



Designation: E90 – 23

Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements¹

This standard is issued under the fixed designation E90; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

INTRODUCTION

This test method is part of a set for evaluating the sound-insulating properties of building elements. It is designed to measure the transmission of sound through a partition or partition element in a laboratory. Others in the set cover the measurement of sound isolation in buildings (Test Method E336), the laboratory measurement of impact sound transmission through floors (Test Method E492), the measurement of impact sound transmission in buildings (Test Method E1007), the measurement of sound transmission through building facades and facade elements (Guide E966), the measurement of sound transmission through a common plenum between two rooms (Test Method E1414), a quick method for the determination of airborne sound isolation in multiunit buildings (Practice E597), and the measurement of sound transmission through door panels and systems (Test Method E1425).

1. Scope

1.1 This test method covers the laboratory measurement of airborne sound transmission loss of building partitions such as walls of all kinds, operable partitions, floor-ceiling assemblies, doors, windows, roofs, panels, and other space-dividing elements.

1.2 Laboratories are designed so the test specimen constitutes the primary sound transmission path between the two test rooms and so approximately diffuse sound fields exist in the rooms.

1.3 *Laboratory Accreditation*—The requirements for accrediting a laboratory for performing this test method are given in Annex A4.

1.4 *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.*

1.5 *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 Recom-*

mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 *ASTM Standards:*²

- C423 Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C634 Terminology Relating to Building and Environmental Acoustics
- E336 Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
- E413 Classification for Rating Sound Insulation
- E492 Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
- E966 Guide for Field Measurements of Airborne Sound Attenuation of Building Facades and Facade Elements
- E1007 Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures
- E1111 Test Method for Measuring the Interzone Attenuation of Open Office Components
- E1289 Specification for Reference Specimen for Sound Transmission Loss

¹ This test method is under the jurisdiction of ASTM Committee E33 on Building and Environmental Acoustics and is the direct responsibility of Subcommittee E33.03 on Sound Transmission.

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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.

- E1332** Classification for Rating Outdoor-Indoor Sound Attenuation
- E1414** Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
- E1425** Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems
- E2235** Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods
- E3091** Specification for Systems to Measure Sound Levels
- 2.2 *ANSI Standards:*³
- ANSI/ASA S1.6-2016** American National Standard Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurement
- ANSI/ASA S1.11-2014, Part 1/IEC 61260-1:2014 (R2019)** Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters
- ANSI/ASA S1.40-2006** Specifications and Verification Procedures for Sound Calibrators
- 2.3 *IEC Standards:*⁴
- IEC 60942:2003** Electroacoustics—Sound Calibrators
- IEC 60942:2017** Electroacoustics—Sound Calibrators
- IEC 61672-1:2013** Electroacoustics—Sound Level Meters—Part 1: Specifications
- IEC 61672-3:2013** Electroacoustics—Sound Level Meters—Part 3: Periodic tests
- 2.4 *ISO Standards:*⁵
- ISO 717-1:2013** Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation
- ISO 3741:2010** Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for reverberation test rooms

3. Terminology

3.1 Terms used in this standard are defined either in Terminology **C634** or within this standard. The definition of terms explicitly given within this standard take precedence over definitions given in Terminology **C634**. The definitions within the terminology section of Terminology **C634** and this standard take precedence over any other definitions found in any other documents, including documents that are referenced in this standard.

3.1.1 For the purposes of this test method, sound transmission loss is operationally defined as the difference in decibels between the average sound pressure levels in the reverberant source and receiving rooms, plus ten times the common logarithm of the ratio of the area of the common partition to the sound absorption in the receiving room (see **Eq 5**).

NOTE 1—Sound transmission coefficient and sound transmission loss

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from International Electrotechnical Commission (IEC), 3 rue de Varembe, Case postale 131, CH-1211, Geneva 20, Switzerland, <http://www.iec.ch>.

⁵ Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

are related by either of the two equations:

$$TL = 10 \log(1/\tau) \quad (1)$$

$$\tau = 10^{-TL/10} \quad (2)$$

3.2 Definitions of Terms Specific to This Standard:

3.2.1 The following terms are either not defined in the terminology section of Terminology **C634** or have definitions in this document different from those stated in the terminology section of Terminology **C634**.

3.2.2 *average sound pressure level, L_p , (dB), n —(1)* in a specified frequency band within a defined measurement region, a continuous time-averaged sound pressure level measured with a moving microphone; (2) for several related time-averaged sound pressure levels measured at different positions for the same length of time either simultaneously or sequentially, ten times the base 10 logarithm of the arithmetic mean of the squared ratios of acoustic pressure to reference pressure (20 μ Pa) from which the individual sound pressure levels were derived.

3.2.3 *outdoor-indoor transmission class, OITC, n —of a building façade or façade element*, a single-number rating calculated in accordance with Classification **E1332** using values of sound transmission loss (TL).

4. Summary of Test Method

4.1 Two adjacent reverberation rooms are arranged with an opening between them in which the test partition is installed. Care is taken that the only significant sound transmission path between rooms is by way of the test partition. An approximately diffuse sound field is produced in one room, the source room. Sound incident on the test partition causes it to vibrate and create a sound field in the second room, the receiving room. The space- and time-averaged sound pressure levels in the two rooms are determined. In addition, with the test specimen in place, the sound absorption in the receiving room is determined. The sound pressure levels in the two rooms, the sound absorption in the receiving room and the area of the specimen are used to calculate sound transmission loss as shown in Section 11. Because sound transmission loss is a function of frequency, measurements are made in a series of frequency bands.

4.2 In theory, it is not important which room is designated as the source and which as the receiving room. In practice, different values of sound transmission loss may be measured when the roles are reversed. To compensate for this, the entire measurement may be repeated with the roles reversed; the source room becomes the receiving room and vice versa. The two sets of sound transmission loss values are then averaged to produce the final result for the laboratory.

4.3 Additional procedures that may be followed when testing doors are given in Test Method **E1425**.

5. Significance and Use

5.1 Sound transmission loss as defined in Terminology **C634**, refers to the response of specimens exposed to a diffuse incident sound field, and this is the test condition approached by this laboratory test method. The test results are therefore most directly relevant to the performance of similar specimens