/2 times the pertinent radial load specified on the applicable MS part number shall be applied to the bearing for 1 minute. After removal of this load, the bearing shall be examined for failure. Bearings that cannot be turned by hand, or that have parts fractured, shall be considered to have failed.

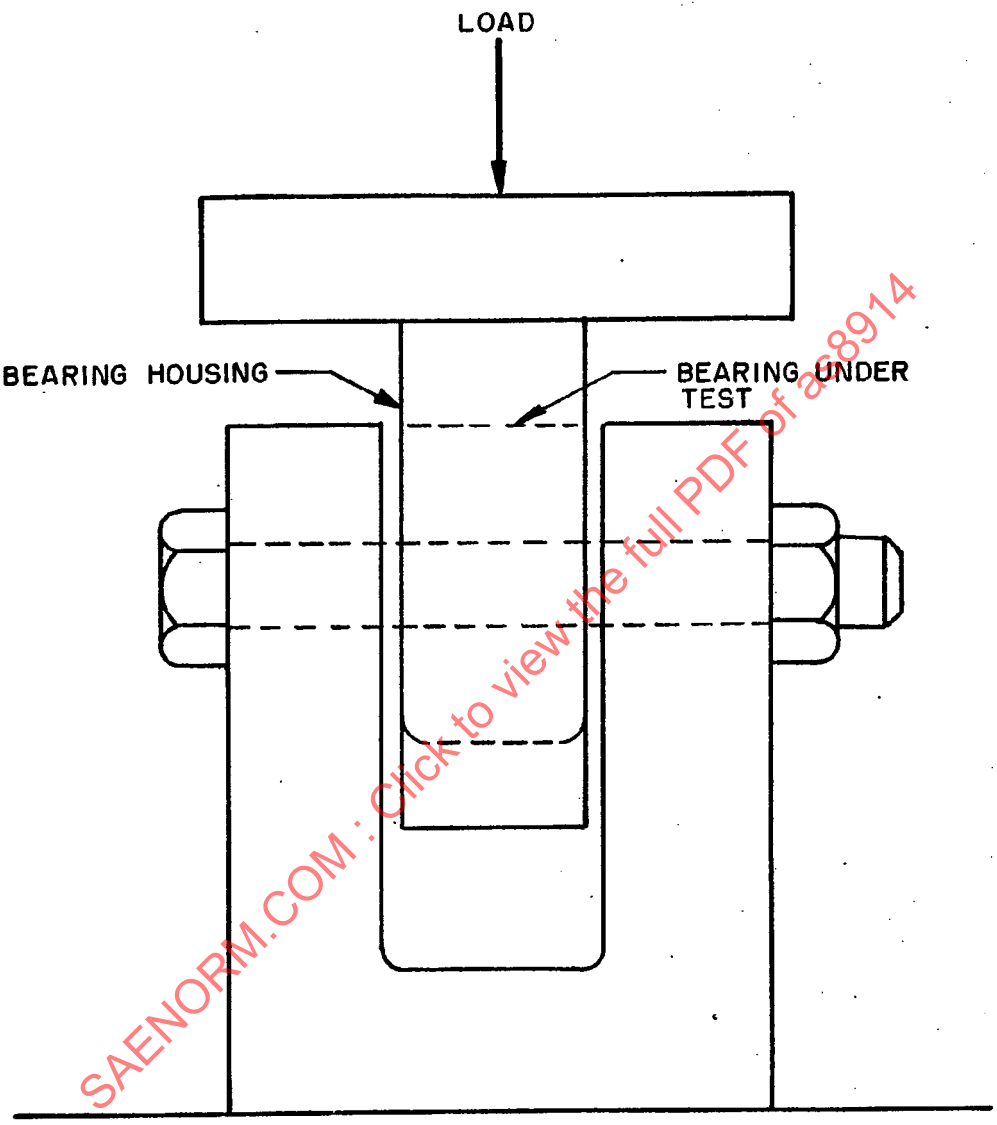




FIGURE 1. Radial Static Capacity Test

4.5.8 Axial limit load: Three bearing sizes of each MS shall be tested to determine the axial limit load. The bearing shall be mounted in a rigid support as shown on figure 2 and rotated manually to determine operational smoothness before testing. The starting friction torque shall be measured. The appropriate load specified on the applicable MS shall be applied for 1 minute. The load shall be removed and the bearing inspected for evidence of failure. If friction torque has increased 100 percent or more, the bearing shall be considered to have failed.

4.5.9 Axial fracture load: Three bearing sizes of each MS shall be tested to determine the axial load limit. An axial fracture load of 1-1/2 times the pertinent axial load specified on the applicable MS shall be applied to the bearing for 1 minute. After removal of this load, the bearing shall be examined for failure. Bearings that cannot be turned by hand, or that have parts fractured, shall be considered to have failed.

4.5.10 Radial dynamic load: Ten bearings of each MS part number submitted shall be tested to determine the radial dynamic load. The bearings shall be mounted on a test fixture having suitable support bearings and drive linkages to provide oscillation of the inner ring. The radial dynamic load specified on the MS shall be applied and maintained within ±1 percent. The bearing shall be oscillated through an arc of 90 degrees and back to starting position for 10,000 cycles. The bearings shall be disassembled and the raceways inspected. Any pitting or evidence of surface fatigue on the raceways or balls shall be considered evidence of bearing failure. If more than 5 bearings show evidence of failure, the bearings shall be considered to have failed the test.



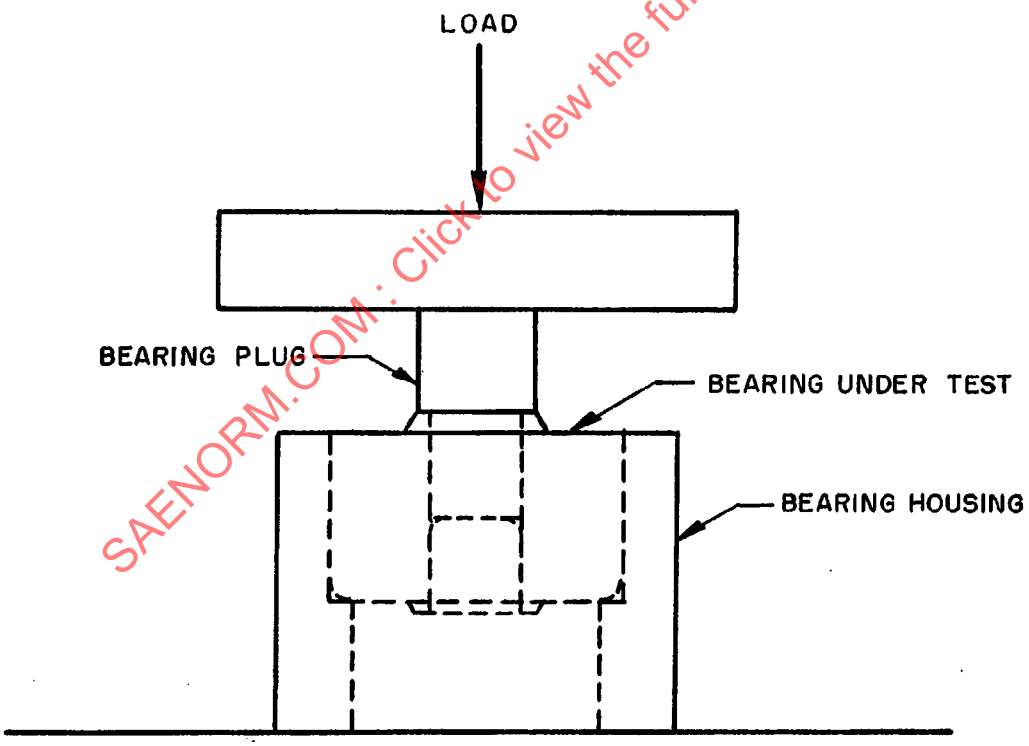


FIGURE 2. Axial Static Capacity Test

4.5.11 Radial play: Five bearings of each MS part number submitted shall be tested for radial play. The inner ring shall be held rigidly and a radial load of 22 pounds applied alternately in opposite directions to the outer race. A dial indicator shall be used to indicate this movement. If 2 or more of these bearings have a radial play larger than that specified, the bearings shall be considered to have failed.

4.5.12 Axial play: Five bearings of each MS part number submitted in the sample shall be tested for axial play. One ring shall be held rigidly and an axial load of 22 pounds applied alternately in opposite directions to the other. A dial indicator shall be used to indicate this movement. If 2 or more of these bearings have axial play larger than that specified, the bearing shall be considered to have failed.

4.5.13 Seals: Three bearings shall be preconditioned by being first held at -67°F for 300 hours and then at 250°F for 300 hours. Bearings shall be subject to sand and dust test in accordance with procedure I of MIL-E-5272 while being operated at 3 rpm in test chamber. Seal deterioration, nonretention of lubricant or ingress of dust into bearings shall be considered seal failure.

4.5.14 Stabilization: Three bearings shall be held at 250 ±10°F for 100 hours and then measured. The bearings shall be held at -67 ±10°F for 100 hours and then measured. All measurements shall be made at room temperature. Bearings that show a dimensional change of more than 0.001 inch (0.025mm) per inch (25mm) of diameter shall be considered to have failed.

4.5.15 Measurement of out-of-round for bore and OD: The OD and the bore shall be measured at three different points around the circumference of the bearing (see figure 3 and 4). One reading shall be taken, then the next reading shall be approximately 20° to the right of the first reading, then the third reading shall be approximately 20° to the left of the first reading. The diameters read at these points must be equal to or within the D-min and D-max given on the MS. The mean, or average, diameter shall be determined from the following formula:

$$D\ mean = \frac{D\ min\ from\ readings + D\ max\ from\ readings}{2}$$

This value shall be equal to or within the tolerance given on the MS.

4.5.16 Edge out-of-round: A distance that is 3.5 times the size of the corner chamfer or corner radius extending inward from the edge shall not be subject to mean diameter requirement, but only to D-min and D-max requirement as specified on the MS.

4.6 Inspection of the preservation, packaging, packing, and marking for shipment and storage:

The inspection of the preservation, packaging, packing, and marking for shipment and storage shall be in accordance with the requirements of section 5.

5. PREPARATION FOR DELIVERY:

5.1 Preservation, packaging, packing, and marking:

Preservation, packaging, packing, and marking shall be in accordance with MIL-B-197. Unit packages shall contain one unit per package. Each unit package shall include the date of lubrication (month and year).