



Designation: D5992 – 96 (Reapproved 2024)

Standard Guide for Dynamic Testing of Vulcanized Rubber and Rubber-Like Materials Using Vibratory Methods¹

This standard is issued under the fixed designation D5992; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers dynamic testing of vulcanized rubber and rubber-like (both hereinafter termed “rubber” or “elastomeric”) materials and products, leading from the definitions of terms used, through the basic mathematics and symbols, to the measurement of stiffness and damping, and finally through the use of specimen geometry and flexing method, to the measurement of dynamic modulus.

1.2 This guide describes a variety of vibratory methods for determining dynamic properties, presenting them as options, not as requirements. The methods involve free resonant vibration, and forced resonant and nonresonant vibration. In the latter two cases the input is assumed to be sinusoidal.

1.3 While the methods are primarily for the measurement of modulus, a material property, they may in many cases be applied to measurements of the properties of full-scale products.

1.4 The methods described are primarily useful over the range of temperatures from -70°C to $+200^{\circ}\text{C}$ (-100°F to $+400^{\circ}\text{F}$) and for frequencies from 0.01 to 100 Hz. Not all instruments and methods will accommodate the entire ranges.

1.5 When employed for the measurement of dynamic modulus, the methods are intended for materials having complex moduli in the range from 100 to 100 000 kPa (15 to 15 000 psi) and damping angles from 0 to 90° . Not all instruments and methods will accommodate the entire ranges.

1.6 Both translational and rotational methods are described. To simplify generic descriptions, the terminology of translation is used. The subject matter applies equally to the rotational mode, substituting “torque” and “angular deflection” for “force” and “displacement.”

1.7 This guide is divided into sections, some of which include:

Terminology and Symbols	Section 3
Factors Influencing Dynamic Measurement	7
Test Methods and Specimens	8
Nonresonant Analysis Methods and Their Influence on Results	9
Report	10
Mechanical and Instrumentation Factors Influencing Dynamic Measurement	Annex A1
Guide to Further Reading	Appendix X1
Double-Shear Specimens—Derivation of Equations and Descriptions of Specimens	Appendix X2
Torsion Specimens—Derivation of Equations and Descriptions of Specimens	Appendix X3
Compression/Tension Specimens—Derivation of Equations and Descriptions of Specimens	Appendix X4
Free Resonant Vibration—Equations for Log Decrement and Stiffness	Appendix X5
Obtaining Loss Factor and Elastic Stiffness from Transmissibility Curves	Appendix X6

1.8 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.10 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- D945 Test Methods for Rubber Properties in Compression or Shear (Mechanical Oscillograph)
- D1566 Terminology Relating to Rubber

¹ This guide is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.10 on Physical Testing.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.