SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS6039

REV. C

Issued 1997-10
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Superseding AS6039B

(R) Bearings, Ball, Rod End, Double Row, Self-Aligning

NOTICE

This document includes cadmium as a plating material. The use of cadmium has been restricted and/or banned for use in many countries due to environmental and health concerns. The user should consult with local officials on applicable health and environmental regulations regarding its use.

1. SCOPE:

1.1 Scope:

This specification covers sealed, self-aligning, anti-friction, rod end ball bearings with application in temperature ranges (1) -65 °F to 250 °F and (2) -65 °F to 300 °F with 20% reduction of dynamic load carrying capacity when subjected to operation above 250° F.

1.2 Classification:

The bearings shall be of the following types, as specified (see 6.2):

Type I - Bearing, ball, solid shank, rod end (AS21150)
Type II - Bearing, ball, external thread, rod end (AS21151)
Type III - Bearing, ball, hollow shank, rod end (AS21152)
Type IV - Bearing, ball, internal thread, rod end (AS21153)

TO PLACE A DOCUMENT ORDER:
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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, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2417	Plating, Zinc-Nickel Alloy
AMS 3652	Polytetrafluoroethylene (PTFE) Film Non-Critical Grade
AMS 3666	Polytetrafluoroethylene (PTFE) Sheet, Glass Cloth Reinforced
AMS 6274	Steel Bars, Forgings, and Tubing, 0.50Cr - 0.55Ni - 0.20Mo (0.18-0.23C)
AMS 6440	Steel Bars, Forgings, and Tubing, 1.45Cr (0.98 1.10C) for Bearing Applications
AS8879	Screw Threads - UNJ Profile, Inch Controlled Radius Root With Increased Minor Diameter
AS21150	Bearing, Ball, Rod End, Double Row, Precision, Solid Shank, Self-Aligning, Airframe, Type I, -65 to 300°F
AS21151	Bearing, Ball, Rod End, Double Row, Precision, External Thread, Self-Aligning, Airframe, Type II, -65 to 300°F
AS21152	Bearing, Ball, Rod End, Double Row, Precision, Hollow Shank, Self-Aligning, Airframe, Type III, -65 to 300°F
AS21153	Bearing, Ball, Rod End, Double Row, Precision, Internal Thread, Self-Aligning, Airframe, Type IV, -65 to 300°F
AMS-QQ-P-416	Plating, Cadmium (Electro deposited)

2.2 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094. Electronic copies may be obtained from http://assist.daps.mil/quicksearch

MIL-STD-129	Military Marking For Shipment And Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-DTL-197	Packaging of Bearings, Antifriction, Associated Parts and Subassemblies.
MIL-PRF-23827	Grease, Aircraft and Instrument, Gear and Actuator Screw, NATO Code Number G-354, Metric
MIL-PRF-81322	Grease, Aircraft, General Purpose, Wide Temperature Range

2.3 ANSI Publications:

Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI/ABMA Std. 4	Tolerance Definitions and Gauging Practices Dimensions/Tolerances/Gauging Practices for Ball and Roller Bearings

2.4 ASTM Publications:

Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

ASTM D 4550	Standard Classification for Thermoplastic Elastomer-Ether-Ester
ASTM E 1444	Standard Practice for Magnetic Particle Inspection
ASTM F 2215	Standard Specification for Balls, Bearings, Ferrous and Nonferrousfor Use in Bearings, Valves, and Bearing Applications

2.5 ASME Publications:

Available from ASME, 3 Park Avenue, New York, NY 10016-5990.

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

3. REQUIREMENTS:

3.1 Aerospace Standards (AS):

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

3.2 Qualifications:

The bearings furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time prior to the award of a contract (see Sections 4 and 6).

3.2.1 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.

3.2.2 Product Manufacture: For government procurement, the local government QAR will be responsible to detect changes in the manufacturing process that are nonconforming or changes that produce nonconforming products and notify the preparing activity. 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. If manufacturing operations are performed in more than one plant, the manufacturer's additional plant(s) shall be reported to the qualifying activity. 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 subcontractors 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.)

3.2.3 Certification of Qualification: To retain qualification of a product approved for listing on the Qualified Products List (QPL), the Qualifying Activity shall require the manufacturer to verify by certification that the manufacturer's product complies with the requirements of this specification. This verification by certification will be in two year intervals from the date of original qualification and will be initiated by the Qualifying Activity. The Qualifying Activity reserves the right to re-examine or require the manufacturer to retest the qualified product whenever deemed necessary to ensure that the product continues to meet any or all of the specification requirements. Sample size and applicable tests to be determined by the qualifying activity.

3.3 Material:

The bearing shall conform to materials as listed on AS21150, AS21151, AS21152, or AS21153, as applicable (see 6.2b). Recycled and recovered raw materials should be used to the maximum extent possible in lieu of virgin raw materials as long as these materials do not jeopardize the intended use and fully comply with all contract requirements. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. None of the above shall be interpreted to mean that the use of used or rebuilt products will be allowed.

3.4 Design and Construction:

Only factory new bearings, as specified herein, shall be furnished. Details of the working parts shall be optional.

3.4.1 Rings: The outer ring shall be of single-piece construction with the rod end shank. The inner ring shall be of a single-piece construction.

3.4.2 Balls: Balls shall meet the requirements of ASTM F2215 and be as specified on the applicable AS sheet.

3.4.3 Threads:

3.4.3.1 Class 1 Rod Ends (External Thread): Dimensions, form and contour shall conform to AS8879. Rerolling of threads to correct dimensional deficiencies shall not be permitted.

3.4.3.2 Class 2 Rod Ends (Internal Thread): Threads shall conform to AS8879.

3.4.3.3 Thread Discontinuities (Laps, Seams and Surface Irregularities): Threads shall have no multiple or single laps at the root or on the sides (Figure 3), except that laps are permissible at the crest which do not exceed 25% of basic thread depth, and on the sides outside the pitch diameter (see Figure 4). Deviation from the thread contour is permissible at the crest of the thread as shown in Figure 4. The incomplete thread at each end of the thread may also deviate from contour.

3.4.4 Dimensions and Tolerances: Dimensions and tolerances shall be in accordance with the applicable AS sheet.

3.4.5 Shank Alignment: The point representing the center of self-alignment motion shall be coincident with the axis of the rod end within .010 inch.

3.4.6 Weight: The approximate weight of the bearing shall be as specified on the applicable AS sheet.

3.4.7 Plating: All external surfaces of the rod end, excluding the bore, seal, and seal retainer, shall be either Zn-Ni plated in accordance with AMS 2417, Type 2 or Cadmium plated per AMS-QQ-P-416, Type I, Class 2, except the chamfer at the inner ring. All external unthreaded surfaces shall have a plating thickness of .0003 to .0006 inches. The plating thickness of the bore chamfers shall be a maximum of .0006 inches. External threaded surfaces shall have a plating thickness range of .0002 to .0005 inches. Hollow (AS21152) and internally threaded (AS21153) shanks need not be internally plated.

3.4.8 Identification of Products: Bearings shall be permanently and legibly marked with the bearing manufacturer's part number,name or symbol (in accordance with MIL-STD 129 and MIL-STD-130), and lot traceability. The individual bearing package and container shall be marked with the complete MS part number, and the manufacturer's name, trademark, or brand, part number, and date of lubrication in accordance with MIL-STD-129.

3.4.9 Hardness: The inner ring and balls shall be through-hardened and shall have a hardness as specified on the applicable AS sheet. The outer raceways shall be case hardened, and the hardness on the surface shall be as specified on the applicable AS sheet.

3.4.10 Surface Roughness: The sides of the inner ring shall have a smooth machine finish that shall not exceed 63 microinches (AA). Otherwise, the surface roughness shall be as specified on the applicable AS sheet.

3.4.11 Seals (Grease Retention): The seals shall be capable of withstanding the test requirements as specified in 4.5.4.1 without failure. Grease conforming to MIL-PRF-81322 shall be injected into the bearing. The amount of grease shall be measured by weight and shall be at least 80% of the nominal theoretical volume within the rod end. Not less than 25% of the bearing lubricant by weight shall be retained in the bearing at the end of 100 hours of testing.

3.4.12 Seals (Dust Contamination): After completion of the dust test specified in 4.5.4.2, seven out of ten tested bearings shall meet the following requirements:

- Radial clearance shall not increase more than 50% or .0002 inches over the pretest value, whichever is greater.

- Starting torque shall not increase more than 100% or 2 inch-ounces over the pretest value, whichever is greater.

3.4.13 Lubrication: The bearing shall be thoroughly cleaned prior to lubrication. Grease conforming to MIL-PRF-81322 or MIL-PRF-23827 shall be injected into the bearing, filling the bearing voids 80% minimum full. The bearing bore and the inside diameter of hollow or internally threaded shanks shall also be coated with MIL-PRF-81322 or MIL-PRF-23827 Grease. The bearing shall have not been lubricated more than 36 months prior to date of delivery of the bearing under contract. The bearing external surfaces shall be coated with the same grease that is packed in the bearing or compatible oil per MIL-DTL-197.

3.5 Performance:

3.5.1 Internal Clearance (Qualification): Radial and axial clearance, measured before the radial and axial limit load rating tests (see 4.5.6 and 4.5.7), shall not exceed the limits as specified on the applicable AS sheet.

3.5.2 Internal Clearance (Acceptance): When tested in accordance with 4.5.6 and 4.5.7, the radial and axial clearance shall be within the limits specified on the applicable AS sheet.

3.5.3 Radial Strength:

3.5.3.1 Radial Limit Load Rating: When tested in accordance with 4.5.8, the bearing shall have a radial limit load rating of not less than the values specified on the applicable AS sheet. If the smoothness of operation of the bearing has been lessened perceptibly or the radial clearance has increased by more than .0002 inch from the initial measurement, the bearing shall be considered to have failed and the lot rejected.

3.5.3.2 Radial Ultimate Load: When tested in accordance with 4.5.9, the minimum static ultimate load shall be not less than 1-1/2 times the radial limit load value specified on the applicable AS sheet. Bearings that cannot be turned by hand, or that have parts fractured, shall be considered to have failed.

3.5.4 Axial Strength:

3.5.4.1 Axial Limit Load Rating: When tested in accordance with 4.5.10, the bearing shall have an axial limit load rating of not less than the values specified on the applicable AS sheet. If the smoothness of operation of the bearing has been lessened perceptibly or if the axial clearance has increased by more than .0005 inch from the initial measurement, the bearing shall be considered to have failed and the lot rejected.

3.5.4.2 Axial Ultimate Load: When tested in accordance with 4.5.11, the minimum static ultimate load shall not be less than 1-1/2 times the axial limit load value specified on the applicable AS sheet. Bearings that cannot be turned by hand, or that have parts fractured, shall be considered to have failed.

3.5.5 Radial Dynamic Load Rating: When tested in accordance with 4.5.12, the bearing shall have a radial dynamic load rating of not less than the value specified on the applicable AS sheet. A bearing shall be considered to have failed if any of the following defects are detected: wear of the outer raceway greater than .002 in or .002 in radial displacement during dynamic testing; spalling, cracking detected by MPI, or fracture of any component. If more than five bearings show evidence of failure, the entire lot shall be considered to have failed the test.

3.5.6 Bearing Starting Torque: The amount of torque required to begin rotation of the bearing shall be measured as specified (see 4.5.14). Starting torque shall be within the maximum allowable values as specified on the applicable AS sheet.

3.6 Workmanship:

Parts shall not contain sharp edges, burrs, loose chips, dirt, or other foreign matter. The raceways and balls shall be free of tool marks, galling, and scratches after assembly.

4. QUALITY ASSURANCE PROVISION:

4.1 Responsibility for Inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any other commercial laboratory acceptable to the purchaser. The purchaser reserves the right to perform any of the inspection set forth in the 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 4. 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 purchaser for acceptance comply with all requirements of the contract. Sampling inspection occurring continuously as part of manufacturing operations and/or from inspection lots is an acceptable practice.

4.1.2 Test Records: The manufacturer shall maintain a record showing quantitative results of all qualification tests until subsequent requalification; and attribute data for all quality conformance tests performed to the requirements of this specification for a minimum of seven years. The records shall be available to the purchaser and shall be signed by an authorized representative of the manufacturer or the testing laboratory, as specified.

4.2 Classification of Inspections:

The examination and testing of the bearing shall be classified as:

a. Qualification inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.3 Qualification Inspection:

Qualification inspection shall consist of all the examination and tests specified under 4.5 and in accordance with Table 1.

4.3.1 Test Samples: Unless otherwise specified by the qualifying activity, representative sizes for qualification testing of bearings in all associated AS standards shall be represented by MS 21151-2, MS 21151-8, and MS 21151-10. The 36 samples shall be identified with the manufacturers part number and such other information as required by the procuring activity (see 6.3). The samples shall be lubricated with grease conforming to MIL-PRF-81322. Successful testing of the bearing samples utilizing MIL-PRF-81322 shall grant approval to MIL-PRF-23827 based on similarity.

4.4 Quality Conformance Inspection:

Quality conformance inspection shall consist of individual tests and sampling tests. Table 2 provides a matrix summarizing quality conformance inspections.

4.4.1 Individual Tests: The individual tests shall consists of the examination of product and 100% magnetic particle inspection of banjo portion of bearing in accordance with ASTM E 1444.

4.4.2 Sampling Tests: The sampling tests shall consist of the tests as specified in Table 2.

4.4.2.1 Lot: A lot shall consist of all bearings of the same type and part number manufactured under the same conditions and offered for acceptance at the time.

4.4.2.2 Sample for Quality Conformance Inspection: The sample bearings shall be selected at random from each lot in accordance with Table 3. If no defects are found in the samples, the lot shall be accepted. If any defects are found in the sample, the entire lot shall be 100% inspected for each characteristic found, and the defective parts shall be removed from the lot. If any hardness defects are found in the Normal Inspection Plan of Table 3A, the lot shall be re-inspected under the tighter Inspection plan of Table 3A. If a defect is found in the Tighter Inspection sample, the entire lot shall be rejected and shall not be offered for sale or acceptance under this specification.

4.4.3 Retention of Qualification: In order to retain qualification, the results of the retention of qualfication tests, listed in Table 4, shall be furnished to the qualifying activity at 60 month intervals. The bearing sizes shall be as specified in 4.3.1. To retain qualification, the manufacturer's products shall pass all the retention of qualification tests. Failure to furnish the test information shall result in loss of qualification for that product. The qualfiying activity may periodically request samples for in-house verification testing.

4.5 Inspection Methods:

4.5.1 Examination of Product: Each bearing in the sample shall be carefully examined for conformance to this specification and the applicable AS with respect to materials, construction, dimensions, tolerances, weight, finish, identification, marking and workmanship. Each bearing shall be inspected in accordance with ANSI/ABMA Standard 4.

4.5.1.1 Magnetic Particle Inspection: This inspection shall be in accordance with ASTM E 1444. The bearing outer race and shank shall be 100% magnetically inspected by both longitudinal and circular methods prior to assembly. Certification of such inspection shall be furnished with qualification sample.

4.5.1.2 Plating: Zn-Ni alloy plating or Cadmium plating as specified on the applicable AS sheet shall be tested for thickness and adhesion in accordance with AMS 2417, Type 2 or AMS-QQ-P-416, Type I, Class 2, except the chamfer at the inner ring where plate coverage is preferred, but not required. Two bearings from each MS size shall be tested. Failure of any bearing to conform to the applicable AS sheets shall be cause for rejection of the represented lot.

4.5.2 Hardness: Three bearings from each MS size shall be disassembled and tested for hardness using a standard hardness tester or other suitable hardness tester as required for reason of size, with readings converted to appropriate Rockwell scale. The test shall be made on the rolling contact area of the inner and outer raceways and on three balls. Readings for balls shall be taken on a flat surface. Readings for rod ends exterior shall be taken on the shank and banjo head O.D. areas, except for externally threaded shanks which shall have readings taken near the approximate centerline of the shank. The hardness shall be as specified in 3.4.9; otherwise the bearing shall be rejected. The effective case depth shall be determined by the micro hardness method and shall be defined as that distance from the raceway to the point where the hardness diminishes to value less than HR_c 50.

4.5.3 Surface Roughness: Surface roughness shall be measured in accordance with ANSI B46.1. The test shall be made on the three bearings from each MS size disassembled in 4.5.2. Any failure to comply with the surface roughness requirements of the applicable AS sheet shall be cause for rejection.

4.5.4 Performance Tests: (Qualification)

4.5.4.1 Seal Test (Grease Retention): Three bearings of each MS size shall be maintained at 250° F + 10° F/ - 0° F for 100 hours while being rotated in a test chamber at 3 rpm ± 1 rpm with no applied load (succesful testing of parts at temperatures above 260° F shall not be cause for rejection). The bearings shall be mounted on a horizontal shaft with the bodies held stationary. Prior to testing the bearings shall be wiped free of grease and weighed. After testing they shall again be wiped free of grease and weighed. Then all bearing components shall be weighed again after being thoroughly washed to remove all grease. The percent grease fill prior to testing and the percent of the grease retained shall be calculated as follows:

$$\% \text{ grease retained} = 100(W_{pt} - W_d)/(W - W_d) \qquad \text{(Eq.1)}$$

where:

W = Weight of the greased rod end with grease wiped off external surfaces

W_d = Dry weight of the rod end components after cleaning

W_{pt} = Weight of rod end after testing with grease wiped off external surfaces

4.5.4.2 Dust Test: Ten bearings from each MS size shall be subjected to the dust test. The bearings shall be tested at 77 °F ± 15 °F in a closed test chamber. Duration of test shall be 48 hours. The bearings shall be mounted on a horizontal shaft and rotated at 3 rpm ± 1 rpm with no applied bearing load and with the bodies held stationary. Pretest values of starting torque and radial clearance shall be recorded. Post-test measurement of starting torque shall be made in the "as tested" condition. Before post-test measurement of radial clearance, seal retainers shall be removed and the bearings cleaned thoroughly and relubricated with the same type grease as originally lubricated. The seals shall be reinstalled, if possible, before post-test radial clearance is measured. Both sets of measurements shall be recorded.

4.5.4.2.1 Test Chamber Requirements: The test chamber shall be cubic, 2 feet per side, and shall provide view ports for test observation. A minimum layer of 1 inch of test media shall be maintained on the chamber floor. Test chamber actuation shall provide continous movement of dust, creating a uniform cloud which shall render test specimens not readily visible through the view ports. Test specimens shall have a minimum spacing of 3 inches from each other and from chamber walls, and the mounting shaft centerline shall be 8 to 16 inches above the chamber bottom.

4.5.4.2.2 Dust Test Media: Testing shall be conducted with Arizona Test Dust in accordance with ISO 12103-1 supplied to SAE Coarse Grade (see 6.4).

4.5.5 Lubrication: The lubricant shall be inspected for quality and cleanliness and shall be in conformance with the type of grease specified in 3.4.13. Lubricant manufacturer's certification and QPL listing shall be the basis for lubricant quality assurance.

4.5.6 Radial Clearance: Five bearings from each MS size shall be tested for radial clearance. The inner ring shall be held rigidly and a radial load of 5½ pounds applied alternately in opposite directions to the outer ring. An indicating device shall be used to measure total radial movement of the outer ring. This value shall be recorded.

4.5.7 Axial Clearance: Five bearings from each MS size shall be tested for axial clearance. The outer ring shall be held rigidly and an axial load of 5½ pounds applied alternately in opposite directions to the inner ring. An indicating device shall be used to measure total axial movement of the inner ring. This value shall be recorded.

4.5.8 Radial Limit Load (Qualification): The five bearings from each MS size tested per 4.5.6 shall be mounted in a rigid support as shown in Figure 1. A 5½ pound radial load shall be applied, and the bearing shall be rotated by hand to determine smoothness of operation before testing. The load shall then be removed and the applicable radial limit load, specified on the applicable AS sheet, shall be applied for one minute. The limit load shall be removed, and the 5½ pound radial load shall be reapplied. The radial clearance shall then be measured as specified in 4.5.6 and 3.5.3.1.

4.5.9 Radial Ultimate Load (Qualification): The radial ultimate load of 1-1/2 times the radial limit load specified on the applicable AS sheet shall be applied to the bearing for 1 minute. After removal of the load, the bearings shall be examined for failure. Three bearings from each MS size submitted shall be tested.

4.5.10 Axial Limit Load (Qualification): The five bearings from each MS size tested per 4.5.7 shall be mounted in a rigid support as shown in Figure 2. A 5½ pound axial load shall be applied, and the bearing shall be rotated by hand to determine smoothness of operation before testing. The load shall then be removed, and the applicable axial limit load, specified on the applicable AS sheet, shall be for applied one minute. The limit load shall be removed and the 5½ pound axial load shall be reapplied. The axial clearance shall then be measured as specified in 4.5.7.

4.5.11 Axial Ultimate Load (Qualification): The axial ultimate load of 1-1/2 times the axial limit load specified on the AS shall be applied to the bearing for 1 minute. After removal of the load, the bearing shall be examined for failure. Three bearings from each MS size submitted shall be tested.

4.5.12 Radial Dynamic Load (Qualification): The bearing shall be mounted in a test fixture having suitable support bearings and drive linkages to provide oscillation of the inner ring (CASE I RATING on the applicable AS sheet). The radial dynamic load specified on the applicable AS sheet shall be applied and maintained within ±1% for the duration of the test. The bearing shall be oscillated through an arc of 90° and back to the starting position for 10,000 cycles at room temperature. The bearings shall be removed and examined for excessive roughness and looseness (see 3.5.5). All ten bearings shall be disassembled and inspected for wear depth of the outer raceway and component defects. Ten bearings from each MS size submitted shall be tested.

4.5.13 Preservation, Packaging, and Marking: Preservation, packaging, and marking shall be examined for conformance with Section 5.

4.5.14 Bearing Starting Torque:

4.5.14.1 Bearing Mounting: The bearing shall be mounted with the rotation axis of the bearing either horizontal or vertical so that one race may be rotated while the other race is held stationary.

4.5.14.2 Torque Measurement: Torque shall be applied either by using an electrically driven torque measuring device which starts at a static state or using a torque watch and slowly increasing torque until first motion of the inner ring occurs. The torque indicator shall be calibrated and shall indicate torque in inch-ounces. The indicator shall be accurate to sub-divisions of torque not greater than 10% of the maximum allowable torque for the bearing measured. The torque shall be measured in both rotational directions and the higher value of the two shall be recorded.

5. PACKAGING:

5.1 Preservation: Preservation shall be in accordance with MIL-DTL-197 or commercial as specified in the Acquisition document (see 6.2).

5.2 Packing: Packing shall be in accordance with MIL-DTL-197, Level A or B or commercial as specified in the Acquisition document (see 6.2).

5.3 Marking: Marking shall be in accordance with MIL-DTL-197 and MIL-STD-129.

6. NOTES:

6.1 Intended Use:

These sealed, anti-friction, rod end bearings are intended for use in aircraft control systems where high rotational speeds are not involved. These bearings are rated for operation from -65 °F to 300 °F with a 20% reduction of dynamic load carrying capacity when subjected to operation above 250° F.

6.2 Acquisition Requirements:

Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Type and complete MS number (see 1.2 and 3.2).

c. Quantity.

d. Levels of preservation, packaging, and packing (see 5.1).

6.3 Qualification:

With respect to product requiring qualification, awards will be made only for such products as have, prior to the award of a contract, been tested and approved for inclusion in the applicable Qualified Products List, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. For direct government procurement, or end government usage the activity responsible for the Qualified Products List is Defense Supply Center Richmond, ATTN: DSCR-VEB, 8000 Jefferson Davis Hwy, Richmond, VA 23297-5616 and information pertaining to qualification or products may be obtained from that activity.

6.3.1 Qualification of a Bearing Distributor: Department of Defense standardization regulations have specific requirements covering qualification approval of a distributor. Details of these requirements may be obtained from the qualifying activity.

6.3.2 Procurement of Bearings From a Distributor Not Listed on the Government QPL: Government contractors and subcontractors who plan to procure a qualified bearing from a distributor not listed on the Government QPL should be aware that distributors frequently stock bearings which were manufactured several years earlier. Since specification requirements are occasionally changed without a corresponding change in part marking the part offered for sale by the distributor may not meet current specification requirements. To assure that these parts meet current specification requirements, the contractor should require the following information from the distributor:

(1) Certification that the bearings have been inspected for compliance to the current specification requirements.

(2) Certification of the original manufacturer's name, part number, and date of lubrication on the outside of each package.

NOTE: DOD regulations state that only distributors who have obtained written permission from the original bearing manufacturer and who have been approved by the qualifying activity for listing on a QPL may rebrand a QPL listed item.

6.4 Dust Test Media Source:

Dust may be purchased from Powder Technologies Inc., P.O. Box 1464, Burnsville, MN 55337, or from other sources.

6.5 Subject Term (Key Word) Listing:

Anti-friction
Axial Ultimate
Cadmium
Radial Ultimate
Sealed Rod End
Zinc Nickel

6.6 The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document.

PREPARED UNDER THE JURISDICTION OF THE
AIRFRAME CONTROL BEARINGS GROUP (ACBG)

TABLE 1 - Qualification Inspection Samples

INSPECTION or TEST	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17-26	27-36	Requirement Paragraph	Test Paragraph
Examination of Products	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X-X	X-X	4.5.1	4.5.1
Magnetic Particle	X	X																	4.5.1.1	4.5.1.1
Plating	X	X																	3.4.7	4.5.1.2
Surface Roughness	X	X	X																3.4.10	4.5.3
Hardness	X	X	X																3.4.9	4.5.2
Seal Test														X	X	X			3.4.11	4.5.4.1
Dust Test																	X		3.4.12	4.5.4.2
Starting Torque				X	X	X	X	X											3.5.6	4.5.14
Radial Clearance				X	X	X	X	X											3.5.2	4.5.6
Radial Limit Load				X	X	X	X	X											3.5.3.1	4.5.8
Radial Ultimate Load				X	X	X													3.5.3.2	4.5.9
Axial Clearance									X	X	X	X	X						3.5.2	4.5.7
Axial Limit Load									X	X	X	X	X						3.5.4.1	4.5.10
Axial Ultimate Load									X	X	X								3.5.4.2	4.5.11
Radial Dynamic Load																		X-X	3.5.5	4.5.12

Note: "X" indicates the test required for each of the test sample of 36 items

TABLE 2 - Quality Conformance Inspection

Examination or Test	Major Characteristics	Minor Characteristics	Special Inspection Plan	Requirement Paragraph	Test Paragraph
Bore center to end of shank "A"		X		3.4.4	4.5.1
Bore "B"	X			3.4.4	4.5.1
Thread Length "C"		X		3.4.4	4.5.1
O.D. "D"		X		3.4.4	4.5.1
Outer Ring Width "H"		X		3.4.4	4.5.1
Inner ring chamfer "N"		X		3.4.4	4.5.1
Inner ring O.D. "O"		X		3.4.4	4.5.1
Thread, UNJF "T"		X		3.4.3	4.5.1 thru 4.5.3
Inner Ring Width "W"	X			3.4.4	4.5.1
Hardness			See Table 3A	3.4.9	4.5.2
Surface Roughness			See Table 3A	3.4.10	4.5.3
Lubrication		X		3.4.13	4.5.5
Radial Clearance	X			3.5.2	4.5.6
Axial Clearance		X		3.5.2	4.5.7
Plating		X		3.4.7	4.5.1.2
Starting Torque	X			3.5.6	4.5.14
Examination of Product		X		3.6	4.5.1