

# INTERNATIONAL STANDARD

**IEC**  
**60268-4**

Third edition  
2004-02

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## Sound system equipment –

### Part 4: Microphones

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**SOUND SYSTEM EQUIPMENT –****Part 4: Microphones**

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International Standard IEC 60268-4 has been prepared by IEC Technical Committee 100: Audio, video and multimedia systems and equipment.

This third edition cancels and replaces the second edition published in 1997, and constitutes a technical revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
100/721/FDIS	100/750/RVD

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

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

The committee has decided that the contents of this publication will remain unchanged until 2008. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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## SOUND SYSTEM EQUIPMENT –

### Part 4: Microphones

#### 1 Scope

This part of IEC 60268 specifies methods of measurement for the electrical impedance, sensitivity, directional response pattern, dynamic range and external influences of sound system microphones, and also gives recommendations as to characteristics to be specified.

It applies to sound system microphones for all applications for speech and music. It does not apply to measurement microphones, but it does apply to each audio channel of microphones having more than one channel, for example for stereo or similar use. It is also applicable to flush-mounted microphones and to the analogue characteristics of microphones with digital audio output.

For the purposes of this International Standard, a microphone includes all such devices as transformers, pre-amplifiers, or other elements that form an integral part of the microphone, up to the output terminals specified by the manufacturer.

NOTE The characteristics specified in this standard do not completely describe the subjective response of the microphone. Further work is necessary to find new definitions and measurement procedures for a later replacement by objective characteristics of at least some of the subjective descriptions use to describe microphone performance.

#### 2 Normative references

The following referenced documents are indispensable for the application 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 60065:2001, *Audio, video and similar electronic apparatus – Safety requirements*

IEC 60268-1:1985, *Sound system equipment – Part 1: General*

IEC 60268-2:1987, *Sound system equipment – Part 2: Explanation of general terms and calculation methods*

IEC 60268-3:2000, *Sound system equipment – Part 3: Amplifiers*

IEC 60268-5:2003, *Sound system equipment – Part 5: Loudspeakers*

IEC 60268-11:1987, *Sound system equipment – Part 11: Application of connectors for the interconnection of sound system components*

IEC 60268-12:1987, *Sound system equipment – Part 12: Application of connectors for broadcast and similar use*

IEC 60574-3:1983, *Audiovisual, video and television equipment and systems – Part 3: Connectors for the interconnection of equipment in audiovisual systems*

IEC 60914:1988, *Conference systems – Electrical and audio requirements*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2002, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61265:1995, *Electroacoustics – Instruments for measurement of aircraft noise – Performance requirements for systems to measure one-third-octave-band sound pressure levels in noise certification of transport-category aeroplanes*

IEC 61938:1996, *Audio, video and audiovisual systems – Interconnections and matching values – Preferred matching values of analogue signals*

ISO 354:2003, *Acoustics – Measurement of sound absorption coefficients in a reverberant room*

### 3 General conditions

#### 3.1 General

Special reference is made to IEC 60268-1, concerning:

- units and system of measurement;
- frequencies of measurement;
- quantities to be specified and their accuracy (see also 4.7);
- marking (see also 6.1);
- ambient conditions;
- filters, networks and measuring instruments for noise specification and measurement;
- individual specifications and type specifications;
- graphical presentation of characteristics;
- scales for graphical presentation;
- personal safety and prevention of spread of fire;
- method of producing a uniform alternating magnetic field;
- search coils for measuring the magnetic field strength,

and to IEC 61938 concerning powering of microphones.

#### 3.2 Measurement conditions

##### 3.2.1 Introduction

For convenience in specifying how microphones shall be set up for measurement, a set of conditions has been defined in this recommendation under the title of "rated conditions".

Three ratings are basic to the formulation of these concepts:

- rated impedance (see 9.2);
- rated power supply (see 8.1);
- rated sensitivity (see 10.3.1).

To obtain the correct conditions for measurement, the above mentioned ratings shall be taken from the specifications supplied by the manufacturer of the equipment.

The term "rated" applied to other characteristics relates to the specification or measurement of the particular characteristic under rated conditions or under conditions unambiguously connected to them. This applies, for example, to the following two characteristics:

- rated output voltage;
- rated equivalent sound pressure level due to inherent noise.

Methods of measurement are given in this standard for electrical impedance, sensitivity, directional pattern, dynamic range and external influences. Where alternative methods are given, the chosen method shall be specified.

### 3.2.2 Rated conditions

The microphone is understood to be working under rated conditions when the following conditions are fulfilled:

- the microphone shall operate at no-load condition (see 9.2);
- if the microphone needs a power supply, this shall be the rated power supply;
- the microphone (except a close-talking microphone) shall be placed in a free sound field, the waves having zero degree incidence with respect to the reference direction;
- the undisturbed sound pressure (in the absence of the microphone) in the sound field at the reference point of the microphone shall be sinusoidal and set at a level of 0,3 Pa (84 dB SPL)
- for close-talking microphones, the microphone shall be placed at a stated distance, no more than 25 mm from the artificial mouth, and the undisturbed sound pressure in the sound field at the reference point of microphone shall be sinusoidal and set at a level of 3 Pa (104 dB SPL).
- if a special microphone needs a different measurement level, this shall be stated in the technical data together with the reason for this. Levels related to the normal reference level of 94 dB by multiples of 10 dB are preferred,
- controls, if any, shall be set to the position recommended by the manufacturer;
- in the absence of a clear reason to the contrary, the measurement frequency shall be 1000 Hz (see IEC 60268-1);
- the ambient pressure, the relative humidity and the ambient temperature shall be within the limits given in IEC 60268-1, and shall be stated.

NOTE 1 The ITU-T has published Recommendation P.51 which includes the specification of an artificial mouth. An artificial mouth conforming to that Recommendation should be used wherever possible.

NOTE 2 An artificial voice which emits a signal simulating that emitted by noise should be used for measuring pressure-gradient close-talking microphones to ensure that nasal sounds are adequately reproduced. The absence of such sounds in the reproduction may give rise to unnatural speech quality.

NOTE 3 Limitations of the measurement site or the measurement equipment may also require the use of other than the given measurement sound pressure levels. This is acceptable only if any change in performance between the level used and the reference level are known with the necessary accuracy for the relevant characteristics.

## 4 Particular conditions

### 4.1 Pre-conditioning

A microphone with preamplifier shall be switched on for the period of time specified by the manufacturer, before measurements are made, to allow the components to reach the stationary temperature for rated conditions. If the manufacturer specifies no period, a period of 10 s shall be allowed for stabilization. If the microphone contains a vacuum tube or other heating device the time shall be 10 min.

## 4.2 Sound source

The sound source shall be capable of producing at the microphone position the sound pressure level as defined for rated conditions. The amplitude non-linearity of the sound source shall be held to such a value that the effect on the measured response does not exceed 0,5 dB. If the conditions of measurement preclude the possibility of securing sufficiently low distortion, a narrow-band filter may be used at the microphone output terminals, which allows the response at the fundamental frequency to be measured.

For free-field calibration and calibration of performance microphones, the sound source shall be contained in an enclosure which radiates sound from one well-defined opening only, and such an opening shall be radially symmetrical with respect to the axis of the reference direction of the microphone.

## 4.3 Measurement of sound pressure

A calibrated reference pressure microphone shall be used to measure the sound pressure. The reference microphone should be calibrated with an accuracy of  $\pm 1$  dB or better.

## 4.4 Voltage measuring system

The electromotive force (e.m.f.) generated by the microphone, when in a sound field, shall be determined by measuring the open-circuit voltage of the microphone using a voltmeter with an input impedance of at least 100 times the rated impedance of the microphone.

NOTE If external equipment, such as a power supply, places a load on the microphone, the true e.m.f. should be calculated by correcting for the effect of this load.

## 4.5 Acoustical environment

### 4.5.1 General

The microphone can be measured in different acoustical environments:

- a) in a free field or similar without boundaries:
  - spherical waves, or
  - plane waves, or
  - waves produced by a specific sound source (artificial mouth or artificial head);
- b) in a diffuse field;
- c) coupled to a sound source by means of a small cavity (coupler).

### 4.5.2 Free-field conditions

A free-field sound wave is normally divergent in character. In certain circumstances it can approximate an ideal plane wave.

Free-field conditions can be obtained:

- in open air, ambient noise and wind permitting, or
- in an anechoic room, or
- in a duct.

A sound source of small dimensions with respect to the wavelength produces a spherical wave in these environments. The spherical wave can be approximated to a plane wave in a region of measurement located at a sufficient distance from the source. Spherical waves can be used to measure pressure microphones but it is necessary to use almost perfect plane waves in the low frequency range for the measurement of pressure gradient microphones.