~~Designation:E1007–04ε1~~ Designation: E1007 – 11

Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures[1]

This standard is issued under the fixed designation E1007; 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.

~~ε[1] NOTE—Equations 2 and 3 were editorially corrected in July 2004.~~

INTRODUCTION

~~This test method is part of a set of standards for evaluating the sound insulating properties of building elements. It is designed to measure the impact sound insulation of a floor-ceiling assembly and associated supporting structures in field situations using a standard tapping machine. Other in the set cover laboratory measurement of impact sound transmission through floor-ceiling assemblies (Test Method~~

This test method is part of a set of standards for evaluating the sound insulating properties of building elements and sound isolation between spaces. It is designed to measure in the field the impact sound isolation between rooms or to estimate lower limits for impact sound transmission through a floor-ceiling partition element installed as an interior part of a building using a standard tapping machine. Others in the set cover measurement of impact sound transmission through an isolated floor-ceiling assembly in a controlled laboratory environment (Test Method E492~~); and the laboratory (Test Method~~), the measurement of airborne sound transmission loss of an isolated partition element in a controlled laboratory environment (Test Method E90~~) and field (Test Method~~), the measurement of airborne sound isolation and airborne sound transmission loss associated with building elements in the field (Test Method E336~~) methods of measuring airborne sound transmission loss of building partitions such as walls, floor-ceiling assemblies, doors, and other space-dividing elements; the measurement of sound transmission through building facades and facade elements (Guide~~), the measurement of sound transmission through building facades and facade elements in the field (Guide E966); and the measurement of sound transmission through a common plenum between two rooms in a controlled laboratory environment (Test Method E1414~~), a quick method for the determination of airborne sound isolation in multiunit buildings (Practice E597), and the measurement of sound transmission through door panels and systems (Test Method E1408~~).

1. Scope

1.1 This test method covers the measurement of the transmission of impact sound generated by a standard tapping machine through floor-ceiling assemblies and associated supporting structures in field situations.

1.2 Measurements may be conducted on all types of floor-ceiling assemblies, including those with floating-floor or suspended ceiling elements, or both, and floor-ceiling assemblies surfaced with any type of floor-surfacing or floor-covering materials.

~~1.3This test method further prescribes:~~

~~1.3.1A uniform procedure for reporting test data, that is, the normalized one-third octave band sound pressure levels generated in the receiving room by the operation of the standard tapping machine on the floor-ceiling assembly.~~

~~1.3.2The use of a single-figure classification rating, "Field Impact Insulation Class, FIIC" that can be used by architects, builders, and specification and code authorities for acoustical evaluation purposes in completed buildings. The FIIC is obtained by matching~~

[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.

~~Current edition approved April 1, 2004. Published May 2004. Originally approved 1984. Last previous edition approved in 1997 as E1007–97. DOI: 10.1520/E1007-04E01.~~

Current edition approved March 1, 2011. Published March 2011. Originally approved 1984. Last previous edition approved in 2004 as E1007 – 04 ε1. DOI: 10.1520/E1007-11.

~~a standard reference contour to the plotted normalized one-third octave band sound pressure levels at each test frequency obtained in accordance with this test method. For details regarding the derivation and significance of the FIIC, see Classification E989.~~

~~1.4~~

1.3 This test method defines several procedures and metrics to assess either the apparent performance of the nominally separating floor-ceiling or the isolation of a receiving room from the sound produced by the operation of the tapping machine. The receiving room may be the space directly below the tapping machine or, in some cases, any separated space that receives sound from the operation of the tapping machine. The source and receiving rooms as well as the floor-ceiling system are identified and described in the test report. All measured levels and derivative single number ratings include the effect of flanking transmission. Efforts to suppress flanking are not permitted. Available measures and their single number ratings are the impact sound pressure levels (ISPL) and impact sound rating (ISR), the reverberation time normalized impact sound pressure levels (RTNISPL) and normalized impact sound rating (NISR), and the absorption normalized impact sound pressure levels (ANISPL) and apparent impact insulation class (AIIC).

1.4 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

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

1.6 *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]

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

E492 Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine ~~E597Practice for Determining a Single-Number Rating of Airborne Sound Isolation for Use in Multiunit Building Specifications~~

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

E989 Classification for Determination of Impact Insulation Class (IIC) ~~E1408Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems~~[3]

E1414 Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

E2235 Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods

2.2 *ANSI Standards:~~S1.4Specification for Sound-Level Meters~~*

~~S1.10Pressure Calibration of Laboratory Standard Pressure Microphones[4] [3]~~

S1.11~~Specification for Octave Band and Fractional-Octave-Band Analog and Digital Filters~~[4] Specification for Octave Band and Fractional-Octave-Band Analog and Digital Filters

S1.40 Specifications and Verification Procedures for Sound Calibrators

S1.43 Specifications for Integrating-Averaging Sound Level Meters

2.3 *ISO Standard:*[4]

ISO 140—Acoustics—Measurement of Sound Insulation in Buildings and of Building Elements; Part VI—Laboratory Measurement of Impact Sound Insulation of Floors, and Part VII—Field Measurements of Impact Sound Insulation of Floors

2.4 ~~*IEC Standard:*~~ *IEC Standards* [5]*:*

~~IEC 804Specification for Integrating-Sound Level Meters~~ IEC 60942 Electroacoustics – Sound Calibrators

IEC 61672–1 Electroacoustics - Sound Level Meters – Part 1:Specifications

3. Terminology

3.1 *Definitions*—For definitions of terms pertaining to acoustics used in this test method, see Terminology C634.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 ~~*source room*—the room containing the tapping machine.~~ absorption normalized impact sound pressure level, ANISPL, (dB), *n*—into a receiving room of at least 40 m^3 in a specified frequency band, the impact sound pressure level (ISPL) normalized

---

[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] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.~~

[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 American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.~~

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

~~[5] The boldface numbers in parentheses refer to the list of references at the end of this standard.~~

[5] Available from International Electrotechnical Commission (IEC), 3 rue de Varembé, Case postale 131, CH-1211, Geneva 20, Switzerland, http://www.iec.ch.

to a reference absorption of 10 m^2 in the receiving room.

3.2.1.1 *Discussion*—10 m^2 is equivalent to 108 Sabins

3.2.2 ~~*receiving room*—a room below or adjacent to the floor specimen under test in which the impact sound pressure levels are measured.~~

~~NOTE1—The receiving room is usually the room below the floor specimen but it may also be on the same level, diagonally below, or, in some cases, it could be above the source room.~~ apparent impact insulation class, AIIC, *n*—a single-number rating derived from values of ANISPL in accordance with Classification E989.

3.2.2.1 *Discussion*—field impact insulation class (FIIC) has been replaced with apparent impact insulation class (AIIC) to make clear that the quantity includes flanking and to harmonize terminology with Test Method E336.

3.2.2.2 *Discussion*—AIIC provides an estimate of the apparent sound insulating properties of a floor-ceiling assembly under tapping machine excitation where sound power from associated support structures are attributed to the floor-ceiling assembly.

3.2.2.3 *Discussion*—The absorption normalized impact sound pressure level (ANISPL) and apparent impact insulation class (AIIC) are analogous to apparent transmission loss (ATL) and apparent sound transmission class (ASTC) for airborne measurements.

3.2.3 ~~*impact sound pressure level*—the average sound pressure level in a specified frequency band produced in the receiving room by the operation of the standard tapping machine on the floor assembly, averaged over each of the specified machine positions.~~ coupled space, *n*—a secondary space large enough to permit measurements without microphones too close to surfaces, but separated from the receiving room (which is partially bounded by the separating floor-ceiling) by a partial barrier with an opening that is at least 33% of the total area between the receiving room and secondary spaces and where the difference in the average A-weighted sound levels in the receiving room and secondary spaces is not more than 6 dB when the tapping machine is in operation.

3.2.4 ~~*normalized impact sound pressure level*—the impact sound pressure level normalized to a reference absorption of 10 m^2 (108 sabins).~~ impact sound pressure level, ISPL, (dB), *n*—in a specified frequency band, the average sound pressure level in a specified frequency band produced in the receiving room by the operation of the standard tapping machine on a floor-ceiling assembly, averaged over each of the specified tapping machine positions.

3.2.5 ~~*field impact insulation class (FIIC)*—a single-number rating derived from measured values of normalized one-third octave band impact sound pressure levels in accordance with Classification~~ impact sound rating, ISR, *n*—a single-number rating derived from values of ISPL in accordance with Classification E989. ~~Note2—FIIC provides an estimate of the sound insulating performance of a floor-ceiling assembly and associated support structures under tapping machine excitation.~~

3.2.5.1 *Discussion*—ISR provides a measure of the isolation of the receiving room from the impact sound produced by the operation of the tapping machine in the source room given the existing conditions (that is, sound absorption, reverberation time) in the receiving room at the time of the test.

3.2.5.2 *Discussion*—impact sound pressure level (ISPL) and impact sound rating (ISR) are analogous to noise reduction (NR) and noise isolation class (NIC) for airborne measurements.

3.2.6 *normalized impact sound rating, NISR*, *n*—a single-number rating derived from values of RTNISPL in accordance with Classification E989.

3.2.6.1 *Discussion*—NISR provides a measure of the potential isolation of the receiving room from the impact sound produced by the operation of the tapping machine in the source room as if the receiving room had a reverberation time of 0.5 s. This reverberation time is typical of many furnished small offices and furnished residential living rooms and bedrooms.

3.2.6.2 *Discussion*—The reverberation time normalized impact sound pressure level (RTNISPL) and normalized impact sound rating (NISR) are analogous to normalized noise reduction (NNR) and normalized noise isolation class (NNIC) for airborne measurements.

3.2.7 *receiving room*, *n*—a room below or near the source room in which the impact sound pressure levels are measured.

3.2.7.1 *Discussion*— Depending on the metric being measured, the impact sound pressure levels may also have to be measured in spaces that are coupled to the receiving room.

3.2.7.2 *Discussion*—The receiving room is usually the room below the floor-ceiling assembly being excited by the tapping machine but, depending on the metric being measured, it may be on the same level, diagonally below, or, in some cases, above the source room.

3.2.8 *reverberation time normalized impact sound pressure level, RTNISPL, (dB)*, *n*—into a receiving room of less than 150 m^3, in a specified frequency band, the impact sound pressure level normalized to a reverberation time of 0.5 s in the receiving room.

3.2.9 *separating floor-ceiling*, *n*—the area of the floor-ceiling assembly that is common to both the source room and the room or space immediately below the source room.

3.2.10 *source room*, *n*—the room or space containing the tapping machine.

3.2.10.1 *Discussion*—The source room could also be an exterior location on a roof or a deck.

3.3 *Symbols:*

3.4 A_2—the total acoustical absorption in the receiving room measured in ⅓ octave frequency bands, m^2.

3.5 T_2—the reverberation time in the receiving room measured in ⅓ octave frequency bands, seconds.

4. Summary of Test Method

~~4.1A standard tapping machine is placed in operation on a floor specimen. The transmitted impact sound is characterized by the one-third octave band spectrum of the average sound pressure level produced by the tapping machine in the receiving room located beneath or adjacent to the floor specimen under test.~~

~~4.2Since the spectrum and level depend on the absorption of the receiving room, the impact sound pressure levels are normalized to a reference absorption for purposes of comparing results obtained in receiving rooms that differ in absorption.~~

4.1 A standard tapping machine is placed in operation on a floor-ceiling assembly. The transmitted impact sound is characterized by the one-third octave band spectrum of the average sound pressure level produced by the tapping machine in the receiving room located beneath or near the floor-ceiling assembly.

4.2 A complete test shall consist of one background noise level measurement, and four tapping level measurements, one for each tapping machine position. The background noise measurement and each tapping level measurement are conducted in the same way, whether by a single sweep or multiple measurements at fixed microphone positions.

4.3 If appropriate, the measured impact sound levels are adjusted for the background noise.

4.4 The adjusted impact sound pressure levels can be used *(1)* without normalization, *(2)* normalized to a standard reverberation time, or *(3)* normalized to a standard amount of absorption.

4.5 If normalized values are to be reported, the reverberation time (T_2) or absorption (A_2), or both, of the receiving room must be determined. To determine absorption, the volume of the receiving room must also be calculated from measured room dimensions.

5. Significance and Use

5.1 The spectrum of the noise produced in the receiving room by the standard tapping machine is determined by *(1)* the size and the mechanical properties of the floor-ceiling assembly, such as its weight, surface properties, mounting or edge restraints, stiffness, and internal damping; *(2)* the ~~acoustical response~~ degree of ~~the receiving room;~~ flanking transmission through associated structures; and *(3)* the ~~degree~~ acoustical response of ~~flanking transmission through associated structures.~~ the receiving room.

5.2 The standardized tapping machine specified in ~~7.1.1~~6.1.1 produces a continuous series of uniform impacts at a uniform rate on a ~~test floor~~ floor-ceiling assembly ~~and generates in the receiving room broadband~~ to allow accurate and reproducible measurements of impact sound pressure levels ~~high enough to make accurate and reproducible measurements possible.~~ in the receiving room. The tapping ~~machine, however,~~ machine is not designed to simulate any one type of impact, such as male or female footsteps ~~nor~~or to simulate the weight of a human walker. Also, measurements described in this method and ratings based on the results are restricted to a specific frequency range. Thus the subjectively annoying creak or boom generated by human footfalls on a limber floor-ceiling assembly may not be adequately evaluated by this test method.

5.3 Laboratory Test Method E492 ~~calls for the elimination of flanking sound transmission and for highly diffuse sound fields in the receiving room. The problems associated with making acoustical measurements in buildings are much more difficult than those met in the laboratory. In ordinary buildings, a great variety of test room shapes and sizes are encountered. The amount of energy exchange at the nominal boundaries of the test specimen, the manner of construction and factors such as structure-borne flanking paths, for example, transmission in the side walls, varies widely. Highly diffuse fields are seldom found in the field and the special efforts that would be required to simulate laboratory conditions and eliminate flanking sound are impractical.~~

~~5.4This test method accepts these limitations and gives measurement procedures for determining the average impact sound pressure level in nearly all cases that may be encountered in the field. The test procedure evaluates the floor-ceiling assembly and adjacent structures as installed (including structure-borne flanking paths). Results are not meant to be identical to laboratory tests of the floor-ceiling assembly alone. Because of the uncontrollable factors mentioned in 5.1-5.3, caution must be used when using test results to predict the performance of other floors with similar construction. It is preferable to confine the use of test results to the comparison of closely similar floors and supporting structures.~~

~~6.Test Specimens~~

~~6.1*Types*—All types of floor-ceiling assemblies surfaced with any type of material may be tested by this test method, including assemblies with floating floors or suspended ceilings.~~

~~6.1.1In all cases the test specimen should be installed in accordance with customary field practice including normal constraint and sealing conditions at the perimeter and at the joints within the specimen.~~

~~6.2*Aging of Specimens*—Test specimens that incorporate materials for which there is a curing process (for example, adhesives, plasters, concrete, mortar, and damping compound) shall age for a sufficient interval before testing. Aging periods for certain common materials are recommended in Test Method E90 and summarized in Table 1 of this test method.~~

~~6.3*Installation of Floor-Surfacing Materials*:~~

~~6.3.1Since floor-surfacing materials of significant weight, such as carpets and pads, may exert a damping or restraining effect on the flexural motion of lightweight floor structures, it is recommended that the entire area of the floor structure under test be covered with the floor surfacing materials. Any exception to this shall be noted in the test report.~~

~~6.3.2The installation or application of floor-surfacing materials should be in accordance with manufacturer's instruction, especially in regard to cleaning and priming of the subfloor.~~

TABLE 1 2 Estimates of Reproducibility, R, of the ANISPL values for the measurements of a specified minimum age fing Periods Before floor-ceiling assembly.

Material Base	Recommended Minimum Age Frequency, Hz	ANISPerioL, dB	R, dB
Masonry	28 days.49	3.42	
80	48.49	3.42	
Plaster:	48.22	8.71	
100	48.22	8.71	
Thicker than 3 mm (⅛ in.)	28 days.19	3.20	
125	48.19	3.20	
Thinner than 3 mm (⅛ in.)	3 days49.29	1.95	
160	49.29	1.95	
Wallboard Partitions:	48.96	2.75	
200	48.96	2.75	
With water-base laminating adhesives	14 days7.98	3.04	
250	47.98	3.04	
With non-water-base laminating adhesives	3 days		
31	47.93	1.84	
With typical joint and finishing compounds	48.74	12 h	
400	48.74	1.52	
Other	As appropriate for caulking49.02	1.53	
500	49.02	1.53	
and adhesive compounds50.16		2.56	
630	50.16	2.56	
involved51.26		1.59	
800	51.26	1.59	
1000	55.48	1.83	
1250	55.80	1.54	
1600	57.74	1.52	
2000	60.41	1.86	
2500	55.59	2.91	
3150	46.94	3.79	
4000	43.67	2.64	
5000	40.14	4.43	
AIIC	46.17	2.10	

6.3.3Floor-surfacing materials that are intended to be applied with adhesive should not be tested merely laying on the subfloor unless otherwise noted in the report.

6.3.4Although most floors are ready for immediate use after being installed, it is recommended that measurements on floors with adhesive-applied surfacing materials be deferred for at least 24 h after installation to allow the adhesive to cure.

6.4*Receiving Room Volume*—Ideally, the receiving room should be large enough so that an approximately diffuse sound field exists in all measurement bands. In the field, sound fields are deemed acceptable down to 100 Hz if the room volume is greater than 60 m calls for highly diffuse sound fields and the suppression of flanking sound transmission in the laboratory's receiving room. This field test method does not allow efforts to suppress flanking. In field tests, acoustical measurements are much more uncertain than in the laboratory since a great variety of receiving room shapes and sizes are encountered in ordinary buildings. Highly diffuse fields are seldom found and the nature of structure-borne flanking transmission can vary widely; consequently, good agreement between laboratory tests and field tests on similar floor-ceiling assemblies should not be expected.

5.4 Several metrics are available for specific uses:

5.4.1 *absorption normalized impact sound pressure level (ANISPL) and apparent impact insulation class (AIIC)*—These metrics are intended to evaluate the performance of the floor-ceiling assembly and adjacent structures as installed (including structure-borne flanking paths). For these metrics, sound power from associated support structures are attributed to the floor-ceiling assembly. Because these are measures of the apparent performance of the nominally separating floor-ceiling, the receiving room shall be the space directly under the tapping machine. ANISPL and AIIC may be reported if the receiving room has a volume of at least 40 m^3 (2100 ft and the smallest dimension is at least 2.3 m. ANISPL and AIIC may be measured and reported only if, in all frequency bands necessary to

calculate the AIIC, the receiving room absorption, A_2, is less than:

(1) $A2 < 2 \times V$ (2/3)

where:

V = the volume of the receiving room, m^3

Results are usually not identical to laboratory tests of the floor-ceiling assembly alone. Because of the uncontrollable factors mentioned in 5.1-5.3, caution must be used when using test results to predict the performance of other floor-ceiling assemblies with similar construction.

5.4.2 *impact sound pressure level (ISPL) and impact sound rating (ISR)*—These metrics are intended to assess the impact sound isolation as it exists at the time of the test due to the mechanical excitation of the floor-ceiling assembly by the standard tapping machine. The measurements can be performed in any space affected by the sound of the operating tapping machine. These metrics do not represent the performance of the separating floor-ceiling. They represent the impact sound isolation between the source floor and the receiving room. There are no receiving room absorption restrictions and no receiving room volume restrictions other than being sufficiently large to accommodate the microphone positions described in 10.3.

5.4.3 *reverberation time normalized impact sound pressure level (RTNISPL) and normalized impact sound rating (NISR)*—These metrics are intended to assess the impact sound isolation as if the receiving room had a reverberation time of 0.5 s. This reverberation time is typical of many furnished small offices and furnished residential living rooms and bedrooms. RTNISPL and NISR shall not be reported for receiving rooms of 150 m^3 or larger.

6. Test Machine

6.1 *Tapping Machine Specifications :*

6.1.1 This test method is based on the use of a standardized tapping machine that conforms to the specifications given in ISO 140 /part 6. The tapping machine shall have five hammers equally spaced in a line. The distance between centerlines of neighboring hammers shall be 100 ± 3 mm. Each hammer shall have an effective mass of 500 ± 6 g which falls freely from a height of 40 ± 3mm. The falling direction of the hammers shall be perpendicular to the test surface to within ± 0.5°. The part of the hammer carrying the impact surface shall be cylindrical with a diameter of 30 ± 0.2 mm. The impact surface shall be of hardened steel and shall be spherical with a curvature radius of 500 ± 100 mm. The time between successive impacts shall be 100 ± 20 ms.

6.1.2 Since friction in the hammer guidance system can reduce the velocity of the hammer at impact, the tapping machine shall be checked for friction between the hammers and the guidance system. Any friction found should be eliminated or reduced as much as possible.

6.1.3 The bottoms of the machine supports shall be at least 100 mm from the nearest hammer.

NOTE 1—Investigations **(1)**[6] involving light-frame floating floors have shown that both the resiliency of the tapping machine supports as well as their spacing from the hammers significantly affect the impact sound pressure levels in frequency bands below 400 Hz.

6.1.4 Following adjustment of the hammer drop in accordance with 6.1.1-6.1.3 , the tapping machine is ready for use on any floor, including those surfaced with soft or resilient materials.

6.2 *Operational Noise*—The presence of airborne sound flanking could cause extraneous noise to occur in the receiving room. The sound pressure levels in the receiving room due to airborne transmission from the operating tapping machine shall be at least 10 dB less than those due to hammer impacts transmitted structurally.

NOTE 2—A loudspeaker or other convenient airborne noise source can be used to evaluate the extent of airborne sound transmission between the rooms (see Test Method E336).

6.3 *Tapping Machine Positions*—the spectrum of the noise in the receiving room may be influenced by the location of the tapping machine on the floor assembly. For purposes of this test method, the tapping machine positions described in 6.3.1-6.3.4 shall be used (see Fig. 1).

6.3.1 *Position 1*—The middle hammer of the tapping machine shall be at the approximate center of the area identified in 9.4. In joist construction arrange the tapping machine so that all hammers are parallel with and aligned with the middle joist if possible.

NOTE 3—Joist locations and orientations may not be obvious in field situations. Inspection of building plans and nailing patterns may assist the determination of joist layout.

6.3.2 *Position 2*—Same as Position 1, except rotate the tapping machine 90° around the axis of the middle hammer.

6.3.3 *Position 3*—Displace the tapping machine laterally with respect to Position 1, so that the longitudinal axis of the machine is centered midway between and parallel to the central joists and to Position 1. In the case of homogeneous floors of concrete slab or solid deck construction without joists, the lateral displacement of the tapping machine shall be 0.6 m from that of Position 1.

6.3.4 *Position 4*—Position the tapping machine so that the longitudinal axis of the machine forms an angle of 45° with respect to Position 1. Displace the machine laterally so that the middle hammer is 0.6 m from the midpoint of Position 1.

7. Measuring Equipment

7.1 Microphones, amplifiers, and electronic circuitry to detect, measure, process and analyze microphone signals shall satisfy

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