NOT MEASUREMENT SENSITIVE

MIL-STD-2225
01 August 1994

MILITARY STANDARD

VIBRATION AND NOISE TESTING FOR INSTRUMENT BEARINGS

AMSC N/A

FSC 3110

FOREWORD

1. This military standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, (Code SR3), Highway 547, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

3. This document sets forth a standard test method for vibration and noise in instrument bearings.

CONTENTS

1. SCOPE

1.1 Scope. Vibration and noise measurements under controlled test conditions provide baseline data which can be used to ascertain relative bearing quality. The causes of vibration and noise are complex phenomena affected by many factors. This standard defines vibration and noise measurements under closely controlled conditions, and there is no guarantee that values measured in accordance with this standard will correlate with actual application. This specification is applicable to instrument ball bearings as defined in AFBMA Standard 12, see 2.2.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this standard to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

MILITARY

MIL-L-6085 - Lubricating Oil, Instrument, Aircraft, Low Volatility.
MIL-P-197 - Packaging of Antifriction Bearings; Associated Parts and Subassemblies.
DOD-L-81846 - Lubricating Oil, Instrument, Ball Bearing, High Flash Point.

STANDARDS

FEDERAL

FED-STD-209 - Clean Room and Work Station Requirements, Controlled Environment.

MILITARY

MIL-STD-45662 - Calibration Systems Requirements.

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks are available from the Defense Printing Service, Subscription Services Desk, 700 Robbins Avenue, Bldg. 4D, Philadelphia, PA 19111-5094.)

2.2 Non-Government Publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DODISS are the issues of the documents cited in the solicitation.

ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION (AFBMA)

AFBMA-STD-12 - Instrument Ball Bearings.

(Application for copies should be addressed to the AFBMA, 1101 Connecticut Ave. N.W., Suite 700, Washington, D.C. 20036-3283.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the 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.

3. DEFINITIONS

3.1 Bearing noise. The bearing vibration in the audible range.

3.2 Bearing vibration. The frequencies and amplitudes of motion of the bearing other than its required primary rotational motion.

4. GENERAL REQUIREMENTS

4.1 Test requirements. The specific test requirements for each bearing shall be as specified in the applicable specification. As a minimum, these shall include test speed, test load and vibration limits.

4.2 Vibration velocity amplitude. The vibration velocity amplitude shall be the standard display objective obtained by means of displacement, velocity, acceleration or force measurements. Standard international units of measurement shall be used.

4.3 Frequency masking. The tester shall be capable of masking off or selecting specified frequency ranges.

4.4 Speeds. The tester shall be capable of testing for bearing vibration at rotational speeds specified by the applicable specification within the range of 300 to 3600 Revolutions Per Minute (RPM). The test shall be performed with one bearing ring rotating and the other ring non-rotating.

4.5 Physical measurement. The physical quantity measured by the transducer shall be the radial or axial component of the vibration of the non-rotating bearing ring. Transducers may measure vibrational displacement, velocity, acceleration, or force, but preferred final display shall be velocity.

4.6 Test preparation. The following conditions shall govern handling, cleaning, lubrication, and test ambient conditions: temperature shall be maintained between 20 to 25°C (68 and 77°F), with relative humidity between 30 and 50 percent; cleanliness shall be maintained at a class 10,000 level as specified in FED-STD-209.

4.6.1 Stabilizing. Bearings shall be thermally stabilized to room temperature by remaining in the test room for 2 hours prior to testing.

4.7 Calibration. The test device calibration shall conform to all the requirements of MIL-STD-45662 and be traceable to the National Institute of Standards and Technology.

4.8 Signal evaluation. The output signal shall be evaluated on a true Root Mean Square (RMS) basis for each of the frequency ranges specified by the applicable specification. Access to the raw, real time signal shall be available for analytical purposes.

4.9 Loads. Unless otherwise specified, axial loads of 75 grams shall be used for bearings with an outer ring outer diameter of 0.3750 inches and less, and 400 grams for bearings greater than 0.3750 inches in outer ring outer diameter. The equivalent outer ring outer diameter for metric bearings is 10mm. The external radial load, including transducer load, shall be not greater than 15 percent of the applied axial load.

5. DETAILED REQUIREMENTS

5.1 Package removal. Bearings shall not be removed from their packages outside of a class 10,000 or better clean room as specified in FED-STD-209.

5.2 Degaussing. Steel bearings to be tested shall be degaussed to a maximum of 2 gauss.

5.3 Integral oil lubrication. Bearings supplied with integral oil lubrication may be tested as received, or processed as specified in 5.3.1 through 5.3.3. The use of grease or non-oil lubricants may introduce extraneous effects that may render erratic results.

5.3.1 Cleaning. Bearings shall be cleaned thoroughly with clean solvents filtered through a 0.5 micron or better filter.

5.3.2 Lubrication. Lubricate bearings per Table I with MIL-L-6085 or DOD-L-81846 oil filtered through a 0.45 micron or better filter and having a viscosity not exceeding 20 centistokes at 37.8°C (100°F).

TABLE I. Lubrication of bearings.

Bearing O.D.	Amount of Oil 1/
Less than 0.6250 inch	1 drop
Equal to or greater than 0.6250 inch	2 drops

1/ Oil drops from a #26 needle, free forming from a nominal needle angle of 45 degrees from vertical.

5.3.3 Oil distribution. Rotate the bearing at less than 20 RPM for a minimum of 3 complete revolutions in each direction to distribute the oil evenly.

5.4 Operation. The test equipment shall be operated in accordance with the test equipment manufacturer's instructions.

5.5 Frequency range. Unless otherwise specified, the frequency range for measuring vibration amplitude shall be 50 Hertz (Hz) to 5 Kilohertz (KHz).

5.6 Load distribution. Unless otherwise specified, the axial test load (see 4.9) shall be evenly and circumferentially distributed across the face of the designated ring. Where design allows, the bearing shall be turned over and retested.

5.7 Test readings. Test readings shall be taken within the specified speed range.

5.8 Retesting. When retesting of a failed bearing is permitted by the applicable drawing/specification, procedures established under 4.6 and 5.3 shall be followed. This may be done no more than twice on any bearing.

5.9 Relubrication. Bearings passing the tests shall be relubricated in accordance with the applicable specification if necessary and packaged per MIL-P-197.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended Use. This standard provides procedures for the measurement of vibration and noise generated by rotating instrument ball bearings. It includes requirements for the test equipment, methods of testing, test parameters and interpretation of data.

6.2 Subject term (key word) listing.

Test procedures

Custodians:
Navy - AS
Army - AT
Air Force - 99

Review activities:
DLA- IS
Air Force - 84

Preparing activity:
Navy - AS

(Project 3110-0810)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.
   NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-STD-2225	2. DOCUMENT DATE (YYMMDD) 940801

3. DOCUMENT TITLE
VIBRATION AND NOISE TESTING FOR INTSRUMENT BEARINGS

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (*Last, First, Middle Initial*)	b. ORGANIZATION	
c. ADDRESS (*Include Zip Code*)	d. TELEPHONE (*Include Area Code*) (1) Commercial: (2) DSN: (*If Applicable*)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME COMMANDER NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION	b. TELEPHONE NUMBER (*Include Area Code*) (1) Commercial (908) 323-7488 (2) DSN 624-7488
c. ADDRESS (*Include Zip Code*) CODE SR3 HIGHWAY 547 LAKEHURST, NJ 08733-5100	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office, 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 DSN 289-2340