

ANSI®
S2.2-1959

Reaffirmed by ANSI
July 10, 2001

Reaffirmed by ANSI
May 19, 2006

Reaffirmed by ANSI
June 28, 2011

Reaffirmed by ANSI
June 16, 2016

Reaffirmed by ANSI June 19, 2020

American National Standard

**Methods for the
Calibration of Shock and
Vibration Pickups**

Secretariat

**Acoustical Society of America
American Society of Mechanical Engineers**

American National Standards Institute, Inc.

American National Standard

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Published by

**American National Standards Institute
11 West 42nd Street, New York, New York 10036**

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Printed in the United States of America

Foreword

(This Foreword is not a part of American Standard¹ Methods for the Calibration of Shock and Vibration Pickups, S2.2-1959.)

This American Standard¹ comprises a part of a group of definitions, standards, and specifications for use in work concerning acoustics, vibration, and mechanical shock. It has been developed under the Sectional Committee Method of ASA procedure, under the co-sponsorship of the Acoustical Society of America and the American Society of Mechanical Engineers.

The S2 Committee under whose jurisdiction this standard was developed has the following scope:

Standards, specifications, methods of measurement and test, and terminology in the fields of mechanical shock and vibration, but excluding those aspects that pertain to biological safety, tolerance, and comfort.

Various subcommittees have been organized to take care of the committee's program and this standard was developed by Subcommittee S2-W-27, whose personnel is shown below.

Suggestions for improvement gained in the use of this standard will be welcomed. They should be sent to the United States of America Standards Institute, 10 East 40th Street, New York, N. Y. York 11

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¹ All American Standards are now designated USA Standards.

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USA Standard Methods for the Calibration of Shock and Vibration Pickups

Introduction

The calibration of shock and vibration pickups has become increasingly important as the need has grown for accurate measurements of the shocks and vibrations to which aircraft, missiles, and other high performance equipment are subjected in service. Numerous methods have been used or proposed for these calibrations. These are briefly described in Section 4 of this standard and in the Appendix. Section 4 contains a tabulation and detailed description of five "standard methods" which have proven themselves to be reliable means for the calibration of shock and vibration pickups. A tabulation (see 4.1) lists approximate ranges of application of each standard method and estimates of attainable accuracy. The description, which follows the tabulation, gives details of performing calibrations by each of the standard methods. Section A1 contains a brief survey of other methods which have been used to calibrate vibration pickups, but which have not found sufficient acceptance as yet to be included among the standard methods. The methods described range from precision techniques suitable for laboratory use only to procedures appropriate to field use.

It is anticipated that the standard will undergo frequent revision to keep pace with the advancement of the art in this new and growing field. Section 4 will grow as methods in Section A1 prove their adequacy as standards. Section A1 will expand as new methods make their appearance.

Calibration methods for both shock and vibration pickups are included in the same standard because it is impracticable to draw a line of demarcation between pickups used in measurements of shocks and vibrations. Using Fourier analysis [1]¹ any shock can be described by the superposition of a sufficient number of sinusoidal vibrations of proper frequency, amplitude, and phase angle.

The standard is limited to the calibration of acceleration, velocity, and displacement pickups. It is not concerned with pickups used for measurements of force, pressure, or strain even though some of these may be calibrated by similar methods.

¹ Numbers in brackets denote references at the end of the standard.

1. Purpose and Scope

1.1 Purpose. This standard is designed to acquaint the user with the general principles of calibration of shock and vibration pickups and to describe concisely several standard methods which have proven to give reliable and reproducible results. Further details concerning these methods are given in the Appendix. Also, other methods that have not as yet reached the stage of development of the standard methods are described briefly in the Appendix.

1.2 Scope. Five methods have been selected as standard methods for the calibration of acceleration, velocity, and displacement pickups. They are described in Section 4 of this standard.

It is impracticable to calibrate all pickups by one standard method over the entire frequency and amplitude range of vibrations and shocks to be measured by the pickups. Several methods are accordingly described. Each method is limited to a range of frequency and amplitude, and to the weight of pickup that can be calibrated. The limitations may include, in addition, other variables such as volume of the pickup and temperature of operation.

1.3 Present and Future Choices of Methods. A pickup should be calibrated by the standard method or methods corresponding to its range of frequency, amplitude, and mass. The choice of method is facilitated by the tabulation of standard methods with estimated ranges and accuracies given in 4.1.

Other methods of calibration, of the types referred to in the Appendix, may be used in the future as these methods attain the degree of reliability characteristic of a standard method.

1.4 Related Standards. This standard is coordinated with the following standards which are closely related to the calibration of pickups:

American Standard¹ Method for Specifying the Characteristics of Pickups for Shock and Vibration Measurement, Z24.21-1957;

American Standard¹ Method for Specifying the Characteristics of Auxiliary Equipment for Shock and Vibration Measurements, S2.4-1960;² and

American Standard¹ Shock and Vibration Terminology, S1.1-1960.²

² These standards will become available in the latter part of 1960.

¹All American Standards are now designated USA Standards.