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Standards Secretariat
Acoustical Society of America
335 East 45th Street
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AMERICAN NATIONAL STANDARD
Procedures for Balancing of Flexible Rotors

ABSTRACT

This standard classifies rotors into groups by their balancing requirements as influenced by the rotor's flexural stiffness and unbalance distribution. Certain classes of rotors may be balanced by normal or modified rigid rotor techniques. Other more flexible rotors may require high-speed balancing. The fundamentals of flexible rotor balancing are discussed as well as methods of assessment of final unbalance. Guidance is given on judging the final balance quality, however, this standard is not intended to serve as an acceptance specification for any rotor group. It is offered to provide direction on how to avoid gross deficiencies or unattainable requirements.

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AMERICAN NATIONAL STANDARDS ON ACOUSTICS

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

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

This standard was approved by the American National Standards Institute as ANSI S2.42-1982 on 2 December 1982.

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as 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.

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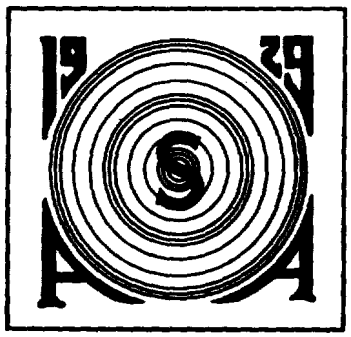

FOREWORD

[This foreword is for information only, and is not a part of American National Standard Procedures for Balancing Flexible Rotors, S2.42-1982 (ASA Catalog No. 46-1982).]

This standard was developed by the International Organization for Standardization, ISO Technical Committee 108 with considerable assistance from the American National Standards Institute Committee S2. The work of ANSI Committee S2 was performed under the secretariat of the Acoustical Society of America. This standard is the American counterpart of ISO 5406 The Mechanical Balancing of Flexible Rotors. Future editions of this standard are expected to incorporate features from ISO 5343 Criteria for Evaluating Flexible Rotor Balance.

American National Standards S2, which participated in the development of this standard, 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 which pertain to biological safety, tolerance, and comfort.

This standard was processed and approved for publication by the Acoustical Society of America following approval by American National Standards Committee S2.

At the time this standard was submitted to Standards Committee S2 for approval, the membership was as follows:

P. Maedel, Jr., *Chairman* S. Feldman, *Vice-Chairman* A. Brenig, *Secretary*

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Individual members of the S2 Committee were:

L. Batchelder
R. G. Bartheld
K. M. Eldred
S. Feldman
A. O. Sykes
H. E. von Gierke

Working Group S2-65, Balancing Technology, which assisted in the development of this standard for S2, is the American counterpart of ISO/TC 108/SC1/WG2 on Balancing Criteria for Flexible Rotors. It had the following membership:

W. E. Howard, *Chairman*

A. Brenig	S. Feldman	N. F. Rieger
M. Csovmay	P. Maedel	D. G. Stadelbauer
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Suggestions for improvements in this standard will be welcomed. They should be sent to the Standards Secretariat, Acoustical Society of America, 335 East 45th Street, New York, New York 10017.

CONTENTS

American National Standard
Procedures for Balancing Flexible Rotors

0 INTRODUCTION

This American National Standard classifies rotors into groups in accordance with their balancing requirements, specifies methods of assessment of final unbalance, and gives initial guidance of final balance quality criteria.

As the next stage in the development of these balance quality grades, the criteria for evaluating the unbalance of flexible rotors will be further described in an addendum to this American National Standard.

As this American National Standard is complementary in many details to ANSI S2.19-1975 Balance Quality of Rotating Rigid Bodies it is recommended that, where applicable, the two should be considered together.

1 SCOPE AND FIELD OF APPLICATION

This American National Standard classifies rotors into groups in accordance with their balancing requirements, establishes methods of assessment of final unbalance, and gives initial guidance on the establishment of balance quality grades so that, ultimately, balance quality grades can be established for all types of flexible rotors.

All rotors are therefore classified to indicate which can be balanced by normal or modified rigid rotor balancing techniques and which require some form of high-speed balancing. Classification of rotors into different categories permits the use of simplified balancing methods for some rotors. For all other rotors, suitable balancing methods are recommended.

As in the case of ANSI S2.19-1975, this American National Standard is not intended to serve as an acceptance specification for any rotor group, but rather to give indications of how to avoid gross deficiencies as well as exaggerated or unattainable requirements. Nevertheless, it may serve as a basis for more involved investigations, for example when a more exact determination of the required balance quality is necessary. If due regard is paid to the specified limits or methods of manufacture and balance, satisfactory running conditions can most probably be expected. However, there may be cases where deviations from this standard may be necessary.

2 REFERENCES

ISO 1925-1981—Balancing—Vocabulary.
ANSI S2.19-1975—Balance Quality of Rotating Rigid Bodies.
ISO 2953-1975—Balancing Machines—Description and Evaluation, in Preparation.

3 DEFINITIONS

3.1 The definitions relating to mechanical balancing in International Standard ISO 1925-1981 and many of the definitions relating to vibration and shock in ISO 2041 are applicable to this standard.

3.2 For the convenience of users of this standard, the following terms and definitions are repeated from ISO 1925-1981 (in the case of 3.4 and 3.15 the entries are adapted from ISO 1925-1981).

3.3 rigid rotor: A rotor is considered rigid when the unbalance can be corrected in any two (arbitrarily selected) planes and, after that correction, its unbalance does not significantly exceed the balancing tolerances (relative to the shaft axis) at any speed up to maximum service speed and when running under conditions which approximate closely to those of the final supporting system.

3.4 flexible rotor: A rotor not satisfying definition 3.3 due to elastic deflection.

3.5 bearing support: The part, or series of parts, that transmits the load from the bearing to the main body of the structure.

3.6 foundation: A structure that supports the mechanical system.

NOTES:

(1) The foundation may be fixed in space or may undergo a motion that provides excitation for the supported system.

(2) In the context of the balancing and vibration of rotating machines, the term "foundation" is usually applied to the heavy base structure on which the whole machine is mounted.

3.7 controlled initial unbalance: Initial unbalance which has been minimized by individual balancing of components and/or careful attention to design, manufacture, and assembly of the rotor.