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AMERICAN NATIONAL STANDARD

Guide for the Measurement, Reporting, and Evaluation of Hull and Superstructure Vibration in Ships

Secretariat:

Acoustical Society of America

Approved on March 11, 2004:

American National Standards Institute, Inc.

Abstract

This standard contains guidelines for limiting the hull and superstructure vibration of ships for the purposes of habitability and mechanical suitability. The mechanical suitability guidelines result in a suitable environment for installed equipment and preclude many major vibration problems, such as unbalance, misalignment, and other damage to the propulsion system. To obtain data to compare with the guidelines, this standard also specifies data acquisition and processing procedures.

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AMERICAN NATIONAL STANDARD

Guide for the Measurement, Reporting, and Evaluation of Hull and Superstructure Vibration in Ships

ANSI S2.25-2004

Accredited Standards Committee S2, Mechanical Vibration and Shock

Standards Secretariat
Acoustical Society of America
35 Pinelawn Road, Suite 114 E
Melville, NY 11747-3177

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ANSI S2.25- 2004
(Revision of ANSI S2.25-2001)

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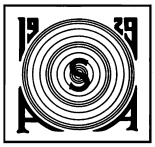

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Contents

Tables

Figures

Foreword

[*This Foreword is for information only, and is not a part of the American National Standard ANSI S2.25 - 2004 American National Standard Guide for the Measurement, Reporting, and Evaluation of Hull and Superstructure Vibration in Ships*].

This standard comprises a part of a group of definitions, standards, and specifications for use in mechanical vibration and shock. It was developed and approved by Accredited Standards Committee S2 Mechanical Vibration and Shock, under its approved operating procedures. Those procedures have been accredited by the American National Standards Institute (ANSI). The Scope of Accredited Standards Committee S2 is as follows:

> *Standards, specification, methods of measurement and test, and terminology in the field 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 a revision of ANSI S2.25-2001, which has been technically revised. Updated values of accelerations and velocities in categories of spaces are recommended and are in line with those of ISO 6954:2000. Also, more accurate weightings for acceleration and velocity measurements for habitability are incorporated, which are consistent with ANSI S3.18-2002 Part 1/ISO 2631-1:1997.

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:

R.J. Peppin, *Chair*

D.J. Evans, *Vice-Chair*

S.B. Blaeser, *Secretary*

Acoustical Society of America ..... S.I Hayek
..... B.E. Douglas (Alt.)

American Industrial Hygiene Association ..... J.J. Earshen
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National Institute of Standards & Technology ..... D.J. Evans
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..... D. Kristler (Alt.)

Vibration Institute ..... R. Eshleman
..... D.J. Vendittis (Alt.)

Individual Experts of Accredited Standards Committee S2, Mechanical Vibration and Shock, were:

L.A. Herstein D.F. Muster

Working Group S2/WG 11, Measurement and Evaluation of Mechanical Vibration of Vehicles, which assisted Accredited Standards Committee S2, Mechanical Vibration and Shock, in the development of this standard, had the following membership.

Arthur Kilcullen, Chair

G.P. Antonides
W. Blake
R.K. Brown
F. Burke
A. Cautilli
J. Chang
Y.K. Chen
K. Danahy
J. Gelsomino
G.D. Hill
A. Kukk
J. Leifer
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J. Slager
R. Sonnenschein
S. Stroubakis
R. Taddeo
M. Wilson
W.A. Wood
R. Woytowich
I. Zgaljic

Suggestions for improvements 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, 35 Pinelawn Road, Suite 114E, Melville, New York 11747-3177. Telephone: 631-390-0215; FAX: 631-390-0217; E-mail: asastds@aip.org

Introduction

Shipboard vibration is objectionable when it results in excessive stresses in structural or mechanical components, adversely affects the reliability or maintainability of machines or equipment aboard ships, interferes with crew duties, or reduces crew comfort.

The primary purpose of this Standard is to provide guidelines for the acceptability of a ship's performance with respect to hull and superstructure vibration. This Standard also describes measurement and data processing procedures which will result in reliable data to compare with the guidelines.

These guidelines apply to the evaluation of ship vibration with respect to several factors. The evaluation of vibration with respect to habitability in this standard is based on the guidelines in ANSI S3.18-2002 Part1/ISO 2631-1:1997 [3] and ISO 6954-2000 [4]. Unlike most vehicles, exposure to shipboard vibration normally lasts for days rather than hours. Guidelines are established for spaces that should be comfortable. A guideline is also given to insure that all spaces, including normally unoccupied spaces, are not harmful for human exposure. The guidelines of this standard are the same for vertical and horizontal vibration [4].

Evaluation of vibration with respect to rotating machinery is based on ANSI 2.19-l999 [2]. Although there is no easily definable relationship between hull vibration and balancing requirements, if ANSI S2.19-1999 is satisfied, the guidelines of this Standard should easily be met. Conversely, if this Standard is not satisfied due to a deficiency in a large rotating component, it would indicate a severe balancing or alignment problem. High vibration at the aft end of a vessel might be caused by propeller pitch unbalance.

Evaluation of vibration with respect to equipment reliability is based on the requirements of IS0 10055-l996 [7], extrapolated from a testing period to the expected life of the equipment. Again, there is no easily definable relationship between hull vibration and equipment reliability, but if both [7] and this standard are satisfied, environmental vibration should not be the cause of equipment reliability problems.

American National Standard

Guide for the Measurement, Reporting, and Evaluation of Hull and Superstructure Vibration in Ships

1 Scope

This Standard establishes uniform procedures for acquiring, processing, presenting, and evaluating shipboard vibration data for sea-going merchant ships of all lengths, and, where applicable, for inland ships and tugboats. It is applicable to both turbine and diesel-driven ships, with single or multiple shafts, but not to outboard-engine driven boats nor to air-driven vessels such as air-cushion vehicles. It contains guidelines for hull and super-structure vibration for:

a) habitability;

b) mechanical suitability.

Data acquired in accordance with this Standard will be useful for:

a) comparing ship specifications with acceptance trial data;

b) comparing various vessels with each other;

c) limited diagnostics of vibration problems; further development and improvement of vibration standards.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[1] ANSI S2.1-2000/ISO 2041:1990 Nationally Adopted International Standard, Vibration and shock-Vocabulary.

[2] ANSI S2.19-1999 American National Standard Mechanical Vibration — Balance Quality Requirements of Rigid Rotors, Part 1: Determination of Permissible Residual Unbalance, Including Marine Applications.

[3] ANSI S3.18-2002 Part 1/ISO 2631-1:1997, American National Standard Mechanical Vibration and Shock — Evaluation of Human Exposure to Whole-Body Vibration — Part 1: General Requirements.

[4] ISO 6954:2000 Mechanical vibration and shock - Guidelines for the measurement, reporting and evaluation of vibration on passenger and merchant ships.

[5] ISO 8041:1990 Human response to vibration — Measuring instrumentation.