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INTERNATIONAL STANDARD

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colour inside

Microspeakers

Micro-haut-parleurs

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MICROSPEAKERS

FOREWORD

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The text of this International Standard is based on the following documents:

CDV	Report on voting
100/3107/CDV	100/3211/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- replaced by a revised edition, or
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MICROSPEAKERS

1 Scope

This document specifies the characteristics of microspeakers as well as the relevant test methods on microspeakers using steady-state sinusoidal signals, sinusoidal chirp, multi-tone or noise. The main characteristics include, but are not limited to, impedance, displacement, amplitude frequency response, distortion, and power handling.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60268-1, *Sound system equipment – Part 1: General*

IEC 60268-2, *Sound system equipment – Part 2: Explanation of general terms and calculation methods*

IEC 60268-21:2018, *Sound system equipment – Acoustical (output based) measurement*

IEC 60268-22:2020, *Sound system equipment – Electrical and mechanical measurements on transducers*

IEC 61260-1, *Electroacoustics – Octave-band and fractional-octave-band filters – Part 1: Specifications*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Terms and definitions

3.1.1
microspeaker
loudspeaker, the radiating element (diaphragm or other radiator) of which is not greater than 40 mm

Note 1 to entry: The term "microspeaker" applies to the microspeaker unit (transducer) and also to passive microspeaker systems, which consist of one or more transducers provided with acoustical structures (e.g. chamber, port, aperture).

3.2 Abbreviated terms

HOHD higher-order harmonic distortion

4 Conditions of measurement

4.1 Rated measuring conditions

For convenience, this document specifies how sound system equipment shall be set up for measurement. Normal measuring conditions are defined in this document. To obtain the actual conditions for measurement, some values (known as "rated conditions") shall be taken from the manufacturer's specification.

These rated conditions are not subjected to measurement, but they constitute the basis for performing the measurements to determine the other characteristics.

The following rated conditions are of this type, and shall be stated by the manufacturer:

– rated impedance;
– rated sinusoidal voltage or power;
– rated noise voltage or power;
– rated frequency range;
– rated geometrical condition;
– rated climatic conditions.

NOTE A full explanation of the term "rated" is provided in IEC 60268-2. See also term 151-16-08 in IEC 60050-151:2001.

4.2 Climatic conditions

IEC 60268-1 states that tests should be carried out in the following environment in order to prevent the influence of temperature and humidity that can affect the properties of microspeakers.

– ambient temperature: 15 °C to 35 °C;
– relative humidity: 25 % to 75 %;
– air pressure: 86 kPa to 106 kPa.

And the standard climatic conditions for arbitration testing are as follows:

– ambient temperature: (23 ± 1) °C;
– relative humidity: 48 % to 52 %;
– air pressure: 86 kPa to 106 kPa.

4.3 Normal measuring conditions

The microspeaker is understood to be working under normal measuring conditions when all the following conditions are fulfilled:

a) the acoustical environment is specified, and chosen from the ones specified in Clause 5;
b) the microspeaker to be measured is mounted in accordance with Clause 6;
c) the microspeaker is positioned with respect to the measuring microphone and the walls in accordance with Clause 7;
d) the measuring equipment suitable for determining the desired characteristics is connected in accordance with Clause 8;
e) the microspeaker is supplied with a specified test signal, in accordance with Clause 11, of a stated voltage U, within the rated frequency range in accordance with 16.1. If required, the input power P can be calculated from the equation: $P = U^2/R$, where R is the rated impedance in accordance with 13.2.

5 Acoustical environment

5.1 General

Acoustical measurements will be made according to one of the acoustic field conditions specified in 5.2 to 5.5, and the choice shall be stated in the results.

5.2 Free-field conditions

Acoustical conditions that approach those of free-field space are used. The environment shall be considered satisfactory where the sound pressure decreases with the distance (r) from a point source according to the $1/r$ law, also with an accuracy of ±0,5 dB in the measured sound pressure amplitude in the region occupied by the sound field between the microspeaker and the microphone during the measurement.

Free-field conditions will prevail over the whole frequency range of measurement. If the environment (e.g. an anechoic chamber at low frequencies) does not fulfill these free-field conditions over the entire frequency range of the measurement, the manufacturer shall state the valid frequency range.

5.3 Half-space free-field conditions

Acoustical conditions where a free-field (see 5.2) exists in a half space are used. These conditions will be met with a reflecting plane of sufficient size so that the sound pressure from a point source mounted on the surface of the plane decreases in the manner specified in 5.2.

5.4 Simulated free-field conditions

Acoustical conditions where the simulated free-field conditions are equivalent to those of free space for the period required for a measurement are used.

The conditions will be met in any environment (e.g. large rooms with no obstructions) where sound emitted by the microspeaker reflected from any surface or object in the environment does not reach the measuring microphone before the completion of the direct sound measurement.

Any such reflection reaching the microphone will be excluded from the measurement by gating or other means.

NOTE Under such conditions, successive measurements are separated by time intervals sufficient for the sound pressure level to decrease to a negligible value owing to reverberation within the space.

5.5 Half-space simulated free-field conditions

Acoustical conditions where the simulated free-field (see 5.4) exists in a half-space are used. These conditions shall be used when a reflecting plane, forming one boundary of a simulated free-field environment, is of sufficient size that no reflections from its edge reach the measuring microphone during the measurement.

NOTE Under such conditions, successive measurements are separated by time intervals sufficient for the sound pressure level to decrease to a negligible value owing to reverberations within the space.

6 Mounting of the microspeaker

6.1 Mounting and acoustic loading of microspeaker units

The performance of the drive unit (transducer) is determined by the properties of the unit itself as well as its acoustic loading. The acoustic loading depends upon the mounting arrangement, which shall be clearly described in the presentation of the results.

One of the following three types of mounting shall be used:

a) in free-field, a standard micro-baffle, the drive unit with/without a specified measuring enclosure;

b) in free-field, in free air, the drive unit with/without a specified measuring enclosure;

c) in free-field, a plane wave tube, the drive unit with/without a specified measuring enclosure;

d) in half-space free-field, the drive unit flushed with a reflecting plane, the drive unit with/without a specified measuring enclosure.

NOTE Mounting condition a) approaches a half-space free-field down to a lower limiting frequency, the value of which depends on the chosen measuring distance. Measurements made at frequencies below this limiting value can be used for comparative purposes only.

The structure and material of a specified measuring enclosure (known as a "box"), whose net volume is usually no more than 1 cm^3, shall be specified by the manufacturer and indicated in the results.

6.2 Mounting and acoustic loading of microspeaker systems

Microspeaker systems are usually measured without an additional baffle. If the manufacturer specifies a special type of mounting for the microspeaker system, this shall be used for the measurement. The mounting method used shall be specified in the results.

6.3 Standard micro-baffle

The standard micro-baffle shall be made of a plane front surface that is acoustically reflective. The micro-baffle shall have the dimensions shown in Figure 1.

The standard micro-baffle should be made of a material of adequate thickness to ensure negligible vibration. The edge of the radiating element should be substantially flush with the front of the micro-baffle. This may be achieved by using a thin, rigid sub-baffle with or without a chamfer, as shown in Figure 2.

Dimensions in millimetres

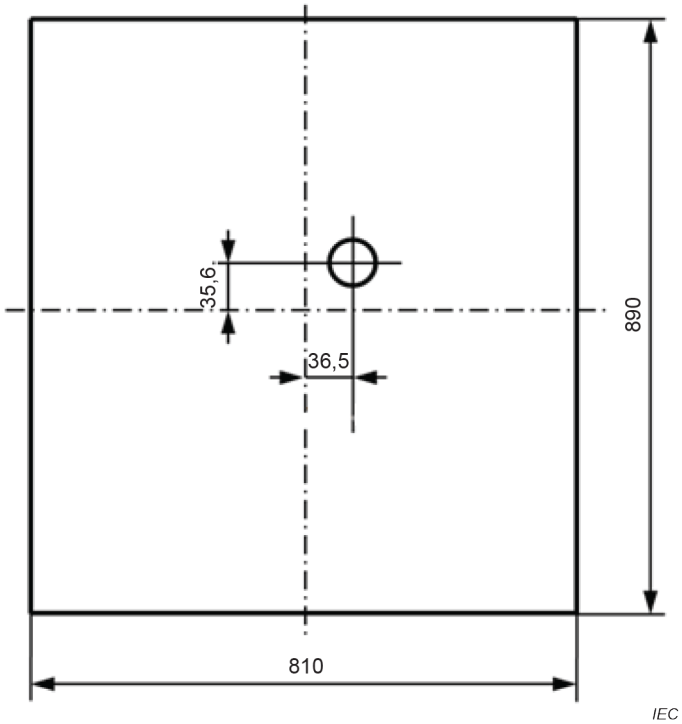
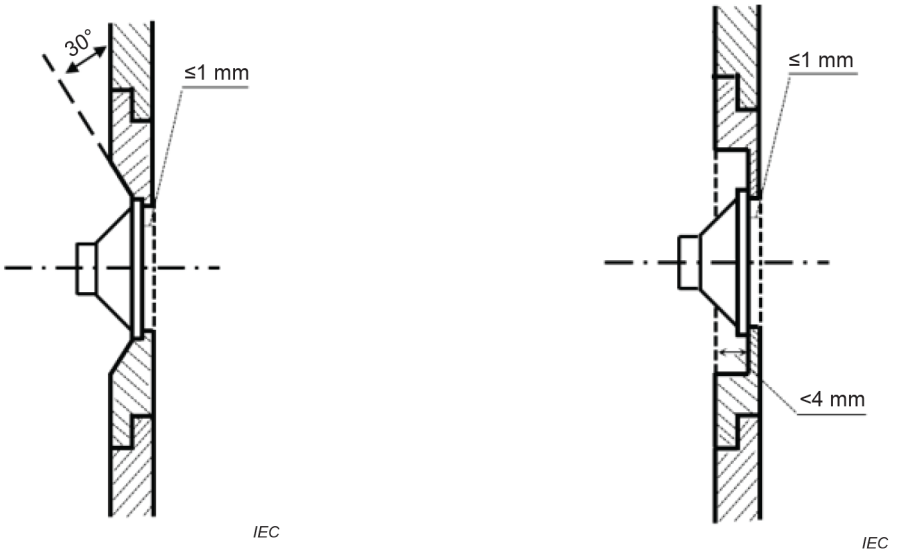


Figure 1 – Standard micro-baffle

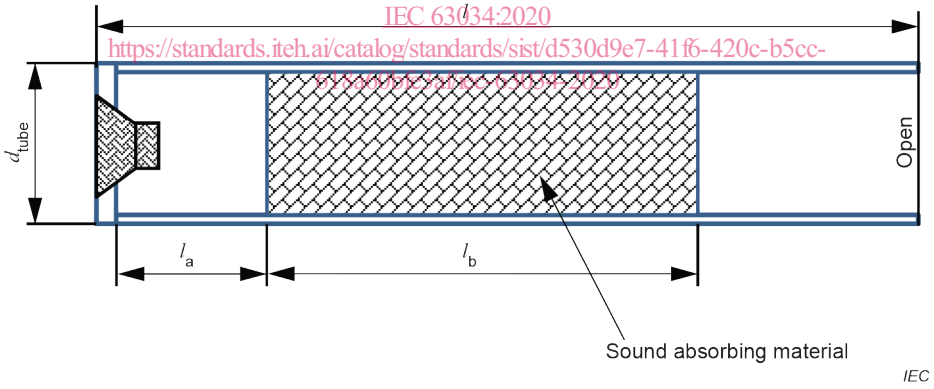


a) Sub-baffle with a chamfer **b) Sub-baffle without a chamfer**

Figure 2 – Standard micro-baffle with sub-baffle

6.4 Measuring plane wave tube

The tube shown in Figure 3 shall be used. The tube shall be made with an acoustically reflective material.



The diameter of the tube d_{tube} shall be 1,5 to 2,5 times as large as the diameter of the radiating element to be measured. The length of the tube l shall be between 600 mm and 1 000 mm.

The tube shall be of a material with adequate stiffness to ensure negligible vibration.

The edge of the radiating element shall be substantially flush with the front surface of the end of the tube.

An appropriate sound absorbing material shall be used to remove standing waves that can occur in the tube. A clearance l_a of between 150 mm and 200 mm and a length l_b of between 200 mm and 500 mm are recommended.

The recommended material of the tube is PVC (vinyl chloride). The recommended material of sound absorbing material is polyester fibre (density: approximately between 20 kg/m^3 and 25 kg/m^3, total mass: between 14 g and 30 g).

After mounting with plane wave tube, the fundamental resonance frequency of the drive unit shall not be changed by more than 5 % and no additional resonance peak shall be generated in the electrical input impedance.

Figure 3 – Plane wave tube

7 Positioning of microspeaker and measuring microphone

7.1 Positioning of the microspeaker

7.1.1 General

The terms in 7.1 are specified by the manufacturer and cannot be measured.

7.1.2 Rated geometrical condition

NOTE This is a rated condition in accordance with 4.1.

The position and orientation of the diaphragm or other kind of radiator shall be stated using the radiator's reference point o_{ref}, the normal vector n_{ref} and the polar vector p_{ref} as illustrated in Figure 4.

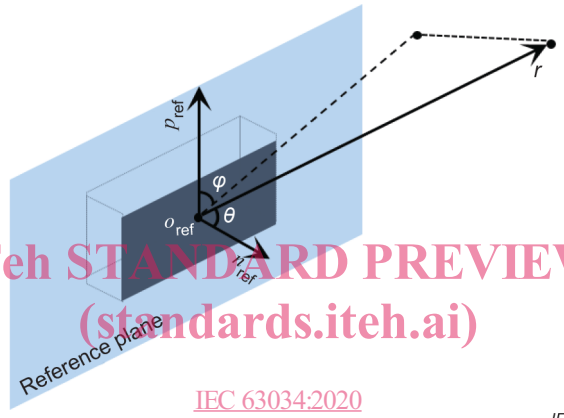


Figure 4 – Rated geometrical conditions of the microspeaker

7.1.3 Reference plane

A reference plane with respect to a physical feature of the microspeaker shall be specified by the manufacturer.

The reference plane shall be used to define the position of the reference point o_{ref} and the direction of the normal vector n_{ref}.

NOTE For symmetrical structures, the reference plane is usually parallel to the radiating surface at the rest position of the microspeaker. For asymmetrical structures, the reference plane is better indicated by means of a diagram.

7.1.4 Reference point

A reference point on the reference plane shall be specified by the manufacturer.

NOTE For symmetrical structures, the reference point o_{ref} is usually the point of axial symmetry of the microspeaker within the reference plane; for asymmetrical structures, the reference point is better indicated by means of a diagram.

7.1.5 Normal vector

The line perpendicular to the reference plane at the reference point as well as its direction shall be specified by the manufacturer. The normal vector $\boldsymbol{n}_{\text{ref}}$ also defines the polar angle $\theta = 0$ in spherical coordinates.