

FED. SUPPLY CLASS

3110

1. SCOPE

- 1.1 Scope. This specification establishes the requirements for airframe, anti-friction self-aligning, ball and roller bearing, rod ends.

2. REFERENCED DOCUMENTS

- 2.1 Specifications. The following specifications of the issue in effect on date of invitations for bids shall form a part of this specification to the extent specified herein:

ASME

ASME B46.1 Surface Texture

Copies can be obtained from ASME, Three Park Ave., New York, NY 10016-5990. www.asme.org

ASTM International

ASTM D 2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor

ASTM E 1444 Standard Practice for Magnetic Particle Examination

Copies can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. www.astm.org

Military Specifications and Standards

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

MIL-S-7742 Screw Threads, Standard, Optimum Selected Series: General Specification for

MIL-PRF-23827 Grease, Aircraft and Instrument, Gear and Actuator Screw

Copies can be obtained from the Department of Defense Single Stock Point (DODSSP). <http://dodssp.daps.dla.mil>

Aerospace Industries Association

NAS659 Bearing, Rod End, External Thread, Self-Aligning, Anti-Friction

NAS660 Bearing, Rod End, Plain Shank, Self-Aligning, Anti-Friction

Copies can be obtained from the Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209. www.aia-aerospace.org

SAE International

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

AS8879 Screw Threads - UNJ Profile, Inch Controlled Radius Root with Increased Minor

Diameter

Copies can be obtained from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096-0001.

www.sae.org

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THIRD ANGLE PROJECTION	CUSTODIAN NATIONAL AEROSPACE STANDARDS COMMITTEE	REVISION 6
PROCUREMENT SPECIFICATION NONE	TITLE BEARINGS, BALL AND ROLLER, ROD END, ANTI-FRICTION, AIRFRAME	CLASSIFICATION SPECIFICATION NAS661 SHEET 1 OF 9

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
1000 WILSON BLVD.
ARLINGTON, VA 22209

THIS DRAWING SUPERSEDES ALL ANTECEDENT STANDARD DRAWINGS FOR THE SAME PRODUCT AND SHALL BECOME EFFECTIVE NO LATER THAN SIX MONTHS FROM THE LAST REVISION DATE.

FORM 09-01

REVISION DATE: JULY 31, 2012

ISSUE DATE: MARCH 1957

3. REQUIREMENTS

3.1 Materials.

3.1.1 Metals. The steel used shall be such that the finished bearings will meet the requirements specified herein. The manufacturer shall use due care in subjecting the steel used to suitable check analysis and physical tests to satisfy the purchaser as to the steel used.

3.1.2 Filled Epoxy Base Filler. When required by the appropriate code letter in the NAS Standard, the bearing shall be filled to within .062 of the shank end with Crest 3119 Resin and Crest 7103 curing agent as manufactured by the Crest Products, Co., Fountain Valley, CA. The mixing proportion of the resin-to-curing agent shall be 100:6.5 by weight. As an alternate filler use Hysol Resin RE-2038 with hardener HD-3475 manufactured by the Hysol Division, Dexter Corporation, Olean, New York. The mixing ratio by weight of RE-2038/HD-3475 is 100/25. The cured epoxy base filler shall withstand temperatures of -67 °F to 250 °F without excessive shrinkage or cracking.

3.2 Design and Construction. The bearings shall be of such design and construction as to meet the requirements specified herein. Except as otherwise specified, the details of the working parts shall be optional.

3.2.1 Raceways. The raceways of the inner and outer rings shall be of single piece construction.

3.3 Closures. Closures shall be provided to prevent the entrance of dust and to retain the lubricant throughout the range of temperature specified herein.

3.3.1 Type. The material of the sealed closure shall be a composition contact seal which will operate satisfactorily at conditions specified in Section 4. Closures of the seal type shall be readily removable by service activities for inspection and relubrication of the bearings, and shall be of such construction that they may be replaced without difficulty. Enclosures shall withstand temperatures of (-67 °F to 250 °F) without warpage or embrittlement which will prevent retention of the lubricant. Closures shall be compatible with the lubricant specified herein.

3.4 Dimensions and Tolerances. Dimensions and tolerances shall be as specified on the applicable NAS drawings.

3.5 Finish. The faces of inner ring shall have a smooth finish that will not exceed 63 microinches Ra per ASME B46.1.

3.5.1 Races. The inner raceway and rolling elements shall be through-hardened. The outer raceway shall be hardened from a minimum of 15 percent to a maximum of 50 percent of the raceway thickness. The raceway and rolling elements shall have a high-grade lapped surface finish that will not exceed 8 microinches Ra per ASME B46.1.

3.6 Hardness.

3.6.1 Metal Shank. The rod end metal shank shall have a uniform cross-sectional hardness and have a tensile strength between 125 KSI minimum and 180 KSI maximum.

3.6.2 Epoxy Base Filler. The epoxy base filler shall have a Barcol hardness between 30 minimum and 40 maximum.

3.7 Plating. All external metal surfaces, except the inner race bore, shall be cadmium plated in accordance with Specification AMS-QQ-P-416 Type II, Class 2. The plating thickness shall not exceed .0005-inch maximum. Dissimilar metals resulting in electrolytic corrosion shall not be used in contact. Parts with Class 3 plating may be supplied until 30 April 1976.

3.7.1 Hydrogen Embrittlement. All rod ends where shank or the eye is heat treated to over 150 KSI shall be baked after plating to provide protection from hydrogen embrittlement. (The hardness of the bearing races shall not be considered in applying this requirement.) Treatment shall be as follows: Immediately after completion of the plating operation and prior to magnetic inspection, all such parts shall be heated to a temperature of 191 °C ± 14 °C (375 °F ± 25 °F) and be held at this temperature for a minimum of 3 hours, after which they may be allowed to cool normally at room temperature.

3.8 Concentricity. The point representing the center of the self-alignment motion shall be coincident with the axis of the rod end shank within .010 inch.

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- 3.9 Self-Alignability. The rod end bearing shall be self-aligning for a minimum of 20° included angle about the axis of the bearing in the normal position.
- 3.10 Lubrication. The bearings shall be packed with grease conforming to Specification MIL-PRF-23827 completely filling the bearing voids. The bearings shall be thoroughly cleaned and dried before the lubricant is injected into the bearings.
- 3.11 Total Internal Radial play. Radial play, measured before and after limit radial and axial strength tests, shall not exceed .0020 inch.
- 3.12 Identification of Product. The bearings shall be legibly marked with the manufacturer's name or trademark and the complete NAS part number as noted in the NAS drawings.
- 3.13 Workmanship. The workmanship shall be in accordance with high-grade aircraft manufacturing practice.
- 3.14 Radial Strength.
- 3.14.1 Limit Load. The static limit load radial strength of the bearing shall be not less than the values specified in Table I, when tested as described in Section 4.
- 3.14.2 Static Fracture. The minimum static fracture radial strength shall be not less than 1-1/2 times the radial static limit load value specified in Table I, when tested as described in Section 4.
- 3.14.3 Load Life. The load life radial strength shall not be less than the radial load values specified in Table I, when tested as described in Section 4.
- 3.15 Axial Strength.
- 3.15.1 Limit Load. The static limit load axial strength of the bearing shall be not less than the values specified in Table I when tested as described in Section 4.
- 3.15.2 Fracture Axial Strength. The minimum static fracture axial strength shall be not less than 1-1/2 times the axial load value specified in Table I, when tested as described in Section 4.

TABLE I – LOAD LIMIT

PART NUMBERS		STATIC LIMIT LOAD		RADIAL LOAD		
		RADIAL	AXIAL	20,000 CYCLES	100,000 CYCLES	500,000 CYCLES
NAS659-3-5	NAS660-3-7	1000	200	775	490	320
NAS659-4-7	NAS660-4-9	1720	340	1450	935	590
NAS659R4-9	NAS660R4-11	3025	605	2100	1350	850
NAS659R5-12	NAS660R5-14	7350	1470	5000	3300	2200
NAS659R6-14	NAS660R6-16	9600	1920	6700	4375	2875

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