



Standard Test Method for Impedance and Absorption of Acoustical Materials Using a Tube, Two Microphones and a Digital Frequency Analysis System¹

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1. Scope

1.1 This test method covers the use of an impedance tube, two microphone locations, and a digital frequency analysis system for the determination of normal incidence sound absorption coefficients and normal specific acoustic impedance ratios of materials.

1.2 *Laboratory Accreditation*—A procedure for accrediting a laboratory for performing this test method is given in [Annex A1](#).

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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

2. Referenced Documents

2.1 ASTM Standards:²

[C384](#) Test Method for Impedance and Absorption of Acoustical Materials by Impedance Tube Method

[C634](#) Terminology Relating to Building and Environmental Acoustics

[E548](#) Guide for General Criteria Used for Evaluating Laboratory Competence (Withdrawn 2002)³

2.2 ISO Standards:

[ISO 10534-1](#) Acoustics—Determination of Sound Absorption Coefficient and Impedance or Admittance—Part 1:

[Impedance Tube Method](#)⁴

[ISO 10534-2](#) Acoustics—Determination of Sound Absorption Coefficient and Impedance in Impedance Tubes—Part 2: Transfer-Function Method⁴

2.3 ANSI Standards:⁴

[ANSI/ASA S1.11](#) Octave-Band and Fractional-Octave-Band Analog and Digital Filters

3. Terminology

3.1 *Definitions*—The acoustical terminology used in this test method is intended to be consistent with the definitions in Terminology [C634](#).

NOTE 1—Historical literature regarding the measurement of normal incidence absorption coefficients referred to “transfer function” measurements; however, the term arises from Laplace transform theory and is not strictly rigorous when the initial conditions have a non-zero value. The term “frequency response function” arises from more general Fourier transform theory ([1](#)).⁵ This test method shall retain the use of the former term although not technically correct. Users should be aware that modern FFT analyzers may employ the latter terminology.

3.2 *Symbols*: The following symbols are used in Section 8 (Procedure):

3.2.1 bpc —normal specific acoustics susceptance ratio.

3.2.2 c —speed of sound, m/s.

3.2.3 gpc —normal specific acoustic conductance ratio.

3.2.4 G_{11} , G_{22} —auto power spectra of the acoustic pressure signal at microphone locations 1 and 2, respectively.

3.2.5 G_{12} —cross power spectrum of the acoustic pressure signals at microphones locations 1 and 2.

3.2.6 H —transfer function of the two microphone signals corrected for microphone response mismatch.

3.2.7 $\bar{H}$ —measured transfer function of the two microphone signals.

3.2.8 H^I , H^{II} —calibration transfer functions for the microphones in the standard and switched configurations, respectively.

¹ This test method is under the jurisdiction of ASTM Committee [E33](#) on Building and Environmental Acoustics and is the direct responsibility of Subcommittee [E33.01](#) on Sound Absorption.

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

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ The boldface numbers in parentheses refer to the list of references at the end of this test method.