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Approved by：Xu Chaoqun

China Civil Aviation Technical Standard Order

This China Civil Aviation Technical Standard Order (CTSO) is issued according to Part 37 of the China Civil Aviation Regulations (CCAR-37). Each CTSO is a criterion which the concerned aeronautical materials, parts or appliances used on civil aircraft must comply with when it is presented for airworthiness certification.

Aircraft Bearings

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers of aircraft bearings applying for CTSO authorization (CTSOA). This CTSO prescribes the minimum performance standards (MPS) that aircraft bearings must first meet for approval and identification with the applicable CTSO marking.

2. Applicability.

This CTSO affects new application submitted after its effective date. Major design changes to article approved under this CTSO will require a new authorization in accordance with section 21.353 of CCAR-21-R4.

3. Requirements.

Aircraft bearings that are to be identified with this CTSO and that are manufactured on or after the date of this CTSO must meet the minimum performance standards specified in the manufacturer’s part

drawing(s) and applicable part specification(s) submitted with the bearing manufacturer’s application for CTSO authorization.

a. Test Requirements. The required performance shall be demonstrated by accomplishing the tests specified for each property in the part drawing(s) and applicable part specification(s), in accordance with the test procedures specified in appendix 1.

b. Deviations. Alternative test procedures or analytical data that produce an equivalent level of safety may be used if specified at the time of CTSO application and approved in accordance with 21.368(a) in CCAR-21-R4.

4. Marking.

a. In addition to the marking specified in 21.423(b) in CCAR-21-R4, the bearing type, the lubrication date (if applicable), and the manufacturer’s inspection lot number shall be permanently and legibly marked on each package or container.

b. Each individual bearing that is manufactured under this CTSO must be permanently and legibly marked with at least the name or symbol of the manufacturer, the manufacturer’s part number, and CTSO number. When this is not practical, marking may be accomplished in a manner acceptable by the authorities.

5. Data Requirements.

a. The applicant must furnish the responsible certification personnel, with the related data to support design and production approval. The application data include a statement of conformance as specified in section 21.353(a) in CCAR-21-R4 and one copy each of the following technical data:

（1）Part drawing(s) and applicable specifications necessary to define the design and minimum performance for each bearing part number.

（2）Manufacturer’s CTSO qualification test report in accordance with the test procedures specified in appendix 1.

（3）Inspection lot number(s) of qualification parts.

b. In addition to the data required by paragraph 5.a, the following data must be available for review by the aircraft certification office:

(1) Copies of all standards/specifications used in the manufacturer’s application for CTSO authorization.

(2) Inspection lot number and quantity for each production lot of bearings.

(3) Acceptance inspection test results for each lot of bearings.

c. Data and information that must accompany aircraft bearings manufactured under this CTSO:

（1）Inspection lot number(s) and quantity of parts shipped.

（2）Date of lubrication (if applicable) or date of manufacturer.

（3）A note with the following statement:

“The parts contained in this shipment have been manufactured and inspected in accordance with CTSO-C149. The conditions and tests required for CTSO approval of this article are minimum performance standards. Aircraft bearings approved under this CTSO are not necessarily interchangeable with other aircraft bearings approved under this CTSO. Bearings of similar dimensional properties may have widely varying performance properties. Substitution of bearings may only be done if approved by the Authorities.”

6. Inspection Lot of Bearings.

An inspection lot consists of assembled bearings of a particular part number, assembled at the same time and processed through all final assembly operations as a single group, and subsequently submitted for final inspection at one time.

7. Availability of Reference Documents.

a．Military documents may be purchased from：

DoDSSP, Customer Service Subscription Service Desk.

700 Robins Avenue, Building 4D, Philadelphia, PA 19111-5094.

b．ANSI/ABMA documents may be purchased from：

ABMA, 1200 19th Street NW, Washington, DC 20036.

c. ASTM documents may be purchased from：

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

Appendix1. Aircraft Bearing Property Test Requirements

Table 1 Aircraft Bearing Property Test Requirements, Rotational Motion

	Design Properties					**Performance Properties**	
Bearing Type	Materials	Hardness	Dimensions	Radial Internal Clearance	Radial Runout	Static Radial Load Rating	Dynamic Radial Load Rating
Ball	X	X	X	X	X	X	X
Miniature/Inst. Ball	X	X	X	X	X	X	X
Roller	X	X	X	X	X	X	X
Needle Roller	X	X	X	X	X	X	X
Applicable Documents	Drawing or Specification	ASTM E18	ANSI/ABMA，Standard 4 ANSI/ABMA，Standard 12.1 ANSI/ABMA，Standard 12.2			ANSI/ABMA，Standard 9 ANSI/ABMA，Standard 11 ANSI/ABMA，Standard 12.1 ANSI/ABMA，Standard 12.2	

Table 2. Aircraft Bearing Property Test Requirements, Slow Rotational and Oscillatory Motion

	Design Properties							
Bearing Type	Materials	Hardness	Dimensions	Surface Treatment	Lubrication	Radial Internal Clearance	Axial Internal Clearance	**Applicable Documents**
Ball	X	X	X	X	X	X	X	MIL-B-7949
Rod ends with integral ball bearing	X	X	X	X	X	X	X	MIL-B-6039
Roller	X	X	X	X	X	X	X	MIL-B-8914
Rod ends with integral roller bearing	X	X	X	X	X	X	X	MIL-B-8952
Needle Roller	X	X	X	X	X	X	X	MIL-B-3990

Needle track rollers, Stud type	X	X	X	X	X	X	X	MIL-B-3990
Needle track rollers, yoke type	X	X	X	X	X	X	X	MIL-B-3990
Spherical plain, lubricated	X	X	X	X	X			MIL-B-8976
Rod ends with integral spherical plain bearings, lubricated	X	X	X	X	X			*MIL-B-81935 and *MIL-B-8976
Spherical plain bearings, self-lubricated	X	X	X	X				MIL-B-81820
Rod ends with integral spherical plain bearings, self-lubricated	X	X	X	X				MIL-B-81935
Journal bearings, straight and flanged, self-lubricated	X	X	X	X				MIL-B-81934

*MIL-B-81935 is applicable to testing; MIL-B-8976 is referenced for product features.

Table 2 Aircraft Bearing Property Test Requirements, Slow Rotational and Oscillatory Motion (continued)

	Design Properties		**Performance Properties**					
Bearing Type	Radial Runout	Axial Runout	No-Load Breakaway Torque	Static Radial Limit Load	Static Axial Limit Load	Dynamic Radial Load Rating	Ultimate Static Radial Limit Load	**Applicable Documents**
Ball	X	X	X	X	X	X	X	MIL-B-7949
Rod ends with integral ball bearing	X		X	X			X	MIL-B-6039
Roller	X		X	X			X	MIL-B-8914
Rod ends with integral roller bearing	X		X	X			X	MIL-B-8952
Needle Roller				X			X	MIL-B-3990
Needle track rollers, Stud type				X			X	MIL-B-3990
Needle track rollers, yoke type				X			X	MIL-B-3990
Spherical plain, lubricated			X	X	X	X	X	MIL-B-8976
Rod ends with integral spherical plain bearings, lubricated			X	X	X	X	X	*MIL-B-81935 and *MIL-B-8976
Spherical			X	X	X	X	X	MIL-B-81820

plain bearings, self-lubricated								
Rod ends with integral spherical plain bearings, self-lubricated			X	X	X	X	X	MIL-B-81935
Journal bearings, straight and flanged, self-lubricated				X	X	X	X	MIL-B-81934

*MIL-B-81935 is applicable to testing; MIL-B-8976 is referenced for product features.

Aircraft Bearing Property Test Requirements

1. Bearing Properties.

Tables 1 and 2 specify bearing property test requirements for each bearing type, as defined on the manufacturers drawing(s) and/or specification(s). The specific material and specific design property values, such as, hardness or dimensions, form the basis of the bearing design; the specific values for performance properties, such as, static radial load rating or ultimate static radial load limit form the basis of the bearing "minimum performance."

2. Bearing Series Test Sample.

A bearing series (model) of a particular design and type, with a range defined in the bearing manufacturer’s application for CTSO authorization, may be qualified by submitting test data for a sample that is most representative of the design encompassed by the series.

Appendix 1. Aircraft Bearing Property Test Requirements

(Continued)

Applicable Documents.

The revision of the documents (or successor documents) listed below in effect on the date of CTSO application must be acceptable to the authorities and used to establish the procedures for test and evaluation of aircraft bearings, as indicated in the part drawing and procurement or product specification(s). All additional specifications governing test and evaluation of a bearing covered by this CTSO must be specified at the time of application for CTSO authorization.

MIL-B-3990 Military Specification, Bearings, Roller, Needle, Airframe, Anti-friction, Inch

MIL-B-6039 Military Specification, Bearing, Double Row, Ball Sealed, Rod End, Antifriction, Self-Aligning

MIL-B-7949 Military Specification, Bearings, Ball, Airframe, Anti-friction

MIL-B-8914 Military Specification, Bearing, Roller, Self-Aligning,

Airframe, Anti-friction

MIL-B-8952 Military Specification, Bearing, Roller, Rod End, Anti-friction, Self-Aligning

MIL-B-8976 Military Specification, Bearing, Plain, Self-Aligning, All-Metal

MIL-B-81820 Military Specification, Bearings, Plain, Self-Aligning, Self-Lubricating, Low Speed Oscillation, General Specification For

MIL-B-81934 Military Specification, Bearings, Plain, Sleeve, Plain and Flanged, Self-Lubricated

MIL-B-81935 Military Specification, Bearings, Plain, Rod End, Self-Aligning, Self-Lubricating, Low Speed Oscillation, General Specification For

ANSI/ABMA Standard 4, Tolerance Definitions and Gauging Practices for Ball and Roller Bearings

ANSI/ABMA Standard 9, Load Ratings and Fatigue Life for Ball Bearings

ANSI/ABMA Standard 11, Load Ratings and Fatigue Life for Roller Bearings

ANSI/ABMA Standard 12.1, Instrument Ball Bearings, Metric Design

ANSI/ABMA Standard 12.2, Instrument Ball Bearings, Inch Design

ASTM E 18 Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials