

ABMA COPYRIGHT NOTICE

Copyright® American Bearing Manufacturers Association, Inc., 1987

These materials have been prepared by the American Bearing Manufacturers Association, Inc. However the information contained in these materials has not been independently verified by the American Bearing Manufacturers Association or Information Handling Services, Inc. Neither organization warrants or assumes any liability for the accuracy or completeness of these materials.



ANSI/AFBMA
Std. 13-1987
(Revision of ANSI/AFBMA
Std. 13-1970)

AMERICAN NATIONAL STANDARD
AFBMA STANDARD

ROLLING BEARING VIBRATION AND NOISE
(METHODS OF MEASURING)

Sponsor
**The Anti-Friction Bearing
Manufacturers Association, Inc.**

Approved September 2, 1987
American National Standards Institute, Inc.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published by

The Anti-Friction Bearing Manufacturers Association, Inc.
1101 Connecticut Avenue, N.W.
Suite 700
Washington, D.C. 20036

Copyright 1987 by The Anti-Friction Bearing Manufacturers Association, Inc.

FOREWORD

(This Forward is not part of ANSI/AFBMA Standard 13-1987, Rolling Bearing Vibration and Noise (Methods of Measuring))

This standard was originally developed by the Annular Bearing Engineers Committee (ABEC) and the Roller Bearing Engineers Committee (RBEC) of The Anti-Friction Bearing Manufacturers Association, Inc., (AFBMA), in response to increasing demands from industry and government services for standards to cover the measurement of noise and vibration in rolling contact (ball and roller) bearings.

As a result of the studies and deliberations of these committees of the AFBMA, members of which had frequent association and contact with equipment builders and users who have need for quiet running bearings, this standard was presented to Sectional Committee B3 of The American National Standards Institute for their review and approval in September 1969. After approval of that committee in December 1969, this standard was approved by The American National Standards Institute on November 20, 1970. This standard was reapproved in 1977 and in 1986.

In response to growing interest for standards for measuring noise and vibration of instrument ball bearings, Section III to the Standard was added in 1987. This section provides the concepts which should be part on any specified test methods for instrument ball bearing noise and vibration.

Suggestions for the improvement of this Standard gained through experience with its use will be welcomed. These should be sent to the American National Standards Institute, Inc. 1430 Broadway, New York, NY 10018.

The officers of Accredited Standards Committee B3 of the American National Standards Institute and the organizations represented at the time the Standard was submitted are as follows:

S. R. Ahlman, Chairman

G. T. Satterfield, Secretary

American Society of Agricultural Engineers
 American Society of Lubrication Engineers
 Anti-Friction Bearing Manufacturers Association
 Hydraulic Institute
 National Machine Tool Builders Association
 Society of Automotive Engineers
 U.S. Department of Defense, DISC
 U.S. Department of the Navy

AFBMA Standards
for Ball and Roller Bearings
and Balls

- 1 — Terminology
- 4 — Tolerance Definitions and Gaging Practices
- 7 — Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plans
- 8.1 — Ball and Roller Bearing Mounting Accessories, Metric Design
- 8.2 — Ball and Roller Bearing Mounting Accessories, Inch Design
- 9 — Load Ratings and Fatigue Life for Ball Bearings
- 10 — Metal Balls
- 11 — Load Ratings and Fatigue Life for Roller Bearings
- 12.1 — Instrument Ball Bearings, Metric Design
- 12.2 — Instrument Ball Bearings, Inch Design
- 13 — Rolling Bearing Vibration and Noise
- 14 — Housings for Bearings With Spherical Outside Surfaces
- 15 — Ball Bearings With Spherical Outside Surfaces and Extended Inner Ring Width (Includes Eccentric Looking Collars)
- 16.1 — Airframe Ball, Roller and Needle Roller Bearings, Metric Design
- 16.2 — Airframe Ball, Roller and Needle Roller Bearings, Inch Design
- 17 — Needle Rollers, Metric Design
- 18.1 — Needle Roller Bearings — Radial, Metric Design
- 18.2 — Needle Roller Bearings — Radial, Inch Design
- 19 — Tapered Roller Bearings — Radial, Inch Design
- 19.1 — Tapered Roller Bearings — Radial, Metric Design
- 20 — Radial Bearings of Ball, Cylindrical Roller and Spherical Roller Types, Metric Design
- 21 — Metric Thrust Needle Roller and Cage Assemblies and Thrust Washers
- 21.2 — Thrust Bearings of Ball, Cylindrical Roller, Tapered Roller and Needle Roller Types, Inch Design
- 22 — Spherical Plain Bearings, Joint Type

An AFBMA Standard is intended as a guide to aid the manufacturer, the consumer and the general public. The existence of an AFBMA Standard does not in any respect preclude anyone, whether he has approved the Standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. AFBMA Standards are subject to revision or withdrawal at any time and users who refer to an AFBMA Standard should satisfy themselves that they have the latest information from the Association.

AMERICAN NATIONAL STANDARD AFBMA STANDARD ROLLING BEARING VIBRATION AND NOISE

Contents

		Page
1.	GENERAL	1
	1.1 Scope	1
	1.2 Definitions	1
2.	TEST METHODS FOR VIBRATION TESTING OF PRECISION BALL BEARINGS OTHER THAN INSTRUMENT BEARINGS	3
	2.1 Selection of Test Methods for non-instrument ball bearings	3
	2.2 Test Method 1 for non-instrument ball bearings	3
3.	TEST METHOD FOR VIBRATION TESTING OF PRECISION INSTRUMENT BALL BEARINGS	5
	3.1 Selection of Test Methods for instrument ball bearings	5
	3.2 Test method concept for instrument ball bearings	5

List of Tables

Table		Page
1	Magnitude of Axial Load to be Applied During Vibration Testing of Ball Bearings	7

List of Figures

Figure		Page
1	Alignment of Thrust Load for Bearing Vibration Testing	7
2	Filter Specification	8
3	Transducer Response Specification	9
4	Example of Test Sequence	10



AMERICAN NATIONAL STANDARD

AFBMA STANDARD

ROLLING BEARING VIBRATION AND NOISE

1. GENERAL

1.1 Scope

1.1.1 Purpose. Under certain operating conditions, vibration in rotating rolling bearings can be of importance as an operating characteristic of such bearings. For this reason, the measurement of vibration emitted by a rolling bearing under specified test conditions is utilized for study and qualification as one facet of quality assurance.

This standard on rolling bearing noise and vibration serves to define and specify, for purposes of bearing quality assurance, the physical quantities measured and the test conditions utilized in measurement of vibration and noise generated by rolling bearings. Based on the standard, parties to the acceptance inspection of rolling bearings may, by agreement, establish acceptance specifications and grades of rolling bearings with which to control bearing vibration and noise.

1.1.2 Limitations of Standard. Rolling bearing vibration and noise are complex physical phenomena. The knowledge of vibration and noise of bearings under a given set of test conditions does not necessarily afford a means of judging the vibratory behavior of the bearing to be expected under different conditions, nor does it suffice for a prediction of the vibration of assemblies of which the bearing forms a part. No simple set of values characterizing vibration and noise of a bearing is adequate for the evaluation of the vibratory performance in all possible applications.

The field of application for standards on bearing vibration and noise is, therefore, not universal. It encompasses the applications where usefulness of these standards as a basis for bearing

selection and specification has been proven by sufficient experimental evidence.

In the current edition of this standard, only selected methods for the measurement of the (structure-borne) *vibration* of certain types of ball bearings have been specified. Other vibration measurement methods, as well as methods for the measurement of rolling bearing (air-borne) *noise*, may be specified in later editions.

1.1.3. Coverage. The standard covers two product types:

- (a) Non-instrument ball bearings (Section 2)
- (b) Instrument ball bearings (Section 3).

Section 2 provides, in Subsection 2.1, a general description of the principles used for the selection of test methods for *non-instrument* ball bearings. Subsection 2.2 describes one selected test method, in sufficient detail to permit correlation of test results obtained with different instruments meeting Subsection 2.2 specifications.

Section 3 provides concepts of the method for vibration testing *instrument* ball bearings. The current edition of this standard does *not include* detailed methods sufficient to permit correlation of test results obtained with different instruments adhering to Section 3 concepts.

1.2 Definitions

1.2.1 Description of Bearing Vibration and Noise. In a running rolling bearing some relative motions of the parts are inherent and functionally required. These are designated primary motions. Thus, co-axial rotation of inner or outer rings with reference to their associated opposite ring members, pivoting of rings in self-aligning bearings around a common center point, and axial translation of the ring members along the common axis of rotation in bearings that permit axial free-

dom of motion, are primary motions in the bearing types referred to. The same holds true for certain orbiting motions of the rolling bodies and for the rotation of the cage around the bearing axis of rotation. Motions in the bearing, other than the required primary motions, are designated secondary motions. The secondary motions of periodically alternating character are designated bearing *vibration*. The airborne sound generated by the bearing is designated *noise*.

Examples of vibratory motions in a bearing are:

- (1) Time-variable radial displacements of the ring axes relative to each other;
- (2) Non-intended time-variable axial displacements of these same axes;
- (3) Non-intended angular displacement of these axes relative to each other;
- (4) Time-variable deformations of the bearing parts, and several types of non-intended motions of the rolling bodies and cages; and
- (5) Periodic displacements of the cage with respect to the rolling elements or rings.

1.2.2 Basis of Measurement. For the purposes of this standard, all vibratory motions of the parts of a rotating bearing are observed and measured in one or both of two ways:

- (1) The (structure-borne) vibration of the bearing is observed and measured as the motions of selected points of the bearing rings, with respect to a reference system in specified directions.
- (2) The (air-borne) noise is observed and measured as the noise generated by the bearing *in a defined acoustical environment*, at a point located at a specific distance from and oriented in a specified direction to the bearing.

These observations yield data on the vibration and noise of the bearing for the selected test conditions. The results may or may not permit

conclusions to be drawn regarding vibration and noise under different operating conditions.

1.2.3 Test Conditions. Typical test conditions that must be specified for meaningful observation and measurement of the vibratory characteristics of a bearing are as follows:

- (1) The specific physical quantity or quantities to be measured.
- (2) Frequency range or ranges in which the measurement shall be performed.
- (3) Masses coupled with the bearing.
- (4) Speed of rotation of the bearing rings.
- (5) External forces and moments applied to the bearing.
- (6) Means of coupling the masses and applying the forces and moments.
- (7) Points of observation and measurement, and directions in which the physical quantity is observed.
- (8) Nature, quantity and distribution of lubricant applied to the bearing.
- (9) Degree of cleanness of the bearing.
- (10) Temperature of the bearing.
- (11) Mechanical and electrical response of systems used in the measurement.
- (12) Acoustical condition under which airborne noise is measured.
- (13) Method of read-out of time-variable quantities; for example, time averaging or peak value detection.
- (14) Environment of tests (temperature, humidity, cleanness, atmospheric pressure, etc.).

2. TEST METHODS FOR VIBRATION TESTING OF PRECISION BALL BEARINGS OTHER THAN INSTRUMENT BEARINGS

2.1 Selection of Test Methods for Non-instrument Ball Bearings.

This section of the standard specifies the standard methods for vibration testing of precision ball bearings, other than instrument ball bearings.

Ball bearing vibration is a complex phenomenon dependent on the conditions of operation. In the interest of reproducible and comparable results, especially, of correlation between results measured on different instruments, ball bearing vibration tests must proceed by an accurately defined method. There is no single optimum test method satisfying the needs of all users or manufacturers of non-instrument ball bearings, but certain methods have sufficiently broad acceptance and enough desirable characteristics to be satisfactory for acceptance inspection. A selection of such methods is specified in this standard. Other methods may be added at a later date if they acquire sufficient acceptance and are found to have the required desirable characteristics.

For a standard test, parties to the acceptance inspection of non-instrument ball bearings shall agree upon the use of one of the standard test methods in its entirety. A method which combines features of more than one method or omits from or adds to a method is not a standard test.

Parties to the acceptance inspection shall agree upon the acceptance limits of bearing vibration level.

2.2 Test Method I for Non-Instrument Ball Bearings.

2.2.1 Physical quantity represented by the readout: radial vibrational velocity in units of micrometers per second, RMS. A second readout in microinches per second may be provided.

2.2.2 Frequency ranges: 50-300, 300-1800, 1800-10,000 Hz. (All three ranges are required.)

2.2.3 Speed of rotation of the bearing rings: outer ring stationary, inner ring rotating at 1800 rpm $\pm 2\%$ around a generally horizontal axis fixed in space.

2.2.4 External Forces Applied to the Bearing:

2.2.4.1 A constant external axial load of the magnitude specified in Table 1, shall be applied to the outer ring.

2.2.4.2 External radial load on the outer ring, including that due to transducer, shall not exceed 1.11 Newtons (0.25 lb). The weight of the bearing outer ring, cage or balls, is not considered to be part of the external load.

2.2.4.3 The position and direction of the resultant of all the applied loads excluding the transducer load must coincide with the geometric axis of the inner ring within the limits given in Figure 1.

2.2.4.4 In addition to the applied load, it is permissible to apply an aligning moment to the bearing outer ring which, in the event of angular misalignment arising between the inner ring and outer ring geometric axes, acts so as to reduce this misalignment. Any such aligning moment shall be essentially proportional to the misalignment angle between the ring axes and shall not exceed 0.067 Newton meters per millimeter of bearing bore diameter (1.5 inch pounds per inch of bearing bore diameter) for each minute of arc of misalignment.

2.2.5 Mechanical Unit

2.2.5.1 The spindle unit used to hold and drive the bearing inner ring shall be so constructed that, except for transmittal of rotary motion, it represents essentially a rigid reference system for the inner ring axis. The transmittal of vibratory velocity between the mechanical unit and the bearing inner ring shall be negligible by comparison to the velocities measured in any band within the frequency range covered.

2.2.5.2 The loading system used to apply axial load to the bearing outer ring shall be so constructed that, with the exceptions of the trans-

mittal of constant axial load and of a restraint on outer ring rotation and possibly of an elastic restoring moment, it acts essentially as a de-coupling means between the bearing and the mechanical unit, leaving the outer ring essentially free to vibrate in all radial, axial, angular, or flexural modes.

2.2.5.3 The distortion of shape of both bearing rings that is caused by contact with elements of the mechanical unit shall be negligible by comparison to the inherent geometrical accuracy of the bearing tested.

2.2.6 Point and Direction of Measurement

Vibration shall be measured on the outside diameter of the stationary outer ring, at a randomly selected point in the plane containing the centers of curvature of that ball groove to which thrust load is applied during the test. The direction of measurement shall be perpendicular to the geometric axis of the inner ring and the measurement shall be made in a system referenced to that axis.

2.2.7 Stabilized Vibration Level

All bearing vibration readings shall be taken at stabilized vibration levels which are indicated by an instrument reading which fluctuates only randomly about a constant average value. Stabilization is achieved by running the bearing under the specified test conditions for a period not exceeding three minutes and recording the average value in each applicable frequency band as soon as that value is reached. In the event that stabilization is not reached within the period of three minutes for the type of bearing examined, parties to the acceptance inspection must agree on a suitable method to obtain stabilized readings.

2.2.8 Lubrication

During testing the bearing shall be lubricated by a test oil of viscosity 82-110 m²/sec (centistoke) at 37.8°C (100°F), conforming to symbol 2190 TEP of Military Specification MIL-L-17331, except for lubricated-for-life sealed or shielded bearings for which the self-contained lubricant supply shall be used. When oil is added

for testing, all working parts of the bearing shall be saturated with oil and the excess allowed to purge during initial running at test speed on the spindle.

2.2.9 Cleanness of Bearing and Test Environment

2.2.9.1 Bearings shall be vibration tested in an environment sufficiently clean to render any effects of contamination on bearing vibration negligible.

2.2.9.2 Lubricated-for-life bearings shall be tested in the condition found in the unbroken original package.

2.2.9.3 Bearings that are not lubricated for life shall be cleaned, the preservative coatings removed and the bearings lubricated with the test oil, using methods that render negligible any effect of contamination on bearing vibration.

2.2.10 Mechanical and Electrical Frequency Response of Sensing System Used in Measurement

2.2.10.1 Electrical frequency response of the sensing system shall fall within limits specified in Figure 2.

2.2.10.2 Response of the electromechanical transducer shall fall within limits specified in Figure 3.

2.2.11 Method of Time-Averaging

The readout of the system used in measurement shall represent a time-average of the bearing RMS vibration velocity sensed by the transducer, taken over a period of not less than 0.5 second.

2.2.12 Test Sequence

2.2.12.1 Each bearing shall be tested at two random locations on the stationary outer ring with thrust applied to the outer ring in a direction in which the bearing can accept operational thrust load. Vibration level readings at each of the two locations shall be taken in each of the frequency ranges specified in 2.2.2. The readings obtained

at the two locations in each frequency range shall be averaged. The average obtained in each frequency band shall be compared separately to the agreed upon limit for that frequency band and for the direction of thrust load used in the test.

2.2.12.2 For bearings that can accept operational thrust in either direction, separate tests shall be performed for each direction of thrust.

2.2.12.3 For acceptance of the bearing, its vibration readings must be within the agreed upon limits in each frequency range, for each thrust direction.

2.2.12.4 A tabular form to illustrate the test sequence is given in Figure 4.

2.2.13 Size Limitation

This test method is standard for bearings of bore size from 5 mm to 130 mm (0.20 in to 5.12 in).

3. TEST METHOD FOR VIBRATION TESTING OF PRECISION INSTRUMENT BALL BEARINGS.

3.1 Selection of Test Methods for Instrument Bearings.

This section of the standard specifies the standard methods for vibration testing of precision instrument ball bearings.

Ball bearing vibration is a complex phenomenon dependent on the conditions of operation. In the interest of reproducible and comparable results, ball bearing vibration tests must proceed by an accurately defined method. There is no single optimum test method satisfying the needs of all users or manufacturers of instrument ball bearings, but certain concepts have sufficiently broad acceptance and enough desirable characteristics, so that more than one specific test method embodying these concepts can be designed which satisfy the requirements of acceptance inspection.

Any specific test method to be implemented for acceptance inspection must be defined with

sufficient precision to permit correlation of test results from different instruments meeting the method specifications. The current edition of this standard does not standardize any specific test method. Future editions may do so, if consensus is achieved concerning such methods.

For a standard vibration test, parties to the acceptance inspection of instrument ball bearings shall agree upon a specific test method conforming to the methods concepts herein standardized. Parties shall further agree upon acceptance limits of bearing vibration level, as determined by the agreed-upon specific test method.

3.2 Test Method Concept for Instrument Ball Bearings.

3.2.1 This vibration test method applies to instrument ball bearings provided that these bearings are capable of carrying axial load in operation, in at least one axial direction.

3.2.2 The test shall be performed with one bearing ring rotating and the other non-rotating. Transducers shall sense the vibration of the non-rotating ring. The speed of the rotating ring shall be specified within the range of 300 to 3600 revolutions per minute.

3.2.3 A concentric axial load shall be applied between the bearing rings. The magnitude of the load shall be specified within the range of 0.74 - 60.0 Newton (75 - 6122 gram weight). Tolerances for eccentricity and misalignment between the action line of the load and the geometrical axis of the bearing shall be specified.

3.2.4 An aligning moment may be specified which tends to restore alignment of inner and outerrings to each other, if they become misaligned. The moment shall be essentially proportional to the misalignment angle and may be specified as the axial offset of the load application point along the axis of the rotating ring, measured from the center plane of the loaded row of balls.

3.2.5 An inertial mass, no smaller than the mass capable of generating the specified axial load by dead-weight action, shall be closely coupled to the *rotating* bearing ring. Coupling of this

mass to the rotating bearing ring shall be deemed to establish the axis and center plane of that ring as the inertial reference system for vibration velocity measurement. The maximum inertial mass coupled to the *non-rotating* bearing ring shall not exceed a specified fraction of the mass coupled to the rotating bearing ring. The fraction shall be selected small enough for an adequate approximation of the requirement that the rotating ring axis and center plane be the inertial reference system for velocity measurement.

3.2.6 The lubrication of the test bearing shall be as follows:

3.2.6.1 Bearings supplied without integral lubrication shall be cleaned and lubricated for test as specified by MIL-STD-206 A, Part I, unless otherwise agreed upon by the parties to the acceptance inspection.

3.2.6.2 Bearings supplied with integral lubrication shall be tested as supplied.

3.2.7 Any run-in preceding test readings, shall be specified as to duration, speed and load and shall be performed using the test lubricant. Running-in shall be specified, if considered desirable for the purpose of providing stabilized vibration readings, which vary only randomly when repeated.

3.2.8 Ambient conditions of the vibration test, including temperature, cleanness and freedom from structural vibrations, shall conform to MIL-STD-206A Part I.

3.2.9 The number of test readings required for acceptance inspection, and the bearing orientation during reading (one side only, or both sides) shall be specified.

3.2.10 The physical quantity measured by the instrument readout shall be the radial or axial component of the vibration velocity of the non-rotating bearing ring, in units of micrometers/sec. (A second readout in microinches/sec may be provided). Velocity shall be referenced to an inertial system. Transducers may sense vibrational displacement or acceleration rather than velocity, provided that the instrument performs automatic conversion to velocity for the readout.

3.2.11 Readout(s) shall correspond to the RMS value of vibration velocity, measured within one (or more) specified frequency bands defined by their passband corner frequencies and rolloff rates. Time averaging of the signal for RMS readout shall be over a specified time period. The unfiltered, unconverted signal shall be accessible for analysis of parameters other than the specified RMS readout, e.g., vibration peak parameters.

3.2.12 All readout frequency bands shall fall within the range of 50 Hz to 10 kHz. Tolerances for the flat and amplitude-linear response of the system shall be specified within all readout frequency bands. Any instrument resonance falling within a readout frequency band shall be explicitly agreed upon as to resonant frequency and maximum deviation from flat response.

3.2.13 A limit on acceptable signal/noise ratio in the readout, including both mechanical and electrical noise, shall be specified, as a function of signal frequency, amplitude and bearing quality tested.

3.2.14 Calibration of the readout shall be traceable to the National Bureau of Standards.

TABLE I
MAGNITUDE OF AXIAL LOAD TO BE APPLIED DURING
VIBRATION TESTING OF BALL BEARINGS.

Bore mm	Thrust load – Newton/lb.		
	Radial contact ball bearings	Angular contact ball bearings	
		Contact angle over 10 to 22 degrees	Contact angle over 22 degrees
over 5 to 10	22.2/5	31.1/7	44.5/10
" 10 " 25	66.7/15	89.0/20	111.2/25
" 25 " 75	111.2/25	155.7/35	177.9/40
" 75 " 130	222.4/50	311.4/70	444.8/100

FIGURE 1
ALIGNMENT OF THRUST LOAD FOR BEARING VIBRATION TESTING

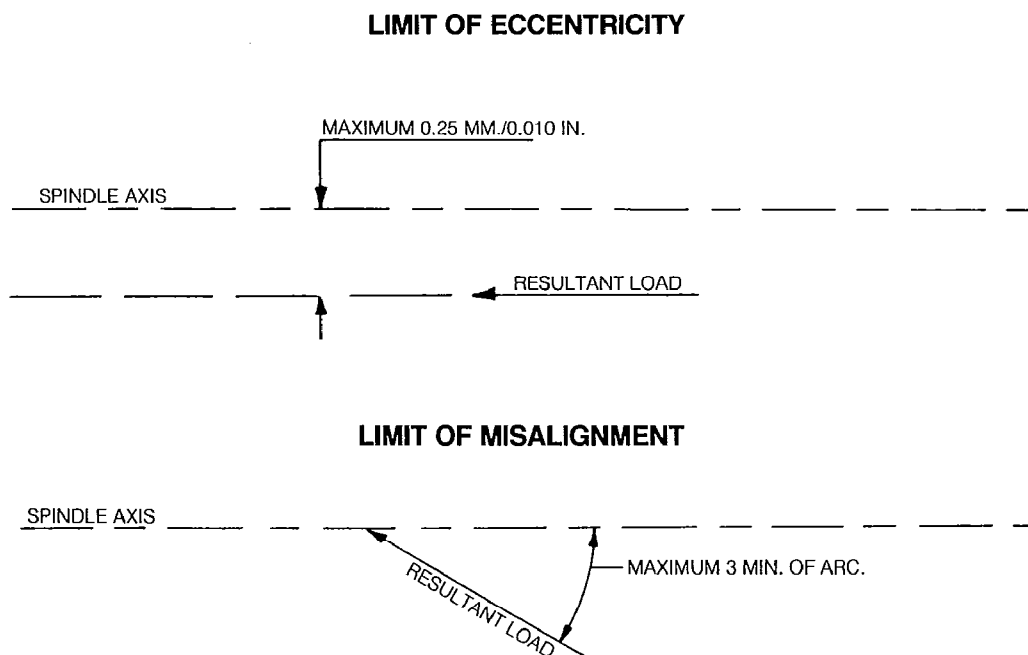
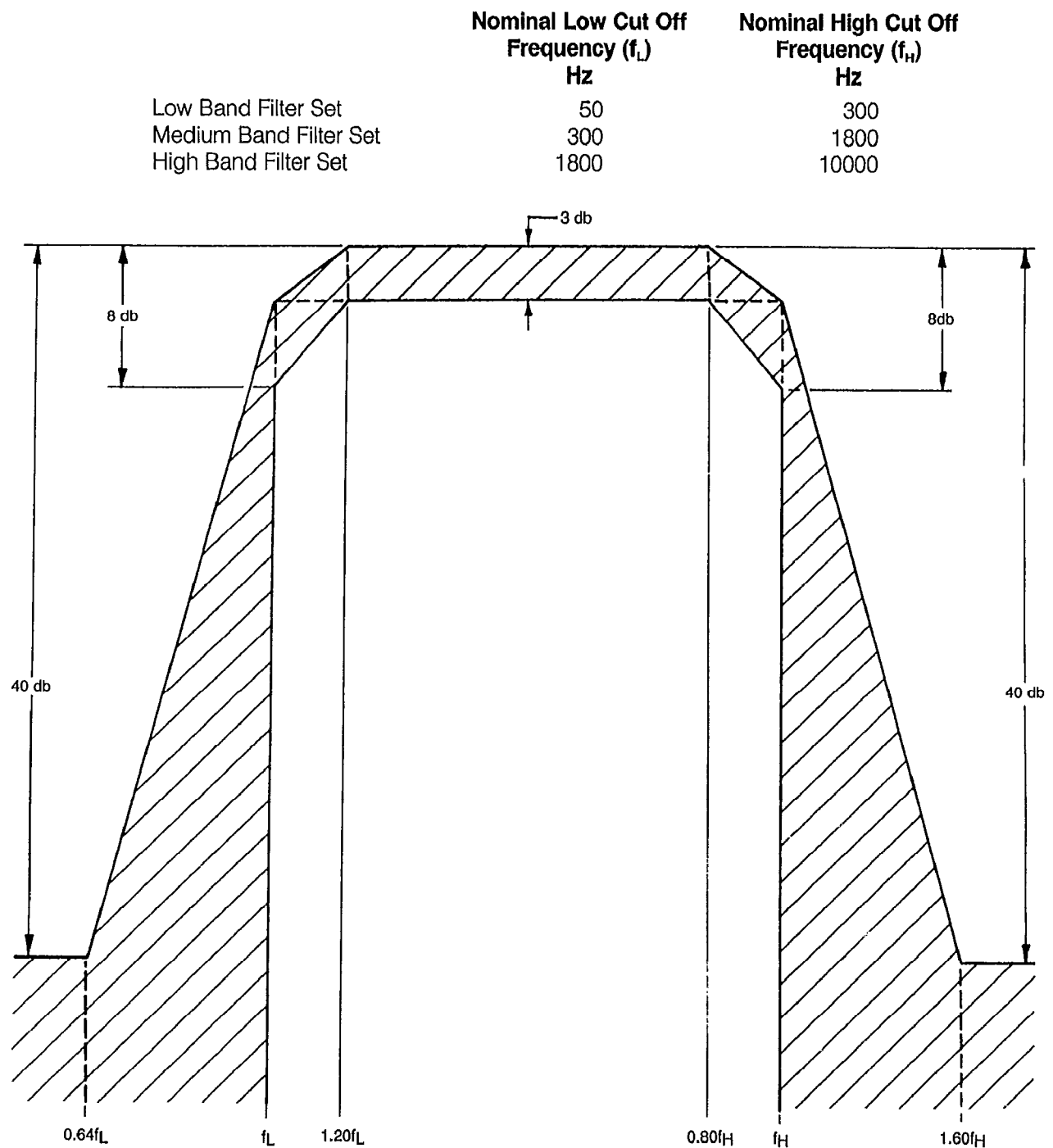


FIGURE 2
FILTER SPECIFICATIONS



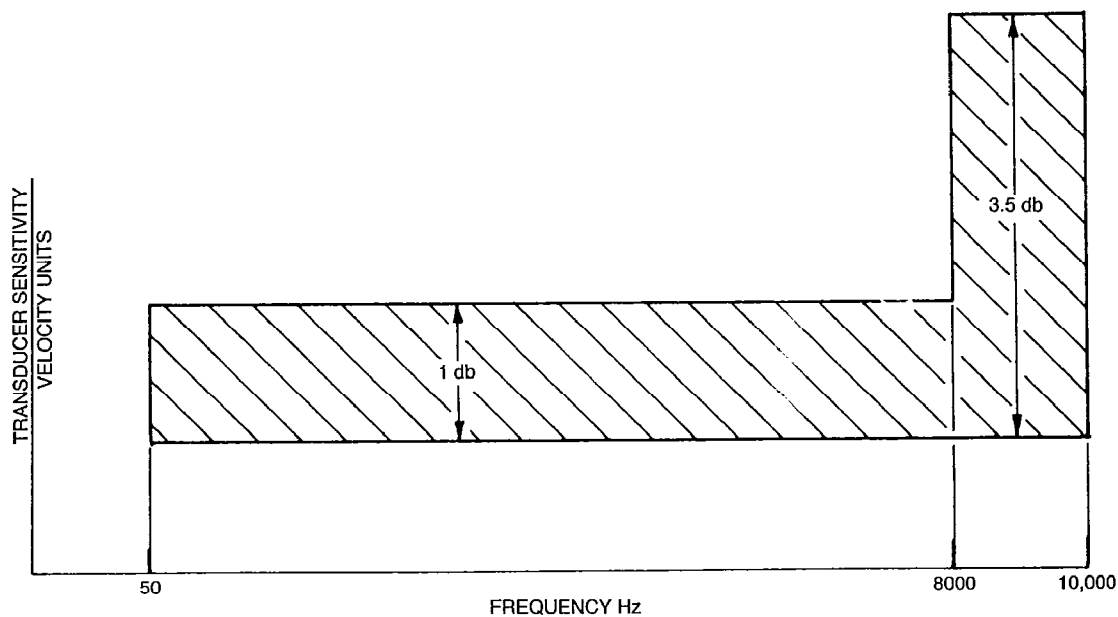
THE FILTER ATTENUATION CURVE MUST FALL WITHIN SHADED AREA

NOTE: The attenuation at all frequencies lower than 64% of the low cut-off frequency and at all frequencies higher than 160% of the high cut-off frequency shall not be less than 40 db.

FIGURE 3

TRANSDUCER RESPONSE SPECIFICATION

Transducer response curve must fall within the shaded area.



Amplitude Linearity: Maximum deviation from linearity shall be less than 10% for vibration amplitudes in the range between 12.7 and 2540 micrometres per second rms (500 and 100,000 microinches per second rms).

Sensitivity of the transducer as matched with the sensing system shall be specified within $\pm 5\%$.

This sensitivity shall be within specification limits for a range of static axial displacement of stylus not less than ± 0.050 mm (± 0.002 in.) from a prescribed position.

In case of variation in the sensitivity between individual transducers adequate compensation must be provided in the sensing system.

FIGURE 4
EXAMPLE OF TEST SEQUENCE

A tabulation of data to be taken during a test sequence of a bearing which may receive operational thrust in two directions. The letters indicate vibration readings in micro-inch/sec. units.

Test Brg. No.	Thrust Direction	Frequency Bands					
		Random Position 1			Random Position 2		
		50-300 Hz	300-1800 Hz	1800-10,000 Hz	50-300 Hz	300-1800 Hz	1800-10,000 Hz
1	1	A	B	C	D	E	F
	2	G	H	I	J	K	L
2	1						
	2						
3	1						
	2						

If the bearing can receive operational thrust in a single direction, use only Thrust Direction 1 and record only data A to F.

Processing of readings can proceed according to the following table:

Test Brg. No.	Frequency Band Limit	Thrust Direction 1			Thrust Direction 2		
		50-300 Hz	300-1800 Hz	1800-10,000 Hz	50-300 Hz	300-1800 Hz	1800-10,000 Hz
1	Average	$\frac{1}{2}$ (A + D)	$\frac{1}{2}$ (B + E)	$\frac{1}{2}$ (C + F)	$\frac{1}{2}$ (G + J)	$\frac{1}{2}$ (H + K)	$\frac{1}{2}$ (I + L)
	Accept/Reject						
2	Average						
	Accept/Reject						
3	Average						
	Accept/Reject						

American National Standards

The standard in this booklet is one of more than 10,000 standards approved to date by the American National Standards Institute.

The Standards Institute provides the machinery for creating voluntary standards. It serves to eliminate duplication of standards activities and to weld conflicting standards into single, nationally accepted standards under the designation "American National Standards."

Each standard represents general agreement among maker, seller, and user groups as to the best current practice with regard to some specific problem. Thus the completed standards cut across the whole fabric of production, distribution, and consumption of goods and services. American National Standards, by reason of Institute procedures, reflect a national consensus of manufacturers, consumers, and scientific, technical, and professional organizations, and governmental agencies. The completed standards are used widely by industry and commerce and often by municipal, state, and federal governments.

The Standards Institute, under whose auspices this work is being done, is the United States clearinghouse and coordinating body for voluntary standards activity on the national level. It is a federation of trade associations, technical societies, professional groups, and consumer organizations. Some 1000 companies are affiliated with the Institute as company members.

The American National Standards Institute is the United States member of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Through these channels U.S. standards interests make their positions felt on the international level. American National Standards are on file in the libraries of the national standards bodies of more than 60 countries.

American National Standards Institute, Inc
1430 Broadway
New York, N.Y. 10018