

IEEE Recommended Practice for Loudspeaker Measurements

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IEEE Recommended Practice for Loudspeaker Measurements

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**Standards Committee of the
IEEE Acoustics, Speech, and Signal Processing Group**

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Approved September 5, 1974

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Foreword

(This foreword is not a part of IEEE Std 219-1975, IEEE Recommended Practice for Loudspeaker Measurements.)

On October 18, 1961, Subcommittee 30.7, Loudspeakers, of the Standards Committee of the IEEE Group on Audio and Electroacoustics began work on a standard for loudspeaker measurements which was to include electrostatic, piezoelectric and other types of loudspeakers in addition to the dynamic type dealt with in the previous IRE standard, IRE Recommended Practices on Audio and Electroacoustics: Loudspeaker Measurements 1961. While this 1961 standard covered only single driver units, the proposed new standard was to apply to loudspeaker systems as well. It was also the intent of Subcommittee 30.7 to include in the standard detailed procedures for each measurement, rather than simply to describe the type of measurement to be made.

It was realized that the scope of the standard to be written was such that completion could be expected to require several years work. Accordingly, the decision was made to concentrate on one type of measurement at a time and to effect preliminary publication of each section separately to permit early application of the methods described by those working in the field and to solicit comments that would assist the Subcommittee in the preparation of the standard in final form. The first such preliminary publication was the IEEE Proposed Standard for Measurement of Loudspeaker Electrical Impedance in the IEEE Transactions on Audio and Electroacoustics, June 1970, pp 213-217.

In 1970, two additional sections of the proposed standard were completed:

Proposed Standard for Measurement of Dynamic Loudspeaker Motional Impedance Rev 2, April 30, 1970; and Proposed Standard for the Measurement of Dynamic Loudspeaker Q and Resonance Frequency Rev 6, June 25, 1970.

Before authorization of publication of these sections, a review of the rate of progress in May 1972 led the subcommittee to the decision to write the entire standard as a unit and to pattern it after IEC 200 (1966), Methods of Measurement for Loudspeakers, in order to expedite completion and to conform with the IEEE policy of compatibility with international standards. In the course of this work IEC 200 was superseded by IEC 268-5 (1972) Sound System Equipment, part 5, Sound System Loudspeakers. In its terminology, definitions and general treatment of the subject, IEEE Std 219-1975 is technically compatible with the recommendations of IEC 268-5. Acknowledgement is made for the assistance received from the document, and also for that received from the November 1973 draft: Australian Standard Specification for Sound System Equipment, Part 5, Sound System Loudspeakers, prepared by Standards Association of Australia Committee TE/24, Electroacoustics and Recording Subcommittee TE/24/4, Loudspeakers. The gratitude of the subcommittee is due to Richard H. Small who furnished a copy.

The Subcommittee 7 members responsible for the writing of IEEE Std 219-1975 were:

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IEEE Recommended Practice for Loudspeaker Measurements

1. General Provisions

1.1 Scope. These recommendations apply to loudspeakers and loudspeaker systems.

1.2 Definitions

loudspeakers. Loudspeakers should be understood, unless otherwise stated, to include both loudspeaker drivers along with their mountings or enclosures (which together comprise a loudspeaker system) and also loudspeaker systems which comprise one or more loudspeaker drivers and such devices as integral crossover filters, transformers, and any other integral passive or active elements.

nominal input power. Nominal input power is equal to the square of the true rms voltage at the input terminals of the loudspeaker, divided by the rated impedance defined in Section 4.1.2.

1.3 Object. The recommendations define terms associated with loudspeakers and their testing, recommend methods of testing on which there is general agreement, and indicate preferred methods of presenting information regarding their characteristics. They involve physical, steady-state measurements only.

Methods of measurement are stated in such a manner as to constitute recommendations to competent technical personnel acquainted with current practices in electroacoustical measurements.

2. Applicable Standards

Applicable standards included are:

- (1) IEC 268-5 (1972), Sound System Equipment, part 5: Sound System Loudspeakers, and IEC Publ 268-1 (1972), Sound System Equipment, part 1: General for:
Units and system of measurement
Ambient conditions (see also Section 4.9)
Graphical presentation
Scales for graphical presentation
- (2) American National Standard, Preferred Frequencies and Band Numbers for Acoustical Measurements, S1.6-1967
Frequencies of Measurement

3. Conditions of Measurement

3.1 Working Conditions

3.1.1 Rated Working Conditions. The loudspeaker should be understood to be working under rated power conditions when the following occurs:

(1) The voltage across the loudspeaker terminals is chosen in accordance with the expression $E^2 = PR$, where E is the rms potential difference, in volts, across the input terminals, P is the rated input power in watts (Section 4.2.1) and R is the rated impedance in ohms (Section 4.1.2).

(2) The volume control, if present, is set for minimum attenuation.

(3) In a multispeaker system, individual loudspeaker level controls or switches are set as suggested by the manufacturer for flat response. If such information is lacking the controls or switches should be set for minimum attenuation.
NOTE: In addition, it is desirable, when volume controls are used for balance adjustment between low frequency, medium frequency, and high frequency drivers, also to measure the performance with these set to the position for maximum attenuation.

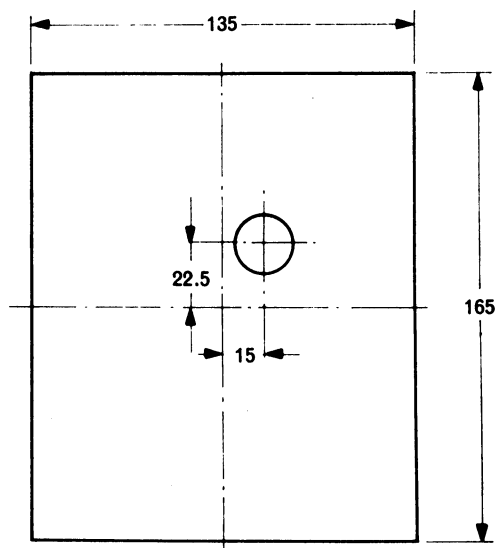
(4) Unless otherwise specified, working conditions shall imply a sinusoidal voltage with a frequency of 1000 Hz.

(5) The loudspeaker is mounted in its own enclosure, a specified enclosure or on the standard baffle (Fig 1).

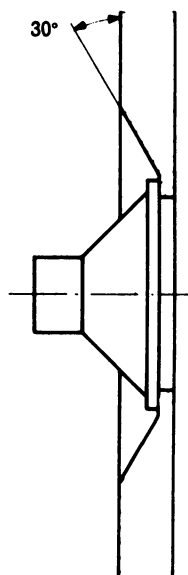
(6) The loudspeaker is working under free-field conditions, except when total power radiated is measured (according to Section 4.7.2), in a reverberation chamber.

3.1.2 Normal Working Conditions. The loudspeaker should be understood to be working under normal conditions when all the conditions listed in Section 3.1.1 have been met except that the voltage has been adjusted to a value 10 dB below the value chosen for rated conditions as defined in Section 3.1.1.

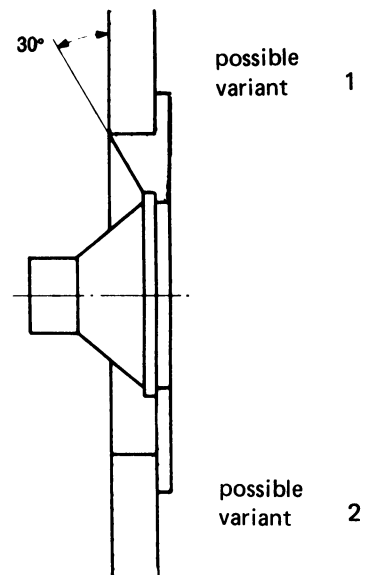
3.2 Free-Field Conditions. Free-field conditions are those that approach acoustically those of free space. An anechoic room should be considered satisfactory if the sound pressure varies inversely as the distance, within ± 1 dB, over the



A



B



C

Fig 1
Standard Baffle
(Dimensions in mm)