



Designation: F2332 – 06 (Reapproved 2022)

Standard Specification for Annular Ball Bearings for Instruments and Precision Rotating Components¹

This standard is issued under the fixed designation F2332; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers annular ball bearings intended primarily for use in instrument and precision rotating components. Instrument and precision ball bearings should meet tolerances specified in ABMA Standard 12.2, Instrument Ball Bearings Inch Design for Classes ABEC 5P and 7P.

1.2 *Intended Use*—Ball bearings defined by this specification are intended for use in critical components of instrument systems. Such components range from air circulating blowers and drive motors through precision gear trains, gyro gimbals, and pickoffs to rate integrating spin-motors.

1.3 The specification contains many of the requirements of MIL-B-81793, which was originally developed by the Department of Defense and maintained by the Naval Air Systems Command (Navy-AS) in Lakehurst, NJ. The following government activity codes may be found in the Department of Defense, Standardization Directory SD-1.²

Preparing activity	Custodians	Review activities
Navy - AS	Army - AT	Army-AV
	Navy - AS	Navy - MC, SH
	Air Force - 99	Air Force-84
	DLA - GS	

1.4 *Classification*—Annular ball bearings for instrument and precision rotating components shall be of the following types, as specified:

1.4.1 *Type I*—Annular ball bearing, for instruments and precision rotating components, deep groove, unflanged; (See [Annex A1 – Annex A4](#))

1.4.2 *Type II*—Annular ball bearing, for instruments and precision rotating components, deep groove, flanged; (See [Annex A5 – Annex A8](#))

1.4.3 *Type III*—Annular ball bearing, for instruments and precision rotating components, deep groove, unflanged, inner ring extended; (See [Annex A9 – Annex A12](#))

¹ This specification is under the jurisdiction of ASTM Committee F34 on Rolling Element Bearings and is the direct responsibility of Subcommittee F34.06 on Aerospace.

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² The military codes that are listed in SD-1 give the address and phone numbers of the DoD contacts. These are found in the DoD's ASSIST website <http://assist.daps.dla.mil/>.

1.4.4 *Type IV*—Annular ball bearing, for instruments and precision rotating components, deep groove, flanged, inner ring extended; (See [Annex A13 – Annex A16](#))

1.4.5 *Type V*—Annular ball bearing, for instruments and precision rotating components, angular contact, unflanged, nonseparable, and counterbored outer ring; (See [Annex A17 – Annex A20](#))

1.4.6 *Type VI*—Annular ball bearing, for instruments and precision rotating components, angular contact, flanged, nonseparable, and counterbored outer ring on flange side; (See [Annex A21 – Annex A24](#))

1.4.7 *Type VII*—Annular ball bearing, for instruments and precision rotating components, angular contact, unflanged, separable, and stepped inner ring; (See [Annex A25 – Annex A28](#))

1.4.8 *Type VIII*—Annular ball bearing, for instruments and precision rotating components, angular contact, flanged, separable, and stepped inner ring; (See [Annex A29 – Annex A32](#))

1.4.9 *Type IX*—Annular ball bearing, for instruments and precision rotating components, angular contact, unflanged, nonseparable, and stepped inner ring. (See [Annex A33 – Annex A36](#))

1.5 *Inch-Pound Specification*—This specification covers only the inch-pound bearings.

1.5.1 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*³

- A240/A240M** Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- A313/A313M** Specification for Stainless Steel Spring Wire
- A380** Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
- A580/A580M** Specification for Stainless Steel Wire
- A666** Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- A756** Specification for Stainless Anti-Friction Bearing Steel
- A967** Specification for Chemical Passivation Treatments for Stainless Steel Parts
- D2273** Test Method for Trace Sediment in Lubricating Oils
- E45** Test Methods for Determining the Inclusion Content of Steel
- E140** Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

2.2 *ABMA Standards:*⁴

- STD 1** Terminology for Anti-Friction Ball and Roller Bearings and Parts
- STD 10** Metal Balls
- STD 12.2** Instruments Ball Bearings—Inch Design

2.3 *SAE-AMS Specifications:*⁵

- SAE-AMS 2303** Aircraft Quality Steel Cleanliness, Martensitic Corrosion Resistant Steels, Magnetic Particle Inspection Procedure
- SAE-AMS 5688** Steel, Corrosion Resistant Wire, 18CR-9.0NI, (SAE 30302), Spring Temper
- SAE-AMS 5880** Steel, Corrosion Resistant Bars, Wire and Forgings, 17CR-0.52MO (0.95-1.2C)
- SAE-AMS 6444** Steel Bars, Forgings, and Mechanical Tubing, 1.45 Cr (0.98-1.10C) (SAE 52100) Premium Aircraft Quality Consumable Electrode Vacuum Melted
- SAE-AMS-QQ-S-763** Steel Bars, Wire, Shapes, and Forgings, Corrosion Resistant

2.4 *ASME Standards:*⁶

- B46.1** Surface Texture (Surface Roughness, Waviness and Lay)
- B89.3.1** Measurement of Out of Roundness

2.5 *ASQC Standards:*⁷

- Z1.4** Sampling Procedures and Tables for Inspection by Attributes

2.6 *NCLS Standard:*⁸

- Z540.1** Laboratories, Calibration, Measuring and Test Equipment

2.7 *ISO Standards:*⁹

- ISO 1224** Bearings, Rolling—Instrument Precision Bearings
- ISO 3290** Bearings, Rolling—Balls—Dimensions and Tolerances
- ISO 10012-1** Quality Assurance Requirements for Measuring Equipment
- ISO 14644-1** Cleanrooms and Associated Controlled Environments. Part 1: Classification of Air Cleanliness
- ISO 14644-2** Cleanrooms and Associated Controlled Environments. Part 2: Specifications for Testing and Monitoring to Provide Continued Compliance with ISO 14644-1

2.8 *Department of Defense:*¹⁰

Specifications:

- MIL-DTL-197** Packaging of Bearings, Associated Parts and Sub-Assemblies
- MIL-PRF-6085** Lubricating Oil, Instrument, Aircraft, Low Volatility
- MIL-PRF-23827** Grease, Aircraft and Instrument, Gear and Actuator Screw, NATO Code G-354, Metric
- MIL-DTL-53131** Lubricating Oil, Precision Rolling Element Bearing, Polyalphaolefin Based
- MIL-S-81087** Silicone Fluid, Chlorinated Phenyl Methyl Polysiloxane, NATO Code Number H-536
- MIL-PRF-81322** Grease, Aircraft, General Purpose, Wide Temperature Range
- MIL-B-81744** Barrier Coating Solution, Lubricant Migration Deterring
- DOD-L-81846** Lubricating Oil, Instrument, Ball Bearing, High Flash Point
- MIL-G-81937** Grease, Instrument, Ultra Clean, Metric
- MIL-PRF-83261** Grease, Aircraft, Extreme Pressure, Anti-Wear

Standards:

- MIL-STD-129** Military Marking
- MIL-STD-130** Identification Marking of U.S. Military Property
- MIL-STD-206** Friction Torque Testing for Bearings, Ball, Annular (Instrument Type)
- MIL-STD-1334** Process for Barrier Coating of Anti-Friction Bearings
- MIL-STD-1647** Identification Markings for Domestically Manufactured Bearings, Ball, Annular for Instruments and Precision Components

2.9 *Federal Standards:*

- FED-STD-791** Lubricants, Liquid Fuel and Related Products, Methods of Testing¹⁰

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

⁴ Available from American Bearing Manufacturers Association 1001 N. Fairfax Street Suite 500 Alexandria, VA 22314-1587. <https://www.americanbearings.org/>

⁵ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

⁶ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁷ Available from American Society for Quality (ASQ), 600 North Plankinton Avenue Milwaukee, WI 53203 <https://asq.org/>.

⁸ Available from NCSL International 5766 Central Ave, Suite 150 Boulder, CO 80301. <https://ncsli.org/>

⁹ Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

¹⁰ Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.