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Standard Specification for Building and Environmental Acoustics Measurement System Elements¹

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1. Scope

1.1 This specification is intended for a broad scope of measurement systems used in making acoustical measurements in accordance with ASTM standards and guides.

1.1.1 The specification in its current iteration includes the specification for the tapping machine.

1.1.2 This specification does not include specifications for systems to measure sound levels as defined in Specification E3091.

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

1.3 *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.*

1.4 *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

C634 Terminology Relating to Building and Environmental Acoustics

E2782 Guide for Measurement Systems Analysis (MSA)

E3091 Specification for Systems to Measure Sound Levels

3. Terminology

3.1 Terms used in this standard are defined either in Terminology C634 or within this standard. The definitions of terms

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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.

explicitly given within this standard take precedence over definitions given in Terminology C634. The definitions within Terminology C634 and this standard take precedence over any other definitions of defined terms found in any other documents, including other documents referenced in this standard.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *acoustical measurement, n*—the process of obtaining quantitative values for sound-related phenomena resulting from vibration in elastic media.

3.2.2 *measurement system, n*—the collection of hardware, software, procedures and methods, human effort, environmental conditions, associated devices, and the objects that are measured for the purpose of producing a measurement. E2782

3.2.3 *tapping machine, n*—a device, that conforms to 4.1, for imparting a standardized momentum onto a nominally horizontal surface to produce impact noise.

4. Tapping Machine Performance Requirements

4.1 A standardized tapping machine shall conform to the following specifications:^{3,4}

4.1.1 The tapping machine shall be motor-driven or electromagnetically driven.

4.1.2 The tapping machine shall be self-driven.

4.1.3 The tapping machine shall have five hammers equally spaced in a line. The distance between centerlines of neighboring hammers shall be $100\text{ mm} \pm 3\text{ mm}$.

4.1.4 Each hammer shall have an effective mass of $500\text{ g} \pm 12\text{ g}$ and shall fall freely from a height of $40\text{ mm} \pm 3\text{ mm}$. Hammer velocity at impact shall be $0.886\text{ m/s} \pm 0.022\text{ m/s}$.

4.1.5 The falling direction of the hammers shall be perpendicular to the test surface to within $\pm 0.5^\circ$.

4.1.6 The part of the hammer carrying the impact surface shall be cylindrical with a diameter of $30\text{ mm} \pm 0.2\text{ mm}$.

4.1.7 The impact surface shall be of hardened steel and shall be approximately spherical with a convex curvature radius of $500\text{ mm} \pm 100\text{ mm}$.

³ Hopkins, C., Sound Insulation, Amsterdam Elsevier/Butterworth-Heinemann, 2007, 622 p.

⁴ Bruel, P.V., Tapping Machines for Measuring Impact Sound Transmission, Bruel & Kjaer Technical Review, No. 2, 1967.

4.1.8 The mean time between impacts shall be $100 \text{ ms} \pm 5 \text{ ms}$. The time between successive impacts shall be $100 \text{ ms} \pm 20 \text{ ms}$. The time between impact and lift of the hammer shall be less than 80 ms.

4.1.9 The hammers shall be able to fall at least 4 mm below the plane on which the supports of the tapping machine rest.

4.1.10 The mass of the tapping machine shall be less than or equal to 15 kg.

4.1.11 The distance between the geometric center of each tapping machine support and the geometric center of the closest neighboring hammer shall be at least 100 mm. The supports shall be equipped with resilient pads.

5. Keywords

5.1 acoustical measurement; instrumentation; tapping machine

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