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Standard Test Method for Evaluating Masking Sound in Open Offices Using A-Weighted and One-Third Octave Band Sound Pressure Levels¹

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INTRODUCTION

This test method is one of a set of standards for evaluating the acoustical performance of components or systems in an open office. The other standards in this set deal with the measurement of the sound attenuation between work stations provided by partial height space dividers, vertical surfaces, and acoustical ceiling systems; speech privacy; and the evaluation of masking sound.

1. Scope

1.1 This test method specifies the procedures that can be used to evaluate the spatial and temporal uniformity of masking sound in open offices using A-weighted sound levels. It also specifies the procedure for evaluating the masking sound spectrum and level using one-third octave band sound pressure levels.

1.2 The results of this test method can be used to determine if the masking sound meets a particular specification for spatial and temporal uniformity if that specification is written in terms of A-weighted sound levels and if the masking sound meets a particular spectrum shape and level in the office area.

1.3 This test method must not be used to evaluate the acoustical environment in an office space. It is intended only to evaluate the masking sound in an office. This test method, for instance, does not evaluate the low frequency *rumble* noise found in some offices.

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

¹ This test method is under the jurisdiction of ASTM Committee E33 on Building and Environmental Acoustics and is the direct responsibility of Subcommittee E33.02 on Speech Privacy.

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2. Referenced Documents

2.1 *ASTM Standards*:²

C634 Terminology Relating to Building and Environmental Acoustics

E1374 Guide for Open Office Acoustics and Applicable ASTM Standards

2.2 *ANSI Standards*:³

S1.11 –2004 Specification for Octave-Band and Fractional-Octave Band Analog and Digital Filters

S1.43 –1997 (R 2007) Specifications for integrating averaging sound level meters

IEC 61672 –2002 Electroacoustics- Sound Level meters-part 1: specifications

3. Terminology

3.1 *Definitions*—The acoustical terminology used in this test method is consistent with the definitions in Terminology C634.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *masking sound*—sound within an office that reduces the intelligibility of intruding speech and the distraction from activity noise. Masking sound may be produced by a masking

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>.

sound system, heating, ventilating, and air conditioning (HVAC) sources, or other sources.

3.2.2 *masking sound system*—the electronic equipment and loudspeakers used to generate, distribute, and produce masking sound throughout an office space.

3.2.3 *spatial uniformity*—a condition where the sound pressure levels throughout a defined space do not vary significantly from the arithmetic mean sound pressure level. The amount of allowable variation is specified by others such as a consultant, designer, or owner.

3.2.4 *temporal uniformity*—at a given position, a condition where the average sound pressure level measured over a short time interval does not differ significantly from the average sound pressure level measured over a long time interval. The amount of allowable variation is specified by others such as a consultant, designer, or owner.

4. Summary of Test Method

4.1 The spatial uniformity of the masking sound in an open office is determined by measuring the A-weighted average sound level with a sound level meter or real time analyzer at several locations and comparing these values to the arithmetic mean sound level or to a specified level. The temporal uniformity of the masking sound is determined by measuring the A-weighted sound levels over an extended period of time at one or more locations. The masking sound spectrum and level is determined by measuring the one-third octave band sound pressure levels at one or more locations.

5. Significance and Use

5.1 Speech privacy in an open office is dependent on many factors (see Guide E1374 for a discussion on open office acoustical considerations). One of these factors is the masking sound in the office. Without masking sound in the open office, confidential speech privacy is not possible at normal voice levels. The four critical acoustical parameters of masking sound are its spatial uniformity, temporal uniformity, spectrum shape, and level. The measurement and determination of these parameters are addressed in this test method.

5.2 The results from this test method can be used to determine if the masking sound meets a particular specification.

6. Test Space

6.1 The test space shall include the entire office area served by the masking system, or as otherwise specified.

6.2 The ceiling system of the test space shall be completely finished, including light fixtures and air diffusers.

6.3 The floor covering and all wall finishes shall be completely installed prior to testing.

6.4 To provide the most meaningful information concerning the ability of the masking sound to provide consistent privacy, it is preferable to test with interior furnishings in place since furniture may influence the distribution of masking sound within the space. However, this test method may also be used for unfurnished spaces.

6.5 The office space shall be unoccupied during the tests.

7. Test Signal

7.1 The test signal used for this evaluation may be any of the following:

7.1.1 The sound due to the HVAC system, the masking sound system, and any other noise sources,

7.1.2 The sound due to the masking sound system alone, or

7.1.3 The sound due to the HVAC system alone.

7.2 If the intent is to evaluate the performance of the combination of sounds from the masking sound system, sound sources associated with the HVAC system and other equipment, then the test procedures shall be carried out with the masking sound system adjusted as intended to be used in the occupied space. The HVAC system should be operated at its noisiest and quietest settings or conditions.

7.3 If the intent is to evaluate the performance of the masking sound system alone, then the background sound pressure levels shall be at least 10 dB lower than the sound pressure levels of the masking sound signal. For the measurement of temporal or spatial uniformity, this may require that the sound pressure levels of the masking sound system be temporarily raised above the design level to provide the proper signal to noise ratio. Care should be taken not to overdrive the masking sound system, which may cause distortion.

7.4 If the intent is to evaluate the performance of the masking sound generated only by the HVAC system and other building sources, the HVAC system and other sound sources shall be operated at their noisiest and quietest settings or conditions.

8. Test Instrumentation

8.1 A sound level meter or analyzer shall be used that conforms to, or is better than, Type I, ANSI S1.43–1997 (R 2007) or class 1, IEC 61672–2002 for a Type 1 meter that has one-third octave band filters.

8.1.1 The overall frequency response of the filters for each test band shall conform to ANSI S1.11–2004 for class 1 or better.

8.2 Test data may be acquired on-site or recorded for later analysis. The recording device shall have a frequency response of ± 1 dB from 80 to 10 000 Hz.

8.3 A microphone with a frequency response of ± 2 dB from 80 to 10 000 Hz shall be used. The microphone shall be oriented with respect to the ceiling in the office per the manufacturer's recommendation for the type of microphone being used.

8.3.1 The microphone position(s) should be at ear-height for the average seated person which is 1.2 m (4 ft) above the floor.

8.3.2 The microphone position(s) should be at least 1 m (3.3 ft) from any vertical surfaces such as walls, columns, desks, or office furniture. In the event that this criterion cannot be met, the selected location shall be as far as possible from the closest surface and the location shall be described in the report.

9. Procedure

9.1 Four different acoustical parameters must be measured in order to evaluate masking sound. These parameters are the