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American National Standard

Vibratory Noise Measurements and Acceptance Criteria of Shipboard Equipment

Secretariat
Acoustical Society of America

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Abstract

This Standard contains guidelines for limiting the machinery and operating equipment vibration on board ships for the purposes of habitability and mechanical suitability. The mechanical suitability guidelines result in a suitable environment for installed equipment and precludes many major vibration problems, such as unbalance, misalignment, or other damage to the machinery and operating equipment.

To obtain data to compare with the guidelines, this Standard also specifies data acquisition and processing procedures.

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The Acoustical Society of America (ASA) provides the Secretariat for Accredited Standards Committees S1 on Acoustics, S2 on Mechanical Vibration and Shock, S3 on Bioacoustics, and S12 on Noise. These committees have wide representation from the technical community (manufacturers, consumers, and general-interest representatives). The standards are published by the Acoustical Society of America through the American Institute of Physics as American National Standards after approval by their respective standards committees and the American National Standards Institute.

These standards are developed and published as a public service to provide standards useful to the public, industry, and consumers, and to Federal, State, and local governments.

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Foreword

[This Foreword is for information only, and is not a part of the American National Standard ANSI S2.16 - 1997 Vibratory Noise Measurements and Acceptance Criteria of Shipboard Equipment].

This Standard comprises a part of a group of definitions, standards, and specifications for use in mechanical vibration and shock. It has been developed using the American National Standards Institute (ANSI) Accredited Standards Committee Procedure. The Acoustical Society of America provides the Secretariat for Accredited Standards Committee S2, Mechanical Vibration and Shock.

American National Standards Committee S2, Mechanical Vibration and Shock, under whose jurisdiction this Standard was developed, has the following scope:

> *Standards, specifications, methods of measurement and test terminology in the fields of mechanical vibration and shock and condition monitoring and diagnostics of machines, but excluding those aspects which pertain to biological safety, tolerance, and comfort.*

This Standard is not comparable to any existing ISO Standard.

At the time this Standard was submitted to Accredited Standards Committee S2, Mechanical Vibration and Shock, for approval, the membership was as follows:

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Working Group S2/WG77, Measurement and Evaluation of Ship Vibration, which assisted Accredited Standards Committee S2, Mechanical Vibration and Shock, in the development of this Standard, had the following membership:

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Suggestions for improvement of this Standard will be welcomed. They should be sent to Accredited Standards Committee S2, Mechanical Vibration and Shock, in care of the Standards Secretariat of the Acoustical Society of America, 120 Wall Street, 32nd Floor, New York, NY 10005-3993, USA. Telephone +1 212 248 0373; FAX +1 212 248 0146; E-mail: asastds@aip.org.

American National Standard

Vibratory Noise Measurements and Acceptance Criteria of Shipboard Equipment

0 Introduction

The installation of machinery and operating equipment on board ships often leads to excessive vibration levels in various ship areas including occupied spaces. Acceleration measurements taken according to standardized procedures and compared with acceptance criteria will provide the requisite information to the shipbuilder for the proper selection and installation of equipment.

1 Scope, purpose, and applications

This Standard specifies procedures and instrumentation for the measurement of structure-borne vibratory noise generated by shipboard equipment. Vibratory acceleration acceptance criteria are presented for several types of equipment.

2 Normative references

ANSI S1.6-1984 (R 1997) *American National Standard Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurements*.

ANSI S1.8-1989 (R1997) *American National Standard Reference Quantities for Acoustical Levels*.

ANSI S1.11-1986 (R 1993) *American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital filters*.

ANSI S1.22-1992 (R 1997) *American National Standard Scales and Sizes for Frequency Characteristics and Polar Diagrams in Acoustics*.

ANSI S2.2-1959 (R 1997) *American National Standard Methods for Calibration of Shock and Vibration Pickups*.

ANSI S2.61-1989 (R 1997) *American National Standard Guide to the Mechanical Mounting of Accelerometers*.

ANSI S2.7-1982 (R 1997) *American National Standard Balancing Terminology*.

NOTE – While the filter terminology in this Standard is consistent with that contained in ANSI S1.11-1986 (R 1993) at the time this Standard was written, it is not entirely consistent with the filter terminology contained in the ANSI terminology standards S1.1 and 2.1.

3 Definitions

This section defines only some of the terms used in this Standard. See ANSI S2.7-1982 (R 1997) for definitions of a general nature.

3.1 equipment. The term *equipment*, when used in this Standard, refers to any equipment as a system, subsystem, or part thereof which is being measured to determine compliance with the structure-borne noise acceptance criteria. These criteria are based in part on the locations in which the equipment is to be placed.

3.2 equipment types. The term *type* is used to divide equipment into groups for the purpose of specifying structure-borne noise criteria. Equipment types are specified in as follows:

3.2.1 Type I. Type I designates reciprocating compressors and internal combustion engines.

3.2.2 Type II. Type II designates pumps, valves, and life support equipment.

3.2.3 Type III. Type III designates equipment not covered by types I, II and IV.

3.2.4 Type IV. Type IV designates vane axial fans.

3.3 mounting

3.3.1 resiliently mounted equipment. Resiliently mounted equipment is equipment which is isolated from the vibration of a support structure by resilient mounts. Testing of equipment attached by shock mounts, however, is not addressed in this Standard.

3.3.2 compound mounts. A compound or two-stage mount is a three-element device consisting of an intermediate mass contained between two resilient elements.

3.3.3 solidly mounted equipment. Solidly mounted equipment is equipment which is rigidly attached to the supporting structure.

3.4 reference vibratory acceleration (a_0). The reference quantity is 1 micrometer per second squared ($\mu m/s^2$) root mean square (rms) ($1\,\mu m/s^2 = 10^{-4}$ centimeters per second squared (cm/s^2).