ANSI S2.19-1999
[Revision of
ANSI S2.19-1989 (R 1997)]

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AMERICAN NATIONAL STANDARD

MECHANICAL VIBRATION—BALANCE QUALITY REQUIREMENTS OF RIGID ROTORS, PART 1: DETERMINATION OF PERMISSIBLE RESIDUAL UNBALANCE, INCLUDING MARINE APPLICATIONS

ANSI S2.19-1999

Accredited Standards Committee S2, Mechanical Vibration and Shock

Standards Secretariat
Acoustical Society of America
120 Wall Street, 32nd Floor
New York, New York 10005-3993

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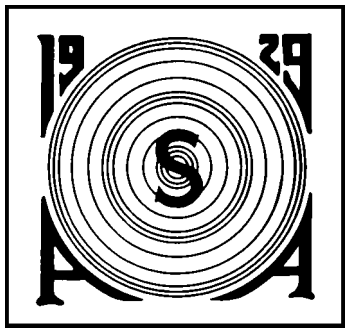

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American National Standard

Mechanical Vibration—Balance Quality Requirements of Rigid Rotors, Part 1: Determination of Permissible Residual Unbalance, Including Marine Applications

Secretariat
Acoustical Society of America

Approved 3 August 1999
American National Standards Institute, Inc.

Abstract

This Standard is the U.S. parallel to ISO 1940-1:1986, *Mechanical vibration—Balance quality requirements of rigid rotors—Part 1: Determination of permissible residual unbalance*. It is a revised version of the prior Standard ANSI S2.19-1989, *American National Standard Mechanical Vibration—Balance Quality Requirements of Rigid Rotors, Part 1: Determination of Permissible Residual Unbalance*, and contains recommended balance tolerances for various types of rotors and a detailed explanation of how they are to be understood for selected rotor planes. This document also deals with methods of allocating the recommended permissible residual unbalance to rotors with narrowly spaced, overhung, and/or unsymmetrically located correction planes. Various representations of the same unbalance in a rigid rotor are illustrated, limitations on the deviation from the recommended tolerances are suggested, the method of determining the residual unbalance in a given rotor plane without having to rely on the balancing machine calibration is described, and errors resulting from end-drive to the rotor are identified. Requirements for marine applications have been incorporated into table 1 by specifying balance quality grade, G, requirements. Clause 10.1, Balancing Report, states what information a report should include about the balancing machine used. An appendix describes a general method for two-plane balancing.

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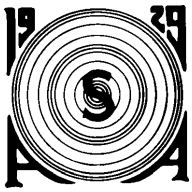

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Foreword

[This foreword is for information only and is not a part of 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.]*

This Standard was developed under the jurisdiction of Accredited Standards Committee S2, Mechanical Vibration and Shock, using the American National Standards Institute (ANSI) Accredited Standards Committee Procedures. The Acoustical Society of America provides the Secretariat for Accredited Standards Committee S2, Mechanical Vibration and Shock. This Standard is the national parallel to ISO 1940-1:1986, *Mechanical vibration—Balance quality requirements of rigid rotors—Part 1: Determination of permissible residual unbalance*.

Accredited 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, and 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.*

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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Vibration Institute	H. Pusey
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Individual experts of Accredited Standards Committee S2, Mechanical Vibration and Shock, were:

P. K. Baade	S. I. Hayek	D. L. Johnson
K. M. Eldred	L. A. Herstein	H. E. von Gierke

Working Group S2/WG65, Balancing Technology, which assisted Accredited Standards Committee S2, Mechanical Vibration and Shock, in the development of this Standard, had the following membership:

R. K. Mehta, *Chair*
K. Won, *Vice Chair*

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A. Brenig	E. Lambert
J. Csokmay	M. T. McGown
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	D. N. Walker

Suggestions for improvements of this Standard will be welcomed. Send suggestions for improvement to Accredited Standards Committee S2, Mechanical Vibration and Shock, in care of the ASA Standards Secretariat, 120 Wall Street, 32nd Floor, New York, NY 10005-3993, USA.

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American National Standard

Mechanical Vibration—Balance Quality Requirements of Rigid Rotors, Part 1: Determination of Permissible Residual Unbalance, Including Marine Applications

0 Introduction

Balancing is the process of attempting to improve the mass distribution of a body so that it rotates in its bearings without unbalanced centrifugal forces. Of course, this aim can be attained only to a certain degree; even after balancing, the rotor will possess residual unbalance.

The measuring equipment available today enables unbalance to be reduced to low limits. However, it would be uneconomical to exaggerate the quality requirements. It has therefore become necessary to determine to what extent the unbalance should be reduced, and where the optimum economic and technical compromise on balance quality requirements would be struck.

It is not readily possible to draw conclusions as to the permissible residual unbalances from any existing recommendations on the assessment of the vibratory state of machinery, since there is often no easily recognizable relation between the rotor unbalance and the machine vibrations under operating conditions. The amplitude of the once-per-revolution vibrations is influenced by characteristics of the rotor, the machine, the structure and the foundation, and by the proximity of the service speed to the various resonance frequencies, etc. Moreover, the machine vibrations may be due only in part to the presence of rotor unbalance.

1 Scope and field of application

This part of S2.19 gives recommendations for determining unbalance and for specifying related quality requirements of rigid rotors. It specifies

(a) a representation of unbalance in one or two planes;

(b) methods for determining permissible residual unbalance;

(c) methods for allocating it to the correction planes;

(d) methods for identifying the residual unbalance state of a rotor by measurement;

(e) a summary of errors associated with the residual unbalance identification.

In table 1 and figure 2 recommendations are given, based on worldwide experience, concerning the balance quality requirements of rigid rotors, according to their type, mass, and maximum service speed.

This part of S2.19 is also intended to facilitate the relations between manufacturer and user of machines. Terminology specified in this part of S2.19 may be used for establishing technical specifications. [For definitions, see ANSI S2.7.]

Detailed consideration of errors associated with the determination of residual unbalance is not included in this standard. Nor does this standard define permissible residual unbalances for flexible rotors; these are covered in ANSI S2.43. The methods for balancing are not described.

The recommended balance quality grades are not intended to serve as acceptance specifications for any rotor group, but rather to give indications of how to avoid gross deficiencies as well as exaggerated or unattainable requirements; they may also serve as a basis for more involved investigations, for example, when a more exact determination of the required balance quality by measurement in the laboratory or in the field is necessary. If due regard is paid to the recommended limits, satisfactory running conditions can most probably be expected. However, there may be cases when deviations from these recommendations become necessary, e.g., because of unusual construction or geometry.