ASA/ANSI S2.9-2008
(Revision of ANSI S2.9-1976)

Reaffirmed by ANSI June 13 2018

AMERICAN NATIONAL STANDARD

Parameters for Specifying Damping Properties of Materials and System Damping

Secretariat:

Acoustical Society of America

Approved on June 13, 2008:

American National Standards Institute, Inc.

Abstract

This standard presents the required nomenclature to improve communications among the many technological fields concerned with material damping that are used for resilient mountings so there will be a clear understanding by both the user and the manufacturer. Since the intention of this standard is to encourage better communication between the manufacturer and the user, the material set forth herein should be regarded as a nomenclature for specifying damping properties of the resilient materials. It is intended to outline, in standardized form, what information should be presented to enable the experienced designer to apply them for selecting the resilient material for machine mountings correctly. Also, the standard defines terminology in a further effort to ease the problem of communication between user and manufacturer.

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ANSI/ASA S2.9-2008

Accredited Standards Committee S2, Mechanical Vibration and Shock

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

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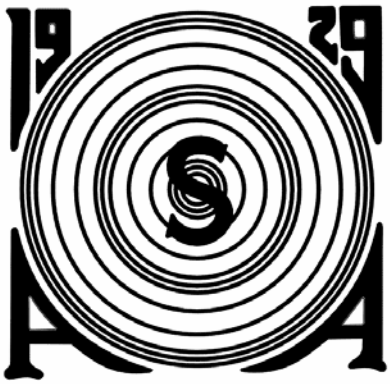

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Acoustical Society of America
ASA Secretariat
35 Pinelawn Road, Suite 114E
Melville, New York 11747-3177
Telephone: 1 (631) 390-0215
Fax: 1 (631) 390-0217
E-mail: asastds@aip.org

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Foreword

[*This Foreword is for information only, and is not a part of the American National Standard ANSI/ASA S2.9-2008 American National Standard Parameters for Specifying Damping Properties of Materials and System Damping.*]

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 a revision of ANSI S2.9-1976, which has been technically revised. This edition has been restructured and some of the formulas, terms and definitions, and illustrations (figures) have been reviewed and corrected. Additional exhibits, illustrations, and a table have been added to this revision of the document.

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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..... R. Shultz (Alt.)

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

A.J. Brammer	D.F. Muster	D.D. Reynolds
L.A. Herstein		D.E. Wasserman

Working Group S2/WG 4, Characterization of the Dynamic Mechanical Properties of Visco-elastic Polymers, which assisted Accredited Standards Committee S2, Mechanical Vibration and Shock, in the development of this standard, had the following membership.

W.M. Madigosky, Chair
J. Niemiec, Vice-Chair

D.A. Brown	A.T. Herfat	J. Lee
R.J. Deigan	D. Hunston	M. Mezache
J.J. Dlubac	J. Jarzynski	K. Ng
J. Fedderly	R. Landel	A.O. Sykes
	G. Lee	

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

The user of resilient mountings sometimes cannot select appropriate mounting systems because insufficient technical information is provided by the manufacturer. Consequently, the user must conduct his own experimental evaluation of mountings and perhaps unknowingly duplicate work already performed by the manufacturer. Also, in military and confidential applications, the user cannot be allowed to disclose applicable information which might otherwise facilitate suggestions and recommendations by the mounting manufacturer. Hence, the user many times must acquire considerable proficiency in the art of applying resilient mountings, and in these instances, he needs appropriate technical information from the manufacturer.

Alternatively, some manufacturers of resilient mountings have experience covering a wide variety of mounting applications. The manufacturers, in most instances, are willing to use their background information for solving the user's mounting problems. However, it is frequently difficult for the manufacturer to provide this service, because the user has not furnished sufficient information to the manufacturer regarding the application.

Meanwhile, communication among different engineering disciplines, which often utilize different nomenclature, is generally quite difficult. This is due not only to the large variety of damping parameters used but also to the lack of unique definitions for many well-accepted parameters.

American National Standard

Parameters for Specifying Damping Properties of Materials and System Damping

1 Scope

The term "damping" as used in this Standard is restricted to those properties of a material that are related to the process of *cyclic energy dissipation* during harmonic vibration. This definition specifically excludes: energy transfer devices such as dynamic absorbers; external damping processes such as viscous damping, air-damping, or acoustic radiation; and energy dissipation during transient or random vibration.

This standard presents the preferred nomenclature (parameters, symbols, definitions, and mathematical expressions) for specifying the damping properties *of uniform materials* and *uniform specimens,* where "uniform" implies homogeneity on a macroscopic scale. For reference purposes, certain non-standard damping parameters are discussed in Annex A. Also included is a classification of damping test parameters (Annex B).

The primary purpose for this standard is to improve communications among the many technological fields concerned with material damping.

2 Standard nomenclature

The standard nomenclature for damping in terms of parameters, symbols, and definitions is listed below. Dimensions and units in both SI (Système International) and English units are given in brackets. [Système International units include force in newtons (N), length in meters (m), and time in seconds (sec), whereas English units include force in pounds (lb_f), length in inches (in), and time in seconds (sec)]. For reference purposes, certain nonstandard damping parameters are discussed in Annex A.

3 Terms and definitions

3.1
bulk modulus
K
the ratio of the change in pressure acting on a volume to the fractional change in volume, or the ratio of the hydrostatic pressure to the volume strain

NOTE 1 K is the bulk modulus of elasticity [$ML^{-1}T^{-2}$ – N/m^2 (lb_f / in^2)].

NOTE 2 Complex bulk modulus of the damping material is defined as:

$K^* = K' + iK''$ (for harmonic time dependence), $i = \sqrt{-1}$ [$ML^{-1}T^{-2}$ – N/m^2 (lb_f / in^2)].

K'' is the dissipation modulus or imaginary part [$ML^{-1}T^{-2}$ – N/m^2 (lb_f / in^2)].

K', K'', K^*, $|K^*|$ are the various bulk moduli. $|K^*|$ is the absolute value of the complex bulk modulus and the magnitude equal to $[(K')^2 + (K'')^2]^{1/2}$ [$ML^{-1}T^{-2}$ – N/m^2 (lb_f / in^2)].