Designation: E2964 – 21

Standard Test Method for Measurement of the Normalized Insertion Loss of Doors[1]

This standard is issued under the fixed designation E2964; 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 part of a set of standards for evaluating the sound-insulating properties of building elements and the sound isolation between spaces. It is designed to measure the field sound isolation performance of doors. Others in the set cover the airborne sound transmission loss of an isolated partition element in a controlled laboratory environment (Test Method E90), field measurements of the sound isolation between rooms in buildings (Test Method E336), the laboratory measurement of impact sound transmission through floors (Test Method E492), the measurement of impact sound transmission in buildings (Test Method E1007), the measurement of sound transmission through building facades and facade elements (Guide E966), and the measurement of sound transmission through a common plenum between two rooms (Test Method E1414).

1. Scope

1.1 The sound insulation properties of a door are measured in a laboratory as the sound transmission loss in accordance with Test Method E90. Using those data, the single-number rating sound transmission class (STC) is assigned. In the field, the rooms on one or both sides of a partition containing a door are often either too small or too large and absorptive to allow the apparent transmission loss (ATL) of the partition-door assembly to be measured. Even if that is not the case, the result measured is the composite ATL of the partition including the door, and not that of the door itself. Test Method E336 states that it is impossible to measure the ATL of a portion of a partition such as a door according to the procedures of that standard. This test method provides a method of evaluating doors in the field using a normalized insertion loss with a resulting single-number rating door transmission class, DTC. This method is intended primarily for hinged personnel doors with latching mechanisms and is limited to door openings of area less than 6 m^2. The flanking effects of surrounding structure are reduced compared to Test Method E336 but not completely eliminated. In a laboratory environment, the DTC is close to or equal to the STC of the door, but in the field results less than the laboratory STC are to be expected due to flanking.

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

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

E413 Classification for Rating Sound Insulation

E492 Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies

[1] This test method is under the jurisdiction of ASTM Committee E33 on Building and Environmental Acoustics and is the direct responsibility of Subcommittee E33.03 on Sound Transmission.

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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.

Using the Tapping Machine

E966 Guide for Field Measurements of Airborne Sound Attenuation of Building Facades and Facade Elements

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

E3091 Specification for Systems to Measure Sound Levels

2.2 *ANSI Standards:*[3]

S1.40-2006 Specifications and Verification Procedures for Sound Calibrators

2.3 *IEC Standards:*[4]

IEC 60942:2013 Electroacoustics–Sound calibrators

2.4 *ISO Standard:*[5]

ISO 16283-1:2014 Acoustics -- Field measurement of sound insulation in buildings and of building elements -- Part 1: Airborne sound insulation

3. Terminology

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

3.1.1 airborne sound; background noise; decibel; diffuse sound field; flanking transmission; pink noise; receiving room; sound absorption; sound attenuation; sound insulation; sound isolation; sound pressure level; sound transmission loss, TL; source room

NOTE 1—The unqualified term average sound pressure level in this document means that sound pressure levels were averaged for specified periods of time.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *apparent transmission loss, ATL, n—of a partition installed in a building, in a specified frequency band* is operationally defined as:

$$ATL = \bar{L}_1 - \bar{L}_2 + 10 \log\left(\frac{S}{A_2}\right) \quad (1)$$

where:

S = the area of the partition common to both source and receiving rooms,
A_2 = the sound absorption in the receiving room,
$\bar{L}_1$ = the average sound pressure level in the source room, and
$\bar{L}_2$ = the average sound pressure level in the receiving room resulting from the combined effect of direct and flanking transmission.

3.2.1.1 *Discussion*—Throughout this test method, log is taken to mean $\log_{10}$, unless otherwise indicated.

3.2.1.2 *Discussion*—This definition attributes all the power transmitted into the receiving room by direct and flanking paths to the area of the partition common to both rooms. If flanking transmission is significant, the ATL will be less than the TL for the partition. Apparent transmission loss (ATL) is equivalent in meaning to apparent sound reduction index (ASRI) used by ISO 16283-1:2014.

3.2.2 *direct transmission, n*—sound that travels between a source and a receiving room only through the common (separating) building element.

3.2.3 *door transmission class, DTC, n*—a single-number rating obtained by applying the classification procedure of Classification E413 to normalized door insertion loss data.

3.2.4 *normalized door insertion loss, NDIL, n—of a door installed in a building in a specified frequency band* is operationally defined as

$$NDIL = \left(\bar{L}_{(rec\ open)} - \bar{L}_{(rec\ closed)}\right) + \left(\bar{L}_{(source\ closed)} - \bar{L}_{(source\ open)}\right) \quad (2)$$

when a sound source is operated on the source side of the door, where:

$\bar{L}_{(rec\ open)}$ = the average sound pressure level on the receiving side of the door with the door open,
$\bar{L}_{(rec\ closed)}$ = the average sound pressure level *due to the source* on the receiving side of the door with the door closed (the background-adjusted average level in the receiving room with the door closed),
$\bar{L}_{(source\ closed)}$ = the average sound pressure level on the source side of the door with the door closed, and
$\bar{L}_{(source\ open)}$ = the average sound pressure level on the source side of the door with the door open.

4. Summary of Test Method

4.1 The door and corresponding source and receiving rooms are selected.

4.2 The number and location of sound sources are chosen, sound is produced in the source room, and sound pressure levels are measured on each side of the door with both open and closed door conditions using either a fixed microphone or scanning method.

4.3 The background sound is measured in the receiving room with the source(s) off and the door closed.

4.4 Results and single-number ratings are calculated and reported.

5. Significance and Use

5.1 This standard provides a method for testing the apparent sound insulating properties of doors in the field originally proposed by Morin (**1**).[6] This allows doors to be evaluated with a result that has been found to be similar to the transmission loss.

[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.

[5] Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, http://www.iso.org.

[6] The boldface numbers in parentheses refer to the list of references at the end of this standard.

5.2 The results of this measurement are the normalized door insertion loss, NDIL, at individual frequencies, and the single-number rating door transmission class, DTC. The insertion loss is normalized by the small change in sound level which occurs on the source side when the door is opened and closed. The results are in theory the same when measured in each direction through the door, but differences have been observed in practice.

5.3 Comparative measurements using this method and the method of Test Method E90 on the same door installations in a laboratory indicate good agreement between the transmission loss and normalized door insertion loss when the door is in a wall between two rooms and flanking is not significant. No similar verification has been done for corridors. See Appendix X1 and Ref (**2**).

5.4 The fixed-microphone and scanning methods have been compared in the field. See Appendix X2.

6. Test Equipment

6.1 *Sound Sources and Signals*—Sound sources shall be loudspeaker systems driven by power amplifiers. The input signal to the amplifiers shall be random noise containing an approximately continuous distribution of frequencies over each test band. White or pink electronic noise sources satisfy this condition.

NOTE 2—Ideally, loudspeaker systems should be omnidirectional. In practice, using multiple driver elements to cover different frequency ranges and placing and aiming sources into trihedral corners of the room will normally be adequate.

6.1.1 The sound power of the source(s) must be sufficient to raise the signal level in the receiving room with the door closed far enough above background noise to meet the requirements of 11.8.

6.2 *Measuring Equipment*—Microphones, amplifiers, filters, and electronic circuitry to process microphone signals and perform measurements shall satisfy the requirements of Section 5 and either Section 6 or Sections 7.1 to 7.4 of Specification E3091.

6.2.1 Measurement quality microphones 13 mm or smaller in diameter and that are close to omnidirectional below 5000 Hz shall be used.

NOTE 3—If measurements are to be made above 5000 Hz, a diffuse-field (random-incidence) microphone or corrector is preferred.

6.2.1.1 If multiple microphones are used, they shall all be of the same make and model.

6.3 *Calibrators*—The field calibrator used for sensitivity checks shall be an acoustic or electroacoustic calibrator meeting class 1 requirements of ANSI S1.40-2006 or IEC 60942:2013.

6.4 Devices used to establish the microphone positions shown in Fig. 1 and Fig. 2 shall be capable of being read to the nearest millimeter.

7. Calibration and Sensitivity Checks

7.1 A thorough calibration of acoustical instrumentation by a calibration laboratory at regular intervals is necessary to help assure that the equipment is operating within instrument standards and manufacturer's specifications. The appropriate calibration interval depends on several factors including the complexity of the instrument, frequency of use, frequency of field use and transportation, manufacturer recommendations, and history of reliability or problems as observed in prior calibrations.

NOTE 4—Specification E3091 provides more information on calibration.

7.2 Perform sensitivity checks of the entire measuring setup (including the microphone, all cables, and instruments) with the same calibration equipment before and after the measurements. If the calibration values differ by more than 0.5 dB, the results are invalid and measurements shall be repeated.

8. Test Site and Door Conditions

8.1 The test specimen shall be a door including seals and frame that must for this test be installed in a partition that separates the source and receiving rooms.

8.2 Particular attention shall be given to identifying potential flanking paths not only through the surrounding partition but also through ducts or through plenums over acoustical ceilings before conducting testing. Report any temporary improvements made to reduce flanking influence.

NOTE 5—While this method is designed to reduce the influence of flanking, significant flanking in the partition around the door or by other paths could influence results. A surrounding partition with a high apparent transmission class will reduce influence of the partition on results. A way to investigate the effect of flanking is to construct a cover over the source side of the door and repeat the measurements of the receive side level with the door closed. A suitable cover is a layer of gypsum spaced approximately 100 mm from the door with sound absorptive material in that cavity and the edges sealed. If the measured sound level on the receive side with the source operating after doing this is not significantly reduced, then that sound level is being controlled by either the background sound or flanking.

8.3 Results will be influenced by the performance of the door seals. Care shall be taken to assure the door is properly closed with any latch present properly engaged when measurements are made on the receiving side with the door closed.

8.4 When the door is opened, it shall be opened as far as possible for each open-door measurement to reduce the influence of reflections from its surface.

9. Selection of Door Location and Direction of Measurement

9.1 If the door location or locations for testing within a building have not been specified by the party requesting the test, select a representative door location or a number of door locations to be examined.

NOTE 6—If the door has acoustical seals, the DTC rating can vary widely depending upon the individual adjustment of these seals. Thus, if multiple doors of a given design exist on a site, consider testing multiple doors or all doors. See 13.3.5.

9.2 Select the corridor or the smaller of the rooms as the source space unless there is a compelling reason to do otherwise (such as high background sound in what would be the receiving room). An outdoor space is acceptable as the receiving side, but an outdoor space shall not be used as the source space.

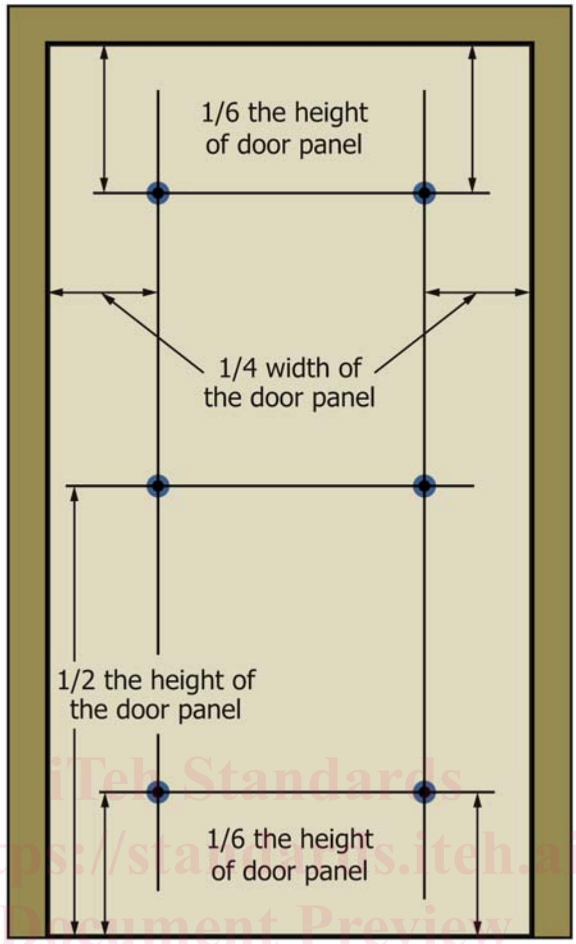

FIG. 1 Elevation View of Microphone Positions for Openings of Width 1 m or Less

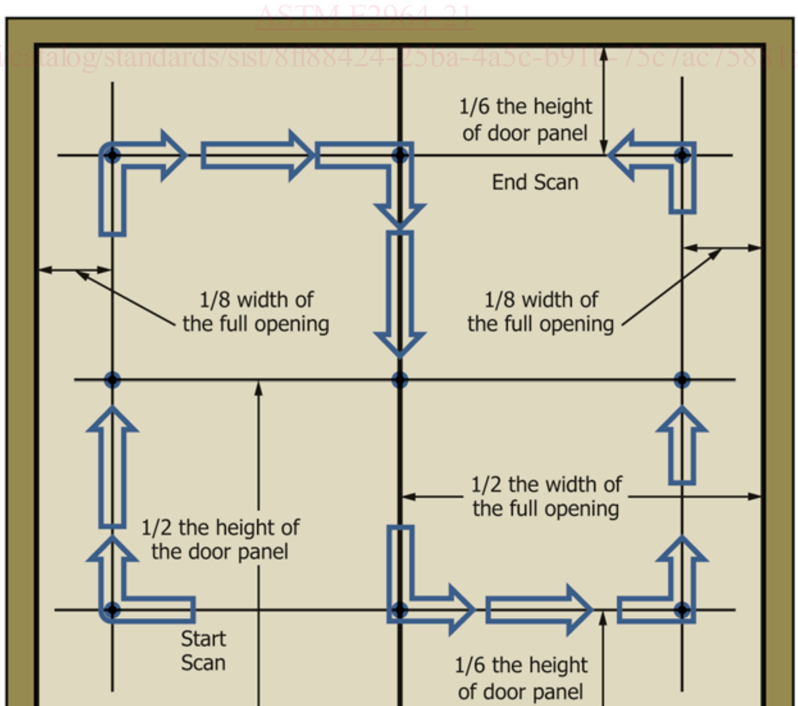

FIG. 2 Elevation View of Microphone Positions and Scan Pattern for Openings More than 1 m Wide

9.3 Select door openings of area less than 6 m^2.

9.4 When possible, select doors that will open at least 90°.

9.5 When possible, locations shall be selected where the surfaces opposite the door surface are at least 3 m from the door surface. All partition surfaces opposite the closed door shall be at least 1.5 m from the door surface. This means for instance that corridors used as the source space must be at least 1.5 m wide. When surfaces opposite the door are curved or irregular, all points on such surface directly opposite the door must be at least 1.5 m from the door surface.

10. Sound Source Placement

10.1 *Location*—Where possible, place the loudspeakers at least 3 m and preferably 5 m from the door, but do not choose the larger room as the source room just to get the loudspeakers more than 3 m from the door. If the loudspeakers are directional, aim them into corners most distant from the door, or for a corridor source room into the wall on the opposite side of the corridor from the door, unless the room is so large that it is necessary to place the loudspeakers closer to the door or aimed at the door for adequate sound. Directional loudspeakers aimed at the door shall be at least 5 m from the door. Where possible in a corridor, place loudspeakers beyond the ends of the partition containing the door.

NOTE 7—Sound sources should be far enough away from the door that the direct field reaching the latter is significantly less than the reverberant field.

10.2 Multiple sources or repeated and averaged tests with sources at multiple locations are preferred but not required. If more than one source position is used, the distance between positions shall be at least 2 m. If more than one source is used simultaneously, they shall be driven by separate noise generators and amplifier channels so the outputs are uncorrelated.

11. Measurement of Average Sound Pressure Levels

11.1 The test method requires four measurements of average sound pressure levels over the series of contiguous one-third-octave bands with mid-band frequencies from 125 to 4000 Hz with the source(s) operating in the source room. Two are in the source room and two in the receiving room, one of each with the door open and closed. An additional measurement is made in the receiving room with the door closed and the source off.

NOTE 8—It is desirable that the frequency range be extended to include at least the 100 and 5000-Hz bands as this is required to calculate octave-band results.

11.2 The operator shall avoid standing between the sound source(s) and measurement positions on the source side or between the door and measurement positions on the receive side. Also, the operator shall avoid standing in a location that would place the microphone directly between the operator's body and the sound source on the source side, or directly between the operator's body and the door on the receive side.

11.3 *Microphone Positions*—The measurement positions shall be 1 m from the plane of the door on each side. The microphone diaphragm shall on each side of the door opening be parallel with the plane of the closed door panel and pointed toward that plane. Either fixed microphone positions or a scanning method as described below shall be used. The same positions or scan path shall also be used for background noise measurements.

11.3.1 *Fixed Positions*—Measurement with fixed positions is the preferred method.

11.3.1.1 If the opening is 1 m or less wide, six measurement positions shall be used on each side of the door as shown on the elevation view of a door in Fig. 1.

11.3.1.2 If the opening is more than 1 m wide, nine measurement positions shall be used on each side of the door as shown in Fig. 2, with three additional measurement points at the midpoint of the total door opening width.

11.3.1.3 Microphone position tolerance shall be ±12 mm in the direction perpendicular to the door surface. The lateral and vertical tolerances on the positions shown in Fig. 1 and Fig. 2 are ±50 mm.

NOTE 9—If using a single microphone to make measurements, consider making all measurements at a given height before proceeding to measurements at another height. Alternatively, a fixture with an easy method to move the microphone to the required heights is useful. If a door panel is more than 1 m wide, it will be necessary to move the microphones to open and close the door.

11.3.1.4 *Averaging Time at Each Fixed Position*—The averaging time for a given frequency shall be the same at each fixed position. When measuring sound pressure levels in all frequency bands simultaneously at fixed positions, the minimum averaging time shall be 10 s for measurements down to 125 Hz. If frequency bands are measured sequentially, the minimum averaging time shall be 5 s at 250 Hz and above. The minimum averaging time, T_a, at frequency f that is less than 250 Hz must be computed from:

$$T_a = \frac{1240}{f}\text{s} \quad (3)$$

NOTE 10—This provides 95 % confidence limits of ± 0.5 dB for the sound level at a position based on the assumption of a Gaussian distribution of sound level with time. For more information, see Ref (**3**).

11.3.1.5 *Determination of Space-Average Levels*—Use the following equation to obtain the average sound pressure level for a number of fixed positions which is a space and time average level:

$$\bar{L} = 10\log\left[\frac{1}{n}\sum_{i=1}^{n}10^{L_i/10}\right] \quad (4)$$

where:

L_i = the level measured at the ith microphone position and there are n positions.

11.3.2 *Scanning Method*—A manual scanning method is an option. The microphone shall be held well away from the operator's body (a boom serves to increase the distance). The microphone speed shall remain as constant as practical. Especially when measuring sound in the receiving room, take care when walking or moving the microphone or its cable to avoid contamination by footstep sounds or extraneous signals due to inadvertent contact between the microphone or cable and the operator's body.

11.3.2.1 If the opening is 1 m or less wide, the scan shall follow a rectangular pattern passing through the six microphone positions shown in Fig. 1.

11.3.2.2 If the opening is more than 1 m wide, the scan shall follow the pattern shown on Fig. 2 passing through the nine identified microphone positions.

11.3.2.3 The scan time shall be at least 30 s for all scanned measurements, including background sound.

NOTE 11—Before proceeding with a full set of measurements, consider making measurements of the background sound and source level with the door closed at one position on the receiving side to evaluate the adequacy of the source level.

11.4 *Recording of Measured Sound Levels*—Record and use sound levels as reported by the measurement instrument with maximum available digits without further rounding.

11.5 *Level in Source Room*—With the sound source(s) operating at a constant level, measure the average sound pressure level at each frequency in the source room, with the door closed and then with the door open.

11.6 *Level in Receiving Room*—With the sound source(s) operating at a constant level, measure the average sound pressure level at each frequency in the receiving room with the door open and then with the door closed.

11.6.1 When measurements are made in areas with fluctuating background noise, the operator shall listen to the noise in the receiving room during measurements of the level in the receiving room with the door closed. If any intermittent interfering sounds are heard during the measurements, the measurements shall be repeated until no such sounds are heard during the collection period.

11.7 *Background Noise Level*—With the sound source(s) shut off and the door closed, measure the average sound pressure level at each frequency in the receiving room using the same measurement method (fixed or scanning) with the same microphone positions or scanning pattern and same instrument range setting used to measure levels in the receiving room with the source operating. If fixed microphone positions are used then use a minimum averaging time of 20 s at each microphone position for each frequency.

NOTE 12—Background noise often varies significantly with time such that it is impossible to know with certainty whether the measured background noise accurately represents that present during a measurement with signal present. A longer integration time is used for the measurement of background noise to obtain a sample more likely to include higher levels of background noise.

11.7.1 Compare the levels in the receiving room with the door closed and source operating, to the background noise levels. If at any frequency the background noise level is within 10 dB of the level in the receiving room with source operating, increase the source level, if possible, to achieve at least a 10 dB difference at each frequency and repeat all level measurements.

11.7.2 If the spectrum of the noise source is filtered to concentrate the available sound power in a few bands, the bandwidth of the filter applied to the source signal shall extend at least one-third-octave band above and below the one-third-octave band being measured.

11.8 *Background-Adjusted Average Level in the Receiving Room with the Door Closed*—Average door-closed levels in the receiving room shall be adjusted for background noise at each frequency band in accordance with this section. Calculate the difference between the average background noise level and the average combined (signal plus background noise) level in the receiving room with the door closed. This calculation shall be performed without any rounding beyond that inherent in the initial recording of data.

11.8.1 For each one-third-octave band, if the difference is 6 dB or more, the background-adjusted average receiving-room level with the door closed shall be calculated as follows:

$$\bar{L}_{(rec\ \ closed)} = 10\log\left(10^{\bar{L}_{sb}/10} - 10^{\bar{L}_b/10}\right) \quad (5)$$

where:

$\bar{L}_b$ = the average background noise level, dB,
$\bar{L}_{sb}$ = the average level of the combined signal and background noise (the measured average level in the receiving room with the door closed), dB, and
$\bar{L}_{(rec\ closed)}$ = the background-adjusted average level in the receiving room with the door closed, dB.

11.8.2 If the difference is less than 6 dB, then subtract 1.26 dB from the combined level in the receiving room with the door closed ($\bar{L}_{sb}$) and use the result as the background-adjusted average level in the receiving room with the door closed ($\bar{L}_{(rec\ closed)}$). In this case, the measurements shall only be used to provide an estimate of the lower limit of the normalized door insertion loss. Identify such measurements in the test report.

12. Calculation of Normalized Door Insertion Loss and Door Transmission Class

12.1 Calculate the normalized door insertion loss at each frequency from 125 to 4000 Hz as follows using space and time averaged results and without any rounding in the calculations:

$$NDIL = \left(\bar{L}_{(rec\ open)} - \bar{L}_{(rec\ closed)}\right) + \left(\bar{L}_{(source\ closed)} - \bar{L}_{(source\ open)}\right)$$

where:

$\bar{L}_{(rec\ open)}$ = the average sound pressure level on the receiving side of the door with the door open,
$\bar{L}_{(rec\ closed)}$ = the average sound pressure level due to the source on the receiving side of the door with the door closed (the background-adjusted average level in the receiving room with the door closed),
$\bar{L}_{(source\ closed)}$ = the average sound pressure level on the source side of the door with the door closed, and
$\bar{L}_{(source\ open)}$ = the average sound pressure level on the source side of the door with the door open.

12.2 Using the measured values of normalized door insertion loss and the method of Classification E413, determine the Door Transmission Class.

12.3 This test method specifies the use of one-third-octave bands for measurement and calculation of normalized door insertion loss. In applications where octave-band values are required, they shall be calculated from the one-third-octave band results using the expression:

$$NDIL_{oct,f} = -10\log\{(1/3)*(10^{-NDIL_a/10} + 10^{-NDIL_b/10} + 10^{-NDIL_c/10})\} \quad (6)$$

where:

$NDIL_{oct,f}$ = the octave-band level of NDIL in the octave band centered at frequency *f*, and

$NDIL_a$, $NDIL_b$, and $NDIL_c$ = the one-third-octave-band levels of *NDIL* in the three one-third-octave bands contained within the octave band centered at frequency *f*.

NOTE 13—Measurements in octave bands are not permitted because variations of actual source spectrum within an octave could influence results. The octave band values calculated from this expression approximate what would be measured if the spectrum in the source room had the same sound pressure level in each one-third-octave band. (Random noise with this spectrum is known as "Pink noise.")

13. Report

13.1 The report shall include the following information:

13.1.1 *Statement of Conformance to Standard*—Include in the report the following statement if true: "The testing described, the results calculated, and this report fully comply with the requirements of ASTM E2964–XX" where XX indicates the last two digits of the year date of the version of the standard used.

13.1.1.1 If there are any exceptions to the statement required in 13.1.1, add the phrase, "with the following exception(s):" and list the exceptions. Such exceptions include deviations from the required measurement procedures, or required elements not included in the report.

13.1.1.2 If there are extensive exceptions to the reporting requirements of this Section 13, use the following statement rather than listing all reporting exceptions: "Extensive exceptions have been made to the reporting requirements of E2964."

13.1.2 *Description of Test Environment:*

13.1.2.1 A general description of the source and receiving spaces and their environs, including furnishings, and clearly indicating which is the source room and which is the receiving room. If measurements are made in both directions, clearly indicate the source and receiving room for each result.

13.1.2.2 The approximate dimensions and volumes of the test rooms.

13.1.2.3 The dimensions and construction of the partition into which the door is mounted including all the essential constructional elements, their size and thickness.

13.1.2.4 If the door cannot be opened at least 170°, or if there is a partition perpendicular to the partition containing the door within 1 m of the door on either side, report these conditions, how far in degrees approximately the door does open, and whether a perpendicular partition within 1 m is on the source or receive side of the door.

13.1.2.5 Describe any obvious potential source of flanking that appears to be a significant influence on results and any steps taken to evaluate or limit flanking.

13.1.3 *Description of Test Specimen:*

13.1.3.1 Provide the manufacturer and model number of the door if available, the size and general construction (steel, wood, solid core, hollow core) and a description of the seals.

13.1.3.2 Observe the condition and adjustment of the seals and report whether they appear to be properly adjusted or appear to have deficiencies in adjustment or required further adjustment before the test for which results are reported.

13.1.3.3 Any description of the test specimen shall as far as practicable be based upon measurement and examination of the specimen itself, rather than upon the building plans or information received from the builder or others. The source of any description not based on direct observation shall be stated.

13.1.3.4 If the construction or installation of the test specimen is, for some reason, such that the results do not represent normal performance of the specimen, including experimental investigative modifications to the door or its seals, state this fact explicitly and put a statement of this on each page containing test results.

13.2 *Description of Test Equipment*—List all sound source and measurement equipment including microphones and field calibrators by make, model, and serial number where applicable, and for the measurement equipment including microphones and field calibrators also list the date of the last complete laboratory calibration.

13.3 *Statement of Test Results:*

13.3.1 Provide in tabular form in dB to one decimal place for each one-third-octave-band the following quantities: $\bar{L}_{(source\ closed)}$, $\bar{L}_{(source\ open)}$, $\bar{L}_{(rec\ open)}$, $\bar{L}_{sb}$, and $\bar{L}_b$ as measured, and the background-adjusted average level in the receiving room, $\bar{L}_{(rec\ closed)}$. If measurements are made in both directions, report all data for both measurements.

13.3.2 Provide in the table the values of NDIL for each one-third-octave band in two forms, rounded to the nearest decibel and also rounded to the nearest tenth of a decibel. Presentation of the NDIL values graphically is encouraged but not required.

13.3.3 Clearly indicate each one-third-octave band for which the difference between the average combined sound pressure levels in the receiving room with the door closed and the average background noise level were less than 6 dB (see 11.8.2). Use an asterisk or other appropriate symbol or number as the indicator. Add the following note referenced to that indicator: "The difference between the average background noise level in the receiving room with the door closed and the total test sound level in the receiving room at this frequency was less than 6 dB. This information shall only be used as an estimate of the lower limit of this result at this frequency."

13.3.4 On each page of the report containing test results, place the statement "This page alone is not a complete report."

13.3.5 Include in the report the following statement, "The results stated in this report represent only the specific door and acoustical conditions present at the time of the test. While the test method attempts to reduce the influence of flanking and non-ideal test conditions, such can still influence results suchTable 1 that results in the field will likely be less than they would be under laboratory conditions. Details of seal adjustments and installation quality can vary from door to door, and even for the same door, pressure on seals can vary from test to test. Thus, the expected performance for an untested door cannot be derived from the test result of a single door (or a sample thereof) of the same door design."