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**Designation: E 1110 – 01**

## Standard Classification for Determination of Articulation Class<sup>1</sup>

This standard is issued under the fixed designation E 1110; 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.

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~~ε<sup>1</sup> Note—Keywords were added editorially in December 1994.~~

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<sup>1</sup> This classification is under the jurisdiction of ASTM Committee E33 on Environmental Acoustics and is the direct responsibility of Subcommittee E 33.02 on Open Plan Spaces.

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### 1. Scope

1.1 This classification provides a single figure rating that can be used for comparing building systems and subsystems for speech privacy purposes. The rating is designed to correlate with transmitted speech intelligence between office spaces.

1.2 Excluded from the scope of this classification are applications involving female speakers or children,<sup>2</sup> languages other than English, and sound spectra other than speech. Thus excluded, for example, would be comparisons of building systems or subsystems for their effectiveness in reducing transmitted noise from machinery, industrial processes, bowling alleys, music rooms, places of entertainment, and the like.

NOTE 1—Recently published work by Pearsons, et al, may eventually permit the restriction on female speakers to be relaxed.<sup>3</sup>

### 2. Referenced Documents

#### 2.1 ASTM Standards:

C 634 Terminology Relating to Environmental Acoustics<sup>4</sup>

E 1111 Test Method for Measuring the Interzone Attenuation of Ceiling Systems<sup>4</sup>

~~P 105 Proposed~~

~~E 1375 Test Method for Laboratory Measurement of Sound Measuring the Interzone Attenuation of Partial Height Space Dividers Furniture Panels Used as Acoustical Barriers<sup>5</sup>~~

~~E 1376 Test Method for Measuring the Interzone Attenuation of Sound Reflected by Wall Finishes and Furniture Panels<sup>5</sup>~~

#### 2.2 ANSI Standard:

S3.5 Methods for the Calculation of the Articulation Index<sup>6</sup>

### 3. Summary of Classification

3.1 Articulation class (AC) is the sum of the weighted sound attenuations in a series of 15 test bands. It is calculated as follows:

$$AC = \sum_{f_i} A(f_i)w(f_i) \quad (1)$$

where:

$f_i$  = the center frequency of the bands from 200 to 5000 Hz,

$A(f_i)$  = the measured attenuation in decibels in the one-third octave band with center frequency  $f_i$ , and

$w(f_i)$  = the weighting for that band, from Table 1.

3.2 The sound attenuation for each band is determined in accordance with the appropriate test method. Current test methods are Test Methods ~~E 1111, E 1375 and Proposed Method P 105; E 1376~~. In Test Methods ~~E 1111, E 1375 and E 1376~~ interzone attenuation is substituted for sound attenuation.

### 4. Significance and Use

4.1 Each weighting factor given in Table 1 represents the fraction of overall speech intelligence contained within the associated one-third octave frequency band.

<sup>2</sup> This is based on a similar exclusion in ANSI S3.5.

<sup>3</sup> Pearsons, K. S., Bennett, R. L., and Fidell, S., "Speech Levels in Various Noise Environments," *National Technical Information Service Research Report*, PB-270 053, 1977.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.06.

<sup>5</sup> See 1985 *Annual Book of ASTM Standards*, Vol 04.06.

<sup>6</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

**TABLE 1 Weighting Factor, for Calculation of Articulation Class**

Band Center Frequency, Hz	Weighting Factor
200	0.12
250	0.30
315	0.30
400	0.42
500	0.42
630	0.60
800	0.60
1000	0.72
1250	0.90
1600	1.11
2000	1.14
2500	1.02
3150	1.02
4000	0.72
5000	0.60

4.2 The weighting factors in Table 1 are obtained by multiplying each individual one-third octave band weighting factor of ANSI S3.5 by 300. Articulation class (AC) values are thus related to but distinctly different from articulation index (AI) values. In particular, the AC considers only the effect of signal attenuation; while the AI considers such additional factors as speech level and spectrum and background sound level and spectrum.

NOTE 2—The AC is similar to the DAI rating proposed by Warnock<sup>7</sup> and has been shown to correlate with AI values derived from ANSI S3.5, except where the AI approaches 1 or 0 (AI values range between 1 and 0 and approach 0 with increasing privacy and nonintelligibility). Articulation class values give the reverse. They usually exceed 100 and increase with increasing privacy and nonintelligibility. Extensive comparison between AC ratings and subjective judgments of open-plan speech privacy has not yet been accomplished.

## 5. Presentation of Results

5.1 The AC shall be reported to the nearest multiple of ten. It is recommended that the AC be reported together with the unweighted sound attenuation for each test frequency band and other data required for the appropriate sound attenuation test method.

## 6. Keywords

6.1 architectural acoustics; articulation class; open office; open-plan space; sound attenuation; speech privacy

<sup>7</sup> Warnock, A. C. C., "Studies of Acoustical Parameters in Open-Plan Offices," *Journal*, Acoustical Society of America, Vol 63, 1978, pp. 832–840.

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