Designation: E1111/E1111M – 14

Standard Test Method for Measuring the Interzone Attenuation of Open Office Components[1]

This standard is issued under the fixed designation E1111/E1111M; 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 describes the measurement and evaluation of acoustical performance of components affecting speech privacy in open-plan spaces. The maximum privacy theoretically available at normal working distances in open-plan spaces, with partial height space dividers (screens), is insufficient without the assistance of relatively elevated background masking sound levels. Thus, the provision of adequate speech privacy in open-plan offices and schools is one of the most difficult tasks in the architectural acoustics field. This test method provides a means of objectively measuring the relevant acoustical characteristics of three major components of open-plan spaces, the ceiling system, furniture panels used as acoustical barriers, and wall finishes which attenuate reflected sound. Furniture panels may be tested for their capacity as an acoustical barrier and/or the degree to which they may reduce reflected sound.

1. Scope

1.1 This test method covers the measurement of the interzone attenuation for three components of open-plan spaces:

1.1.1 Ceiling systems when used in conjunction with partial-height space dividers. This arrangement is commonly used in offices to achieve speech privacy between work zones in the absence of full-height partitions. This test method is applicable to any ceiling configuration, including, for example, a pattern of sound-reflective panels in an otherwise sound-absorptive ceiling. This test method generally requires use of a fixed space divider height of 1.50 m [5 ft]. In recognition of trends toward alternate divider heights in open office environments, measurements with an alternate divider height may be conducted in accordance with this standard.

1.1.2 Furniture panels used as acoustical barriers in open-plan spaces to provide speech privacy or sound isolation between working positions.

1.1.3 Vertical panels, including wall finishes such as sound-absorbent panels, and furniture panels or screens which may reflect sound. It may not be applicable to such items as window finishes or furniture other than panels if these differ significantly from flat wall panels.

1.1.4 The combination of results from the various components of an open-plan office is beyond the scope of this standard.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 Unless otherwise qualified, all dimensions specified in this test method shall be understood to have a tolerance of ±6 mm (±¼ in.) The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C423 Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

[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] 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.

C634 Terminology Relating to Building and Environmental Acoustics
E795 Practices for Mounting Test Specimens During Sound Absorption Tests
E1110 Classification for Determination of Articulation Class
E1179 Specification for Sound Sources Used for Testing Open Office Components and Systems
E1374 Guide for Open Office Acoustics and Applicable ASTM Standards

2.2 *ANSI Standards:*
S1.4 Specification for Sound Level Meters[3]
S1.6 Preferred Frequencies and Band Numbers for Acoustical Measurements[3]
S1.11 Specification for Octave Band and Fractional-Octave-Band Analog and Digital Filters[3]

3. Terminology

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

3.1.1 acoustical barrier, ambient noise, diffraction, level, (sound) absorption coefficient, sound pressure levels, pink noise, white noise.

3.2 *Definitions of Terms Defined in Other Standards not included in Terminology C634:*

3.2.1 The term *source point* is defined in Specification E1179.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *furniture panel*—a furnishing that does not extend to the ceiling, and that is used to subdivide an open-plan space and provide a degree of visual and acoustical privacy. Furniture panels include interlocking systems furniture and freestanding screens.

3.3.2 *nominal reference level*—for a one-third octave-band, the arithmetic mean of sound pressure levels measured at specified positions relative to the source in a region free from reflections.

3.3.3 *interzone attenuation*—at a specified position, for a one-third octave band, the difference between the nominal reference level and the sound pressure level at the specified point.

3.3.4 *nominal interzone attenuation*—for a one-third octave-band, at a specified point, the arithmetic mean interzone attenuation calculated using the interzone attenuation for the point in question and for two adjacent positions 0.30 m (1 ft) along the survey path.

4. Summary of Test Method

4.1 The test facility is essentially an expanse of floor and ceiling in which all surfaces excluding the floor and test specimen have negligible sound reflections. The facility may be set up in a laboratory, in a mock-up of a proposed building, or in a completed building. The configuration of the room will depend on the open-plan component being tested.

4.1.1 For testing a ceiling system, a standard space divider is positioned with such dimensions and construction that sound generated on one side can reach a measuring point on the other side only by way of diffraction over the top of the space divider and by reflection from the ceiling. With the diffracted component fixed by the dimensions of the space divider and by the height of the source and measurement position, the difference between the sound pressure levels measured on each side of the space divider provides a comparative measure of the contribution of ceiling system reflection to the total sound transmission. See Figs. 1 and 2.

4.1.2 For a furniture panel tested as an acoustical barrier, the panel is arranged such that it blocks the direct path of sound from the sound source to the measuring microphones. Sound generated by the sound source on one side of the furniture panel under test reaches the other side chiefly by diffracting over its top edge. A potential secondary path is transmission through the panel. The differences in sound pressure levels measured on each side of the furniture panel provide a measure of its effectiveness as an acoustical barrier. See Figs. 3 and 4.

4.1.3 For wall finishes and furniture panels tested for their capacity in suppressing reflected sound, the sound is generated on one side of a standard barrier that extends from floor to ceiling, with a gap at the end facing the test specimen, and is partially reflected by the test specimen to reach the other side. The difference in magnitude of the sound pressure levels measured on the source and receiving side of the barrier provides a measure of the attenuation of reflected sound attributable to the properties of the test specimen. Sound-absorbent specimens will reflect less energy around the barrier than sound-reflective specimens. Two test conditions are established in this test method. Specimens that are wall finishes are applied over a sound-reflective side wall, whereas specimens that are furniture panels are placed against a sound-absorptive side wall. See Fig. 5.

4.2 When the test is conducted in a mock-up of a proposed building or in a completed building, strict adherence to the test method may not be possible in that the conditions of ceiling height and plenum depth, etc., cannot be met because of the building design. Under these circumstances, the measurements apply only to that situation and other identical situations.

5. Significance and Use

5.1 Providing speech privacy in open-plan spaces depends upon many factors, the most significant of which are the following: *(1)* the shadow zone of part-height space dividers and the diffraction of sound from the edges of space dividers; *(2)* the primary sound reflective properties of the ceiling system; *(3)* the level of masking sound present in the space; and *(4)* the distance between speaker and listener. Guide E1374 provides additional detail on the factors contributing to speech privacy in open-plan spaces.

5.2 In this test method the third factor, masking sound, is eliminated and the fourth factor, the distance between speaker and listener, is standardized for all specimen types. For the measurement of ceiling systems, the first factor, the shadow zone, is also standardized for each divider height used. Experience has indicated that results obtained by this test

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

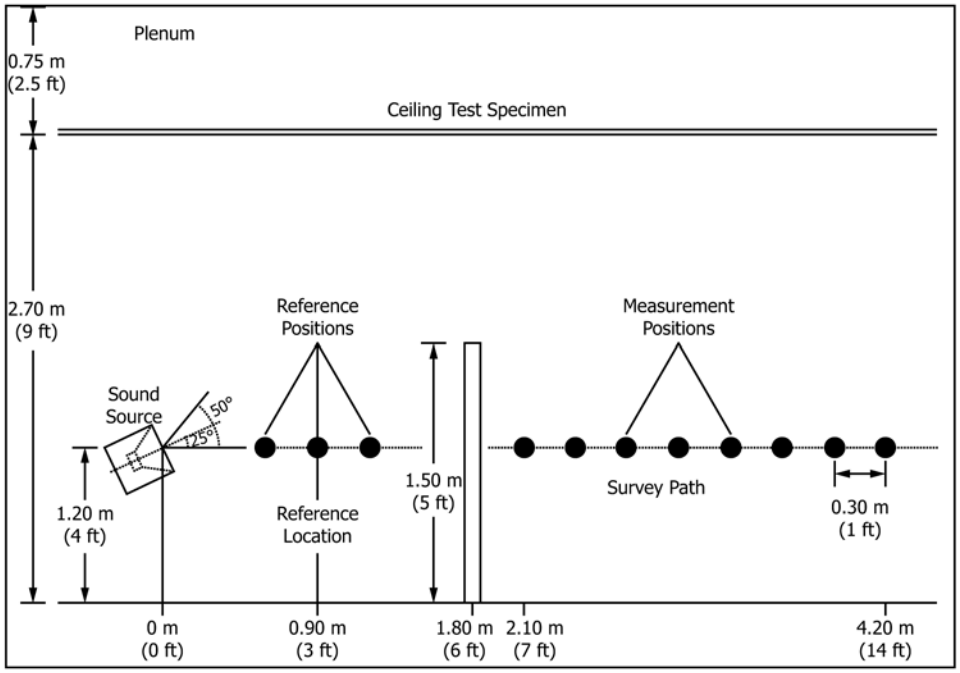

FIG. 1 Ceiling Test Configuration, Elevation (speaker is horizontal for other tests)

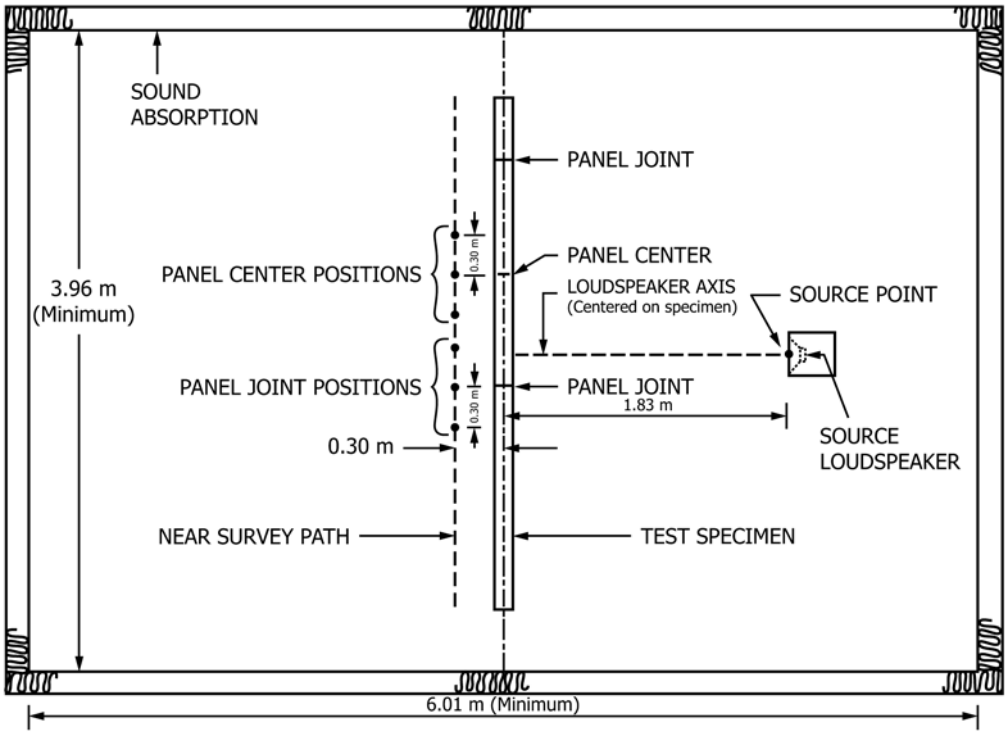

FIG. 2 Test Configuration for Furniture Panels as Acoustical Barriers with Standard Survey Positions, (Plan View)

method may not fairly represent the speech privacy that may be achievable with non-flat ceiling systems. For the measurement of furniture panels used as acoustical barriers, the second of these factors, the sound reflectance of the ceiling, is standardized. For the measurement of reflective and absorptive vertical surfaces used as wall finishings or furniture panels, the first and second factors are standardized and all paths between the speaker and listener reflecting only off of the ceiling are eliminated.

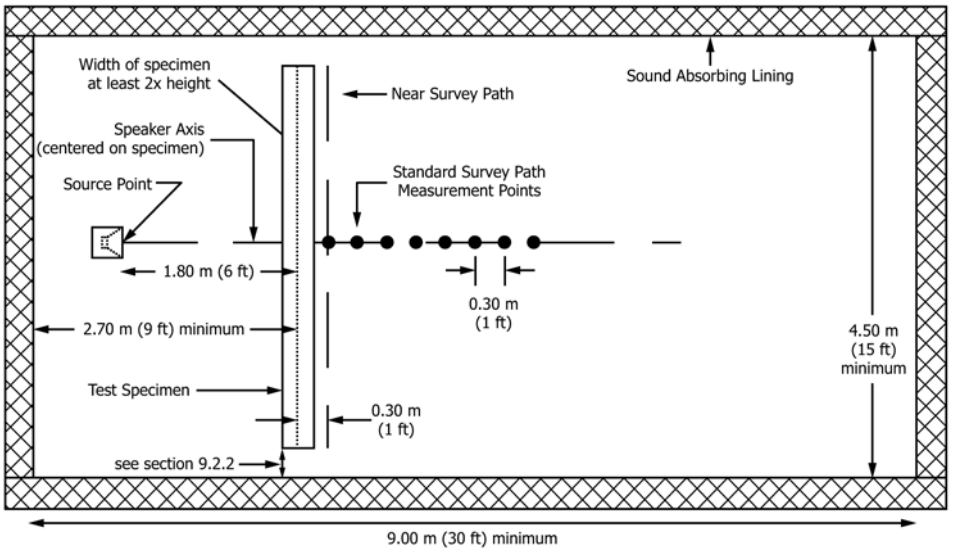

FIG. 3 Test Configuration for Furniture Panels as Acoustical Barriers with Near Survey Positions, (Plan View)

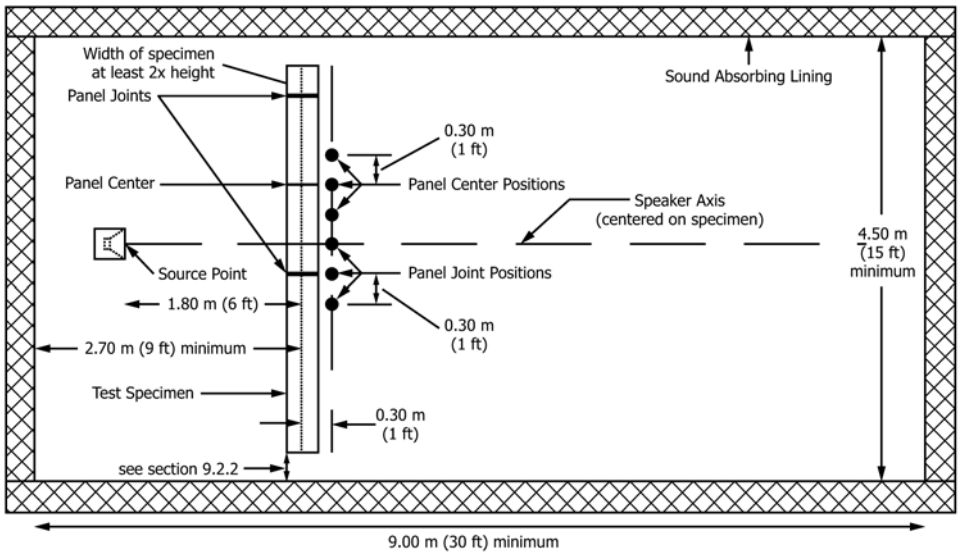

FIG. 4 Test Configuration for Furniture Panels as Acoustically Reflecting Surfaces, (Plan View)

5.3 This test method provides standardized techniques to assess the contribution of specific components of an open-plan space. The test method specifies an acoustical testing environment for each component type that isolates its contribution from the contribution of other components, which may in actual open-plan environments contribute significantly to the overall speech privacy.

5.4 The significance of test results obtained by this test method must also be considered with regard to the attainable measurement accuracy. The attainment of speech privacy in the presence of masking sound is critically dependent upon sound level of the speech relative to the masking sound; a change as small as 2 dB in either the speech or masking sound may change the privacy from significant to insignificant. The normally accepted test accuracies for sound attenuation measurements may be inadequate to evaluate components having marginal interzone attenuation performance for open-office needs.

6. Laboratory Test Facility

6.1 The plan view dimensions of the facility shall be at least 4.50 by 9.00 m [15 by 30 ft]. The height of the facility, measured from the floor to the inner face of the sound-absorptive covering on the ceiling, shall be at least 2.70 m [9 ft]. Where ceiling systems are to be measured, additional height is required to provide the plenum space described in 9.1.1.

6.2 The floor shall be of a solid material such as concrete or plywood weighing at least 20 kg/m^2 (4 lb/ft^2). It shall be covered with carpet without an underlayment. This is typical of open plan spaces. The absorption coefficients of the carpet shall be measured in accordance with Test Method C423, and the sound absorption average (SAA) shall lie in the range from 0.15 to 0.40.

6.3 The walls shall have random incidence sound absorption coefficients of at least 0.90 for all test frequencies. The wall

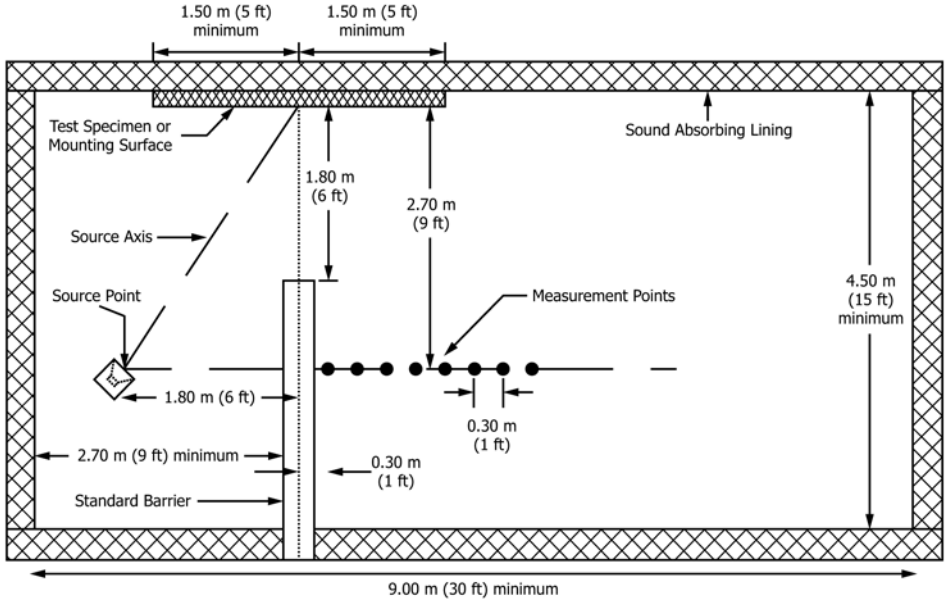

FIG. 5 Measurement Positions for Reference Levels, (Plan View)

covering sound absorption shall be measured in accordance with Test Method C423 with a mounting equivalent to that used in the test facility except where the requirements of 9.3 are to be met. To meet the requirements of 9.3, the sound absorbing material on sections of a wall may either be demountable or be covered with a hard surface.

6.4 Test configuration shall be as follows:

6.4.1 For measurements of a ceiling system, a space divider shall extend the full width of the facility between the side walls and shall be placed at least 2.70 m [9 ft] from both end walls. The divider shall have a core of rigid, impermeable material weighing not less than 7.0 kg/m^2 [1.4 lb/ft^2], and shall be faced on both sides with a 50 mm [2.0 in.] thickness of sound absorbing material. The core shall extend fully to the top of the space divider, as shall the sound absorption facing material. The space divider shall have a minimum SAA of 0.80 when measured in general accordance with the provisions for testing office space dividers in Test Method C423. There shall be no gap between the bottom of the space divider and the floor. If the space divider is assembled in sections, care shall be taken to minimize sound transmission at the joints. Measurements shall be made with a space divider 1.50 m [5 ft] high. Measurements may also be made with a space divider 1.80 m [6 ft] high. See Figs. 1 and 2.

NOTE 1—Since the core and absorptive facings of the divider extend to its top, the divider may not be capped.

6.4.2 For measurements on furniture panels tested as acoustical barriers: The ceiling covering shall have random incidence sound absorption coefficients of at least 0.95 at all frequencies at which measurements are to be made. See Figs. 2 and 3.

NOTE 2—Since reflections from those portions of the walls and ceiling of the facility which are not part of the specimen may reduce the measured attenuations, it is important to eliminate these reflections as much as possible.

6.4.3 For measurements of wall finishes or furniture panels tested for the ability to attenuate reflected sound:

6.4.3.1 The ceiling coverings shall have random incidence sound absorption coefficients of at least 0.95 at all frequencies at which measurements are to be made.

6.4.3.2 A standard barrier shall extend from the floor to the ceiling of the test facility and shall be no greater than 200 mm [8 in.] thick. It shall comprise a septum of rigid, impermeable material having a surface weight of approximately 10 kg/m^2 [2 lb/ft^2] such as 12 mm [0.5 in.] gypsum board or plywood, and sound-absorbing material on both sides of the septum. This sound absorbing material shall have a minimum SAA of 0.80 when measured in a Type A mounting (see Practices E795) in accordance with Test Method C423. See Fig. 5.

6.4.3.3 The bottom edge of the barrier shall fit snugly against the floor. If the barrier is assembled in sections, care shall be taken to minimize sound leaks at the joints. At the end remote from the specimen, the barrier should be extended to meet the wall of the test chamber to prevent sound transmission.

6.4.3.4 The standard barrier shall be placed at least 2.7 m [9 ft] from both end walls.

7. Apparatus

7.1 A sound source meeting the specifications and requirements of Specification E1179 is required. It is best described as a loudspeaker within an enclosure with special constraints on directivity.

7.1.1 The sound power generated by the sound source shall be adequate to maintain one-third octave band sound pressure levels at least 10 dB above the ambient noise levels of the test facility and the internal noise levels of the measuring instrumentation at each of the desired measurement locations.

7.2 *Microphones:*

7.2.1 All microphones shall meet ANSI S1.4 Type 1 specification and have a documented frequency response provided by a calibration laboratory or manufacturer, measured by either the electrostatic actuator or reciprocity method.

7.2.2 Each microphone shall have a free field frequency response of ±0.5 dB from 200 to 5000 Hz and at angles of incidence between 0 an 90 degrees.

7.2.3 If multiple microphones are used, channels for all microphones shall have the sensitivity adjusted with the same calibrator such that all channels read the same value ±0.1 dB at the calibrator frequency.

7.2.4 Instrumentation used to measure sound pressure levels shall meet the meter response requirements of ANSI S1.4.

7.3 *Filters*—Filters used with the microphone or source amplifiers shall conform to ANSI Specification S1.11 for Order 3, Type 1, ⅓ octave-band filters.

8. Sampling

8.1 Specimens for this test method will be a complex assembly of many component parts. Therefore, a requirement for minimum sampling is impractical and not required. However, the individual components shall be randomly selected from normal stock if possible.

9. Test Specimen

9.1 *Ceilings:*

9.1.1 The ceiling to be tested shall cover the entire area of the laboratory facility, or at least a 4.50 by 9.00 m [15 by 30 ft] area in a field test facility. Its nominal height shall be 2.70 m ± 50 mm [9 ft ± 2 in.] above the floor, and it shall be suspended from a flat structural slab or deck with a plenum depth of not less than 0.60 m [2 ft] with a preferred depth of 0.75 m [2.5 ft]. The upper and perimeter surfaces of the plenum shall be sound reflective. The plenum shall contain no ducts, beams, or similar obstructions that will affect the test results. The nominal ceiling height shall be defined as that of the exposed surface of a continuous flat ceiling, or of the lowest exposed surface of a nonflat ceiling. If, in a field test situation, the ceiling height and plenum conditions cannot be met, this test method may be used to evaluate the test setup and may not be used to obtain general interzone attenuation data for the ceiling system.

9.1.2 When the ceiling assembly includes differing elements in the horizontal plane, such as light fixtures or varying ceiling levels, the orientation with respect to the space divider and the sound measurement survey line shall be described and reported.

NOTE 3—In a ceiling containing both sound absorptive and reflective areas such as light fixtures, interzone attenuation values may differ widely depending on the location of the survey line with respect to the ceiling layout. It is therefore advantageous to choose two or three survey lines in such a way as to yield both maximum and minimum attenuations. The orientation and survey line for minimum attenuation shall always be measured and reported.

9.2 *Furniture Panels Tested as Acoustical Barriers:*

9.2.1 Furniture panels to be tested shall be assembled in accordance with the manufacturer's instructions and shall be arranged as they would normally be arranged in an open office. Joints between panels shall be sealed by no other means than those provided or recommended by the manufacturer.

9.2.2 In order to prevent flanking around the ends of a panel, the width of the specimen shall be at least twice its height or its width may be the same as the width of the test facility. Two or more panels may be placed or joined edge to edge to meet these recommendations. Normal installation procedure shall be followed.

9.2.3 The specimen shall be placed at least 2.70 m [9 ft] from both end walls.

9.2.4 Report the height of the specimen. The height of the specimen should not exceed 2.40 m [8 ft]. If the specimen is higher than 2.40 m [8 ft], the height shall be completely documented in the test report as discussed in 12.1.12.

9.2.5 Furniture panels may be tested with accessories attached to them. The accessories and the positions where they are attached shall be fully described in the test report.

9.2.6 Furniture panels that are significantly asymmetrical, such as curved screens, shall be tested twice, once with each face toward the sound source. The test results for each orientation shall be reported separately.

9.3 *Wall Finishes Tested for the Ability to Attenuate Reflected Sound:*

9.3.1 Mount specimens that are wall finishes on an impervious, hard, vertical reflecting surface such as gypsum board or plywood, with a surface mass of at least 10 kg/m^2 [2 lb/ft^2]. The mounting surface shall be perpendicular to the plane of the standard barrier and shall extend at least 1.50-m [5-ft] on either side of it (see Fig. 5).

9.3.2 The specimen mounting surface shall extend from the floor to the ceiling of the test facility.

9.3.3 The perpendicular distance from the edge of the standard barrier to the nearest point of the specimen shall be 1.80 m [6 ft] (see Fig. 5).

NOTE 4—It is anticipated that wall finishes tested using this test method will be chiefly sound absorbent and intended to attenuate reflected sound. However, hard, sound-reflective finishes such as gypsum board or wood paneling may also be test specimens. While it might appear unnecessary to install a sound-reflective specimen over a sound-reflective panel that is part of the test facility, it is not always possible to clearly distinguish in advance whether a specimen is reflective enough to require no backing. For this reason, all wall finishes are to be installed over a hard reflecting surface.

NOTE 5—To satisfy the requirements of 9.3.1 and 9.4.1, it may be necessary to have an adjustable edge on the standard barrier or a removable hard mounting surface.

9.3.4 The specimen, whether applied as a continuous layer or an array of patches, should be mounted on the hard surface so that it is disposed symmetrically on either side of the centerline of the standard barrier. Small specimens may be butted together to form a larger specimen. If an interlocking method is normally used to join sections of the specimen, the specimen should be so mounted. The specimen, its mounting accessories and the mounting arrangement shall be fully described in the report.

NOTE 6—Unless patches or spot treatments are being tested, the specimen should cover the full hard mounting surface. Otherwise, the sound-reflective properties of the exposed portion of the mounting surface may influence the test results.

9.3.5 If the specimen to be tested extends beyond the normal limits for the mounting surface, then the mounting surface must be extended so that it has at least the same lateral dimensions as the specimen.

9.4 *Furniture Panels Tested for its Ability to Attenuate Reflected Sound:*

9.4.1 Furniture panels shall be tested with all walls of the test facility acoustically absorptive in accordance with 6.3. There shall be no hard mounting surface present.

9.4.2 The perpendicular distance from the edge of the barrier to the nearest point of the specimen shall be 1.80 m [6 ft].

9.4.3 The vertical midline of the specimen shall coincide with the centerline of the standard barrier. The specimen shall be at least 2.00 m [6.5 ft] wide. If the specimen comprises sections joined together, a joint should not coincide with the vertical midline.

9.4.4 The lower edge of the specimen shall be no more than 0.50 m [1.5 ft] above the floor of the test room. The upper edge of the test specimen shall be at least 1.50 m [5 ft] above the floor of the test room.

9.4.5 Specimens may be tested with accessories such as shelves, cabinets, or work surfaces attached to them. Such attachments will alter the sound reflecting properties of the specimen, and the accessories as well as the position and method of attachment shall be described fully in the test report.

9.4.6 Specimens that are significantly asymmetrical, such as curved or irregularly shaped screens, or specimens with different accessories on each face, shall be tested twice, once with each side exposed to the sound source. The attenuations for each side shall be reported separately.

10. Procedure

10.1 *Sound Pressure Level Measurements:*

10.1.1 The precision associated with the measurement of sound pressure levels depends on the interpretation of the output of the instrumentation that might be a sound level meter, level recorder, or digital analyzer. In any event, levels should be measured with an uncertainty of less than 0.5 dB with 95 % confidence.

10.1.2 The measurement of nominal interzone attenuation for each test frequency shall have an uncertainty of 1 dB or less with 95 % confidence.

10.1.3 Each microphone shall be calibrated at regular intervals and a record shall be kept of the dates of such calibration. If multiple microphones are used, their adjusted sensitivities shall be matched within 0.5 dB in each of the specified frequency bands. Calibration over the whole range of test frequencies shall be done annually, and calibration checks for at least one frequency shall be made prior to each test.

10.1.4 Measurements shall be made to ensure that variation of the sound source does not affect the test. This can be repeated measurements at a reference position made at the beginning and end of the test, or simultaneous measurement of the nominal reference level and other measurement points. Variations should not exceed 0.5 dB in any frequency band.

10.1.5 The sound source shall be positioned with the source point 1.20 m [4 ft] above the floor.

10.1.6 Microphones shall be positioned such that the diaphragms are 1.20 m, [4 ft] above the floor.

10.2 *Survey Path for Ceiling Specimens.* See Figs. 1 and 2.

10.2.1 The survey path is perpendicular to the space divider and passes through source point.

10.2.2 The sound source is positioned facing the space divider such that the source point is 1.80 m [6 ft] from the center of the space divider.

10.2.3 The axis of the source point is tilted upward at an angle of 25° from horizontal, so the lower edge of a 50° included angle is parallel to the floor.

10.2.4 Positions for measuring the nominal reference level, are 0.60, 0.90, and 1.20 m [2, 3, and 4 ft] from the source point along the survey path.

10.2.5 Positions for measuring the interzone attenuation are on the receiving side of the space divider (facing away from the source point) at 0.30 m [1 ft] intervals along the survey path. The nearest position shall be 2.10 m [7 ft] from the source and the farthest position 4.20 m [14 ft] from the source.

10.2.6 The survey path shall be at least 0.90 m [3 ft] from the side walls of the test room.

10.3 *Survey Paths for Furniture Panels used as Acoustical Barriers:*

10.3.1 *Sound Source Position and Positions for Measuring the Nominal Reference Level:*

10.3.1.1 The sound source is positioned facing the specimen such that the source point is 1.80 m [6 ft] from the centerline of the specimen with the sound source axis parallel to the floor. In plan view, center the loudspeaker axis on the specimen.

10.3.1.2 Positions for measuring the nominal reference level are 0.60, 0.90, and 1.20-m [2, 3, and 4 ft] from the source point along the axis of the sound source, 1.20 m [4 ft] from the floor. Obtain these levels with no specimen or hard surface present in the test facility and with the carpet exposed. Alternatively, these reference values may be obtained with the source moved away from the specimen and the walls provided that any sound reflecting surfaces are covered with sound absorptive material. See Fig. 6.

10.3.2 *Standard Survey Path.* See Fig. 3.

10.3.2.1 The standard survey path is perpendicular to the specimen and passes through the source point.

10.3.2.2 Positions for measuring the interzone attenuation along the standard survey path are on the receiving side of the specimen (facing away from the source point) at 0.30-m [1 ft] intervals along the survey path. The nearest position shall be 2.10 m [7 ft] from the source and the farthest position 4.20 m [14 ft] from the source.

10.3.3 *Near Survey Path.* See Fig. 4.

10.3.3.1 The sound source is positioned facing the specimen such that the source point is 1.83 m [6 ft] from the centerline of the specimen with the sound source axis parallel to the floor. In plan view, center the loudspeaker axis on the specimen.

10.3.3.2 The near survey path is parallel to and 0.30 m [1 ft] from the specimen on the side away from the sound source.

10.3.3.3 Select measurements positions near the plan-view center of the specimen (if the specimen consists of a single furniture panel) or near the plan-view center of the panel closest to the specimen center line (if the specimen consists of

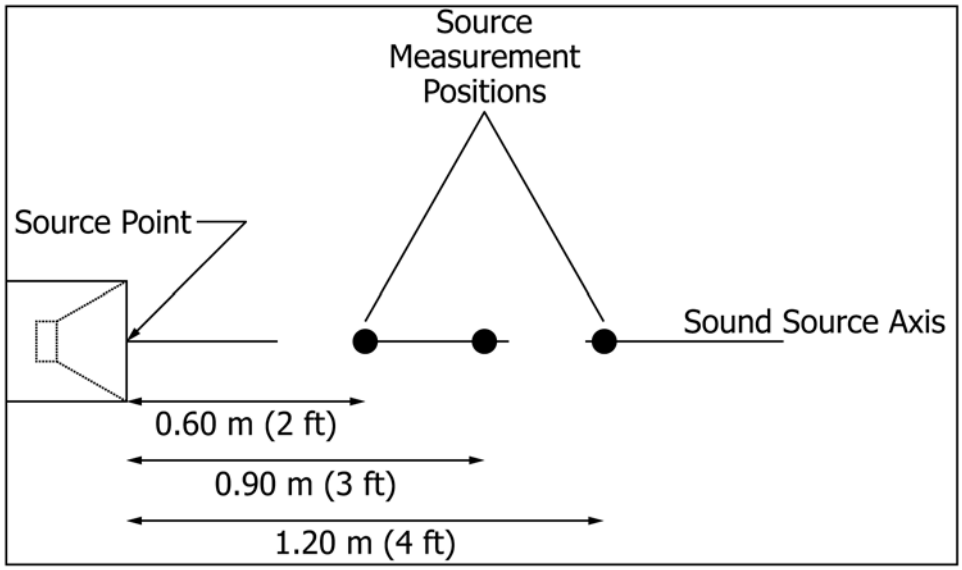

FIG. 6 Measurement Positions for Reverence Levels (Plan View)

panels joined as in 9.2.2). Make measurements at three positions along the near survey line, including a position directly opposite the panel center and at positions 0.30 m [1 ft] to either side of this position.

10.3.3.4 If the specimen consists of two or more furniture panels joined as in 9.2.2, select additional measurements points near the joint closest to the plan-view centerline of the specimen. Select measurement points at three positions along the near survey path; at a position directly opposite the joint, and at positions 0.30 m [1 ft] to either side of this position.

10.4 *Survey Path for Wall Finishes and Furniture Designed to Cover a Section of Wall.* See Fig. 5.

10.4.1 *Sound Source Position and Positions for Measuring the Nominal Reference Level:*

10.4.1.1 The sound source is positioned facing the specimen such that the source point is 1.80 m [6 ft] from the centerline of the barrier with the sound source axis parallel to and 1.20–m, [4 ft] from the floor, (see Fig. 5).

10.4.1.2 In plan view, the sound source axis shall pass through the point where the centerline of the barrier intersects the face of the specimen.

10.4.1.3 Positions for measuring the nominal reference level are 0.60, 0.90, and 1.20–m [2, 3, and 4 ft] from the source point along the axis of the sound source, 1.20 m [4 ft] from the floor. Obtain these levels with no specimen or hard surface present in the test facility and with the carpet exposed. Alternatively, these reference values may be obtained with the source moved away from the specimen and the walls provided that any sound reflecting surfaces are covered with the sound absorptive material. See Fig. 6.

10.4.2 *Standard Survey Path:*

10.4.2.1 The source point and the measurement positions are on a horizontal line passing perpendicularly through the standard barrier, 0.90 m [3 ft] from its edge.

10.4.2.2 Positions for measuring the interzone attenuation along the standard survey path are on the receiving side of the standard barrier (facing away from the source point) at 0.30-m [1 ft] intervals along the survey path. The nearest position shall be 2.10 m [7 ft] from the source and the farthest position 4.20 m [14 ft] from the source.

10.5 The sound signal shall be pink or white noise in the range from 200 to 5000 Hz center frequencies, as defined in ANSI S1.6. If desired, the range may be extended provided that the requirements of Specification E1179 are met.

10.6 Determine the interzone attenuation for each one-third octave-band at each receiving position specified in the appropriate portion of 10.2, 10.3, and 10.4 for the component being tested by calculating the difference between the nominal reference level, and the level measured at the receiving position.

10.7 Calculate the nominal interzone attenuation, for each position which has two adjacent positions 0.30 m [1 ft] on each side along the survey path. For example, the nominal interzone attenuation at the 3.00-m [10 ft] position along the standard survey path is the arithmetic mean of the interzone attenuations at the 2.70, 3.00, and 3.30-m, [9, 10, and 11 ft] positions.

11. Single Number Classification

11.1 The articulation class (AC) shall be calculated in accordance with Classification E1110 using the nominal interzone attenuations for each distance specified in 10.7.

11.2 The minimum of these AC values may be reported as the "minimum articulation class," without a qualifying distance or location.

11.3 For furniture panels used as acoustical barriers the articulation class shall also be calculated for the panel-center and (if measured) panel-joint positions.

11.4 *Ceiling Specimens:*

11.4.1 The minimum articulation class is the minimum AC measured for a given space divider height.

11.4.2 The articulation class reported for a space divider 1.50 m [60 in.] high shall be designated AC(1.5) [AC(60)]. The

articulation class reported for a space divider 1.80 m [72 in.] high shall be designated AC(1.8) [AC(72)]. Articulation class measurements reported for other height dividers shall be designated AC followed by the height of the space divider within parenthesis; for SI units in meters rounded to the nearest 0.1 meters, and for inch-pound units in inches rounded to the nearest inch.. Similarly, the minimum articulation class shall be reported with the height of the divider within parenthesis, that is, AC(1.5) min [AC(60)].

NOTE 7—The designation AC without a height in parentheses was used in previous editions of this method and implies a space divider 1.52 m, (60 in.), high.

12. Report

12.1 Report the following information:

12.1.1 A statement, if correct in every respect, that the test has been conducted in full accordance with this test method,

12.1.2 A full description of deviations, if any, from this test method,

12.1.3 Identification of the units used; SI or inch-pound.

12.1.4 For ceiling specimens, the height of the ceiling and the depth of the plenum.

12.1.5 A complete description of the specimen, its components; accessories and the positions thereof as per 9.1.2, 9.2.5, 9.3.4, and 9.4.5; dimensions, method of assembly, and configuration. If this description has not been determined by direct examination, the test report shall so indicate,

12.1.6 A description and drawing of the position and orientation of the survey line(s) and the space divider or standard barrier if present with respect to the horizontal configuration of the ceiling,

12.1.7 Specifically identify any atypical panels, such as reflective panels, and include a description and their exact location in the test,

12.1.8 A tabulation or chart, or both, of interzone attenuation rounded to the nearest tenth dB at all measurement positions and all one-third octave bands for the minimum center frequency range from 200 to 5000 Hz,

12.1.9 A tabulation or chart, or both, of nominal interzone attenuation rounded to the nearest tenth dB at all nominal measurement positions and all one-third octave bands for the minimum center frequency range from 200 to 5000 Hz,

12.1.10 For ceiling specimens, the requirements in 10.6 and 10.7, apply to each space divider height measured, with the height of the space divider clearly identified,

12.1.11 Where both faces of a specimen are tested as in 9.2.6 or 9.4.6, the measured interzone attenuations, nominal interzone attenuations, and articulation class values shall be reported for each orientation separately,

12.1.12 Report the clearance between the top of the specimen and the absorptive covering of the test facility ceiling where the clearance is less than that recommended in 9.2.4,

12.1.13 The articulation class for each nominal interzone distance, and

12.1.14 The minimum of these articulation class values reported as the minimum articulation class with the height of the space divider following in parentheses if appropriate, without a qualifying distance or location.

ANNEX

(Mandatory Information)

A1. GUIDE FOR ACCREDITATION OF TESTING LABORATORIES

A1.1 Scope

A1.1.1 This annex provides guidelines for agencies evaluating testing laboratories for the purpose of granting accreditation for Test Method E1111.

A1.2 Referenced Documents

A1.2.1 *ASTM Standards:* [2]

C634 Terminology Relating to Environmental Acoustics

E717 Guide for the Preparation of the Accreditation Annex of Acoustical Test Standards

A1.3 Terminology

A1.3.1 The acoustical terminology used in this annex is consistent with Terminology C634.

A1.4 General Requirements

A1.4.1 Accreditation shall not be given for field tests.

A1.5 Requirements Specific to This Method

A1.5.1 *Physical Facilities*—The testing agency shall provide information demonstrating compliance with the following provisions of this test method:

Test Facility	6
Apparatus	7
Test Specimen	9

A1.5.2 *Procedures*—The testing agency shall provide a sample report of a complete test (including raw data), showing compliance with the following provisions of this test method:

Test signal	7.1, 10.5
Speaker position	10.1.5, 10.2, 10.3, 10.4
Survey line	10.2, 10.3, 10.4
Calibration	10.1.3
Signal stability	10.1.4
Nominal reference level	10.2.4, 10.3.1.2, 10.4.1
Receiving levels	10.2.5, 10.3.2, 10.3.3.3, 10.4.2
Interzone attenuation	10.6
Nominal interzone attenuation	10.7
Articulation class	11
Report contents	12