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Standard Specification for Sound Sources Used for Testing Open Office Components and Systems[1]

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1. Scope

1.1 This specification states the requirements for sound sources used for measuring the speech privacy between open offices and for measuring the laboratory performance of acoustical components (see Test Methods E1111 and E1130).

1.2 The sound source shall be a loudspeaker located in an enclosure driven with an appropriate test signal.

1.3 This specification describes the sound source and method of qualifying it using a special qualification signal. Test signals required by open office test methods may differ.

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

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

E1050 Test Method for Impedance and Absorption of Acoustical Materials Using a Tube, Two Microphones and a Digital Frequency Analysis System

E1111 Test Method for Measuring the Interzone Attenuation of Open Office Components

E1130 Test Method for Objective Measurement of Speech Privacy in Open Plan Spaces Using Articulation Index

2.2 *ANSI Standards:*[3]

S1.4 Specification for Sound Level Meters

S1.6 Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurements

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

S1.43 Specifications for Integrating-Averaging Sound Level Meters

2.3 *IEC Standards:*[4]

61260 Electroacoustics—Octave and fractional-octave band filters

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

3. Terminology

3.1 *Definitions:*

3.1.1 The acoustical terminology used in this specification is consistent with Terminology C634.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *directivity measurement*—the measurement used to determine directivity as defined in 4.2.

3.2.2 *qualification signal*—a test signal of broadband noise or bands of white or pink noise as defined in Terminology C634.

3.2.3 *source point*—the point at which the loudspeaker axis intersects the front plane of the loudspeaker (see Fig. 1).

3.3 The following terms in this standard have specific meanings that are defined in Terminology C634:

3.3.1 *background noise,*

3.3.2 *pink noise,*

3.3.3 *sound pressure level,* and

3.3.4 *white noise*

4. Sound Source Specifications

4.1 *Sound Source Description*—The sound source shall be a loudspeaker enclosed in a box that has a maximum dimension of 0.30 m on a side.

4.2 *Directivity*—With the source driven with the qualification signal, the maximum and minimum sound pressure levels of any one-third octave band, from 200 to 3150 Hz measured

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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] 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 Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland, http://www.iec.ch.

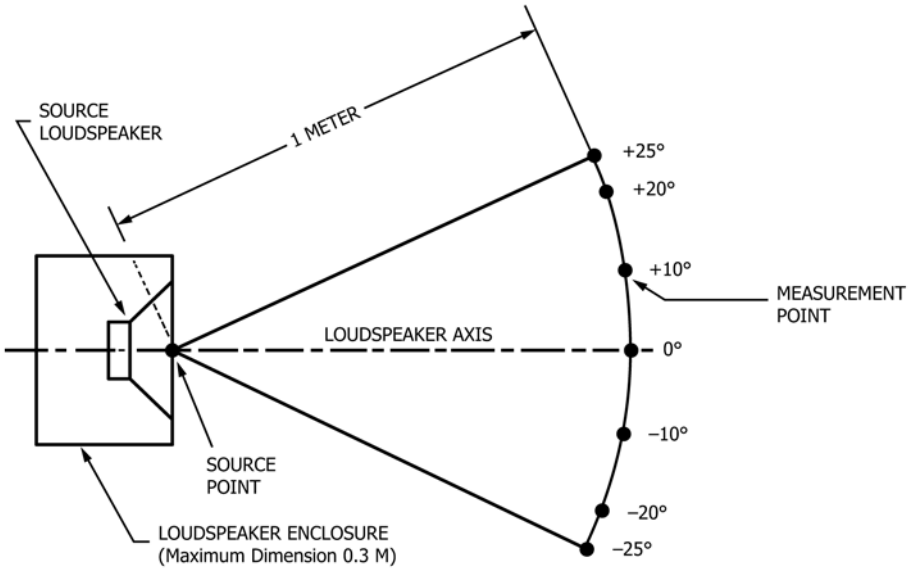

FIG. 1 Measurement Points for Sound Source Directivity

at a distance of 1.0 m from the source point, at any angle up to and including 25° in any direction from the loudspeaker axis, shall differ by no more than 2 dB. At frequencies above 3150 Hz, the difference shall be no more than 3dB.

NOTE 1—At angles beyond 25° from the loudspeaker axis, the source may produce lower sound pressure levels than within the 50° included angle.

NOTE 2—The directivity requirement may be met by using more than one loudspeaker, each one used separately to cover a different portion of the test frequency range.

5. Source Qualification

5.1 *Test Environment*—The measurements shall be carried out in a sound field, essentially free of acoustical reflections. The preferred test environment is an anechoic room with surfaces that have a minimum normal incidence sound absorption coefficient of 0.990 at all frequencies above 175 Hz as measured in accordance with Test Methods C384 or E1050 or, by the use of other methods, can be shown to be essentially anechoic between 200 Hz and 5000 Hz. Alternatively, an outdoor environment may be used if it is shown that sound reflections do not influence the data. (See also, Section 6.)

5.2 *Test Instruments:*

5.2.1 The measurement system used to measure sound pressure levels shall satisfy the accuracy requirements of ANSI S1.4, ANSI S1.43, or IEC 61672-1 Type 1 sound level meters except that weighting networks are not required.

5.2.2 The microphone shall meet the requirements of either IEC 61672–1 or ANSI S1.4, or ANSI S1.43. For microphones meeting ANSI S1.4, the microphone shall be oriented so the sound in incident on the microphone at the calibration angle of incidence for the microphone. For microphones meeting IEC 61672–1, the microphone shall be oriented so the sound is incident on the microphone from the reference direction.

5.2.3 One-third octave filters shall meet the requirements of ANSI S1.11 for Class III, Type R or Type E filters or IEC 61260.

5.3 *Qualification Sound Output*—When the sound source is driven with the qualification signal, the sound output shall be adequate to maintain one-third octave-band sound pressure levels at least 10 dB above the corresponding background noise in each band at each measurement location.

NOTE 3—Sources which produce an A-weighted sound level of 70 to 90 dB at 1 m when driven with broadband noise usually meet this requirement.

NOTE 4—The background noise consists of the ambient noise and the internal noise of the measuring instruments, as defined in Terminology C634.

5.4 *Directivity Measurement*—The directivity of the sound source shall be verified by driving the source with the qualification signal and measuring the sound pressure levels at measurement points that include those shown in Fig. 1. The microphone shall be oriented such that the angle between the axis of the microphone and the line connecting the center of the microphone diaphragm and the center of the loudspeaker is the same for each measurement. This shall be carried out for each one-third octave with midband frequencies from 200 to 5000 Hz defined in ANSI S1.6 or IEC 61260. At a minimum, the data shall be obtained at seven measurement points in each of two perpendicular planes, such as the horizontal and vertical planes, at a distance of 1 m from the source point.

5.5 The source shall be characterized per 5.4 prior to first use and after repair or replacement of any component in the speakers that can affect directivity.

6. Space Qualifications

6.1 *Draw way test*—To determine the acceptability of the space used to verifying directivity (5.4) do the following:

6.1.1 Place the sound source near the center of space at least 2 m from any horizontal or vertical surface.

6.1.2 Excite the source with random noise over the range of 200 to 5 000 Hz.

6.1.3 Measure at two locations, 1 m from the source point and 1.5 m from the source point, along the following axes:

6.1.3.1 Directly in front of the source, and

6.1.3.2 At a ± 25° angle from the loudspeaker axis in both vertical and horizontal planes

6.1.4 For each set of measurements, measure the one-third octave band 10s average sound pressure level over the frequency range of interest.

6.1.5 For each axis measured, subtract the sound pressure level at the 1.5 m point from that at the 1 m point.

6.1.6 The difference shall be 3.5 dB ±0.5 dB for each and every ⅓ rd octave band for the room to be considered adequate.

6.2 *Other methods:*

6.2.1 Any other method can be used to qualify the space such that it can be shown the method yields results equivalent to that above.

7. Qualification Report

7.1 A report shall be made available providing the qualification test data for sources that meet this specification.

8. Keywords

8.1 loudspeaker; open office; open office components; open office components and systems; sound; sound source directivity; sound sources