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AMERICAN NATIONAL STANDARD

Mechanical vibration – Measurement and evaluation of machine vibration – Part 1: General guidelines

(a nationally adopted international standard)

Secretariat:

Acoustical Society of America

Approved on September 24, 2019:

American National Standards Institute, Inc.

Abstract

This nationally adopted international standard establishes general conditions and procedures for the measurement and evaluation of vibration using measurements made on rotating, non-rotating, and non-reciprocating parts of complete machines. It is applicable to measurements of both absolute and relative radial shaft vibration with regard to the monitoring of radial clearances, but excludes axial shaft vibration. The general evaluation criteria, which are presented in terms of both vibration magnitude and change of vibration, relate to both operational monitoring and acceptance testing. They have been provided primarily with regard to securing reliable, safe, long-term operation of the machine while minimizing adverse effects on associated equipment. Guidelines are also presented for setting operational limits.

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Mechanical vibration – Measurement and evaluation of machine vibration – Part 1: General guidelines (a nationally adopted international standard amendment)

ANSI/ASA S2.80-2019/Part 1 / ISO
20816-1:2016

Accredited Standards Committee S2, Mechanical Vibration and Shock

Standards Secretariat
Acoustical Society of America
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Foreword

[This Foreword is for information only and is not a part of the American National Standard ANSI/ASA S2.80-2019/Part 1/ISO 20816-1:2016 American National Standard Mechanical vibration – Measurement and evaluation of machine vibration – Part 1: General guidelines (a nationally adopted international standard). As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard.]

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, including the effects of exposure to mechanical vibration and shock on humans, including those aspects which pertain to biological safety, tolerance and comfort.

This standard is an identical national adoption of ISO 20816-1:2016 Mechanical vibration – Measurement and evaluation of machine vibration – Part 1: General guidelines, which was prepared by ISO/TC 108/SC 2.

The ANSI/ASA equivalents to ISO/IEC standards referenced herein are given below:

- ANSI/ASA S2.80-201x/Part 2/ISO 20816-2:2017 is an identical national adoption of ISO 20816-2:2017
- ANSI/ASA S2.81/ISO 21940 Parts

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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Suggestions for improvements to 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, 1305 Walt Whitman Road, Suite 300, Melville, New York 11747. Telephone: 631-390-0215; FAX: 631-923-2875; E-mail: asastds@acousticalsociety.org.

Introduction

Machines are now being operated at increasingly high rotational speeds and loads, as well as more flexible operation at part and full load, and under increasingly severe operating conditions. This has become possible, to a large extent, by the more efficient use of materials, although this has sometimes resulted in there being less margin for design and application errors.

At present, it is not uncommon for continuous operation to be expected and required for 2 years or 3 years between maintenance operations. Consequently, more restrictive requirements are being specified for operating vibration values of rotating machinery, in order to ensure continued safe and reliable operation.

This document is a basic document which establishes general guidelines for the measurement and evaluation of mechanical vibration of machinery, as measured on rotating and on non-rotating (and, where applicable, non-reciprocating) parts of complete machines, such as shafts or bearing housings. Recommendations for measurements and evaluation criteria pertaining to specific machine types are provided in additional parts of ISO 20816 as they become available as a replacement of the relevant parts of ISO 7919 and ISO 10816. ISO/TR 19201 gives an overview over these and further machinery vibration standards.

For some machines, measurements made on non-rotating parts are sufficient to characterize adequately their running conditions with respect to trouble-free operation. There are also types of machine, such as steam turbines, gas turbines and turbo compressors, all of which can have several modes of vibration in the service speed range, for which measurements on structural members, such as the bearing housings, might not adequately characterize the running condition of the machine, although such measurements are useful. Such machines generally contain flexible rotor shaft systems, and changes in the vibration condition can be detected more decisively and more sensitively by measurements on the rotating elements. Machines having relatively stiff and/or heavy casings in comparison to rotor mass are typical of those classes of machines for which shaft vibration measurements are frequently preferred.

Vibration measurements are used for a number of purposes, ranging from routine operational monitoring and acceptance tests to advanced experimental testing, as well as diagnostic and analytical investigations. These various measurement objectives lead to many differences in methods of interpretation and evaluation. To limit the number of these differences, this document is designed to provide guidelines primarily for operational monitoring and acceptance tests.

Three primary vibration quantities (displacement, velocity and acceleration) are defined and their limitations given. Adherence to the guidelines presented should, in most cases, ensure satisfactory service performance.

American National Standard

Mechanical vibration — Measurement and evaluation of machine vibration — Part 1: General guidelines (a nationally adopted international standard)

1 Scope

This document establishes general conditions and procedures for the measurement and evaluation of vibration using measurements made on rotating, non-rotating and non-reciprocating parts of complete machines. It is applicable to measurements of both absolute and relative radial shaft vibration with regard to the monitoring of radial clearances, but excludes axial shaft vibration. The general evaluation criteria, which are presented in terms of both vibration magnitude and change of vibration, relate to both operational monitoring and acceptance testing. They have been provided primarily with regard to securing reliable, safe, long-term operation of the machine while minimizing adverse effects on associated equipment. Guidelines are also presented for setting operational limits.

NOTE 1 The evaluation criteria for different classes of machinery will be included in other parts of ISO 20816 when they become available. In the meantime, guidelines are given in Clause 6.

NOTE 2 The term “shaft vibration” is used throughout ISO 20816 because, in most cases, measurements are made on machine shafts. However, the ISO 20816 series is also applicable to measurements made on other rotating elements if such elements are found to be more suitable, provided that the guidelines are respected.

For the purposes of ISO 20816, operational monitoring is considered to be those vibration measurements made during the normal operation of a machine. The ISO 20816 series permits the use of different measurement quantities and methods, provided that they are well-defined and their limitations are set out, so that the interpretation of the measurements is well-understood.

The evaluation criteria relate only to the vibration produced by the machine itself and not the vibration transmitted to it from outside.

This document does not include consideration of torsional vibration.

NOTE 3 For torsional vibration, see, for example, ISO 3046-5, ISO 22266-1 or VDI 2039.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.