



Designation: E492 – 22

Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine¹

This standard is issued under the fixed designation E492; 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.

INTRODUCTION

This test method is one of several for evaluating the sound insulating properties of building elements. It is designed to measure the impact sound transmission performance of an isolated floor-ceiling assembly, in a controlled laboratory environment. Others in the set deal with measurement of impact sound transmission through floor-ceiling assemblies (Test Method E1007), measurement of sound isolation in buildings (Test Method E336), the measurement of sound transmission through a common plenum between two rooms (Test Method E1414), and the laboratory measurement of airborne sound transmission loss of building partitions such as walls, floor-ceiling assemblies, doors, and other space-dividing elements (Test Method E90).

1. Scope

1.1 This test method covers the laboratory measurement of impact sound transmission of floor-ceiling assemblies using a standardized tapping machine. It is assumed that the test specimen constitutes the primary sound transmission path into a receiving room located directly below and that a good approximation to a diffuse sound field exists in this room.

1.2 Measurements may be conducted on floor-ceiling assemblies of all kinds, including those with floating-floor or suspended ceiling elements, or both, and floor-ceiling assemblies surfaced with any type of floor-surfacing or floor-covering materials.

1.3 This test method prescribes a uniform procedure for reporting laboratory test data, that is, the normalized one-third octave band sound pressure levels transmitted by the floor-ceiling assembly due to the tapping machine.

1.4 *Laboratory Accreditation*—The requirements for accrediting a laboratory for performing this test method are given in Annex A2.

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

1.6 *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.*

1.7 *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

- C423 Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C634 Terminology Relating to Building and Environmental Acoustics
- E90 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- E336 Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings
- E989 Classification for Determination of Single-Number Metrics for Impact Noise

¹ This test method is under the jurisdiction of ASTM Committee E33 on Building and Environmental Acoustics and is the direct responsibility of Subcommittee E33.10 on Structural Acoustics and Vibration.

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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.

E1007 Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures

E1414 Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

E2235 Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods

2.2 ANSI Standards:³

S1.10 Pressure Calibration of Laboratory Standard Pressure Microphones

S1.11 Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters

S1.43 Specification for Integrating-Averaging Sound-Level Meters

S12.51 Acoustics—Determination of Sound Power Levels of Noise Sources Using Sound Pressure—Precision Methods for Reverberation Rooms

2.3 ISO Standards:³

ISO 140/6 Acoustics—Measurement of Sound Insulation in Buildings and of Building Elements Part 6: Laboratory Measurements of Impact Sound Insulation of Floors

ISO 3741 Determination of Sound Power Levels of Noise Sources Using Sound Pressure—Precision Methods for Reverberation Rooms

2.4 IEC Standards:⁴

IEC 60942 Electroacoustics—Sound Calibrators

IEC 61672 Electroacoustics—Sound Level Meters—Part 1: Specifications

3. Terminology

3.1 The following terms used in this test method have specific meanings that are defined in Terminology **C634**:

airborne sound
average sound pressure level
background noise
decay rate
decibel
diffuse sound field
impact insulation class
one-third octave band
receiving room
reverberant sound field
reverberation room
sound absorption
sound pressure level

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *receiving room*—a reverberation room below the floor specimen under test in which the sound pressure levels due to the tapping machine are measured.

4. Summary of Test Method

4.1 A standard tapping machine is placed in operation on a floor specimen that is intended to represent a horizontal separation between two rooms, one directly above the other. The average spectrum of the sound pressure levels produced by

the tapping machine is measured in the receiving room below in one-third octave bands.

4.2 Since the spectrum depends on the absorption of the receiving room, the sound pressure levels are normalized to a reference absorption for purposes of comparing results obtained in different receiving rooms that differ in absorption.

5. Significance and Use

5.1 The spectrum of the noise in the room below the test specimen is determined by the following:

5.1.1 The size and the mechanical properties of the floor-ceiling assembly, such as its construction, surface, mounting or edge restraints, stiffness, or internal damping,

5.1.2 The acoustical response of the room below,

5.1.3 The placement of the object or device producing the impacts, and

5.1.4 The nature of the actual impact itself.

5.2 This test method is based on the use of a standardized tapping machine of the type specified in **8.1** placed in specific positions on the floor. This machine produces a continuous series of uniform impacts at a uniform rate on a test floor and generates in the receiving room broadband sound pressure levels that are sufficiently high to make measurements possible beneath most floor types even in the presence of background noise. The tapping machine itself, however, is not designed to simulate any one type of impact, such as produced by male or female footsteps.

5.3 Because of its portable design, the tapping machine does not simulate the weight of a human walker. Therefore, the structural sounds, i.e., creaks or booms of a floor assembly caused by such footstep excitation is not reflected in the single number impact rating derived from test results obtained by this test method. The degree of correlation between the results of tapping machine tests in the laboratory and the subjective acceptance of floors under typical conditions of domestic impact excitation is uncertain. The correlation will depend on both the type of floor construction and the nature of the impact excitation in the building.

5.4 In laboratories designed to satisfy the requirements of this test method, the intent is that only significant path for sound transmission between the rooms is through the test specimen. This is not generally the case in buildings where there are often many other paths for sounds—*flanking sound transmission*. Consequently sound ratings obtained using this test method do not relate directly to sound isolation in buildings; they represent an upper limit to what would be measured in a field test.

5.5 This test method is not intended for field tests. Field tests are performed according to Test Method **E1007**.

6. Test Rooms

6.1 The test facility shall be so constructed and arranged that the test specimen constitutes the only important transmission path for the tapping machine sound.

NOTE 1—Common methods for ensuring that this requirement is satisfied include mounting the specimen resiliently in the test opening,

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>.