
Measurement microphones - Part 3: Primary method for free-field calibration of laboratory standard microphones by the reciprocity technique (IEC 61094-3:1995)

Measurement microphones -- Part 3: Primary method for free-field calibration of laboratory standard microphones by the reciprocity technique

Meßmikrofone -- Teil 3: Primärverfahren zur Freifeld-Kalibrierung von Laboratoriums-Normalmikrofonen nach der Reziprozitätsmethode

Microphones de mesure -- Partie 3: Méthode primaire pour l'étalonnage en champ libre des microphones étalons de laboratoire par la méthode de réciprocité

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ICS:

17.140.50	Elektroakustika	Electroacoustics
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Measurement microphones
Part 3: Primary method for free-field calibration of laboratory
standard microphones by the reciprocity technique
(IEC 1094-3:1995)

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This European Standard was approved by CENELEC on 1995-11-28. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 29/294/DIS, future edition 1 of IEC 1094-3, prepared by IEC TC 29, Electroacoustics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61094-3 on 1995-11-28.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-09-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-09-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A, B and C are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 1094-3:1995 was approved by CENELEC as a European Standard without any modification.

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Annex ZA (normative)

Normative references to international publications
with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 27-2	1972	Letter symbols to be used in electrical technology - Part 2: Telecommunications and electronics	HD 245.2 S1 ¹⁾	1983
IEC 50(801)	1984	International electrotechnical vocabulary (IEV) - Chapter 801: Acoustics and electroacoustics	-	-
IEC 1094-1	1992	Measurement microphones Part 1: Specifications for laboratory standard microphones	EN 61094-1 ²⁾	1994
IEC 1094-2	1992	Part 2: Primary method for pressure calibration of laboratory standard microphones by the reciprocity technique	EN 61094-2	1993
ISO 9613-1	1993	Acoustics - Attenuation of sound during propagation outdoors Part 1: Calculation of the absorption of sound by the atmosphere	-	-
ISO	1993	Guide to the expression of uncertainty of measurements	-	-

1) HD 245.2 S1 includes supplements A:1975 and B:1980 to IEC 27-2.

2) EN 61094-1 includes the corrigendum February 1993 to IEC 1094-1.

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NORME
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Première édition
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1995-11

Microphones de mesure

Partie 3:

Méthode primaire pour l'étalonnage en champ libre
des microphones étalons de laboratoire
par la méthode de réciprocité

(standards.iteh.ai)

Measurement microphone

<https://standards.iteh.ai/catalog/standards/sist/f4f09aa0-4376-48b6-9e7c-9d801fee/sist-en-61094-3-2002>

Part 3:

Primary method for free-field calibration
of laboratory standard microphones
by the reciprocity technique

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International Electrotechnical Commission
Международная Электротехническая Комиссия

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEASUREMENT MICROPHONES

**Part 3: Primary method for free-field calibration
of laboratory standard microphones
by the reciprocity technique**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a world-wide organization for standardization comprising all national electrotechnical Committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

International Standard IEC 1094-3 has been prepared by IEC technical committee 29: Electroacoustics.

This part of IEC 1094 cancels and replaces IEC 486 published in 1974.

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

DIS	Report on voting
29/294/DIS	29/311/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.

IEC 1094 consists of the following parts, under the general title *Measurement microphones*:

- Part 1: 1992, Specifications for laboratory standard microphones
- Part 2: 1992, Primary method for pressure calibration of laboratory standard microphones by the reciprocity technique
- Part 3: 1995, Primary method for free-field calibration of laboratory standard microphones by the reciprocity technique
- Part 4: 1995, Specifications for working standard microphones.

Annexes A, B and C are for information only.

MEASUREMENT MICROPHONES

Part 3: Primary method for free-field calibration of laboratory standard microphones by the reciprocity technique

1 Scope

This part of IEC 1094 is applicable to laboratory standard microphones meeting the requirements of IEC 1094-1. The principles of the method are applicable to other types of microphones. In particular, microphones which fulfil the requirements of IEC 1094-1, when fitted with a special adaptor, may also be calibrated according to this standard when the adaptor is removed.

This part of IEC 1094 specifies a primary method of determining the free-field sensitivity so as to establish a reproducible and accurate basis for the measurement of sound pressure under free-field conditions.

This part of IEC 1094 is intended for use by laboratories with highly experienced staff and specialized equipment.

2 Normative references

The following normative documents contain provisions, which through reference in this text, constitute provisions of this part of IEC 1094. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 1094 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 27-2: 1972, *Letter symbols to be used in electrical technology - Part 2: Telecommunications and electronics*

IEC 50 (801): 1994, *International Electrotechnical Vocabulary (IEV) - Chapter 801: Acoustics and electro-acoustics*

IEC 1094-1: 1992, *Measurement microphones - Part 1: Specifications for laboratory standard microphones*

IEC 1094-2: 1992, *Measurement microphones - Part 2: Primary method for pressure calibration of laboratory standard microphones by the reciprocity technique*

ISO 9613-1: 1993, *Acoustics - Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere*

ISO: 1993, *Guide to the expression of uncertainty of measurements*

3 Definitions

For the purpose of this part of IEC 1094, the following definitions apply in addition to the definitions given in IEC 1094-1.

3.1 reciprocal microphone: A linear passive microphone for which the open-circuit reverse and forward transfer impedances (see 206 in IEC 27-2) are equal in magnitude.

3.2 phase angle of free-field sensitivity of a microphone: For a sinusoidal plane progressive wave of given frequency, for a specified direction of sound incidence and for given environmental conditions, the phase angle between the open-circuit voltage and the sound pressure that would exist at the position of the acoustic centre of the microphone in the absence of the microphone.

Unit: degree or radian ($^{\circ}$ or rad)

3.3 acoustic centre of a microphone: For a sound-emitting transducer, for a sinusoidal signal of given frequency and for a specified direction and distance, the point from which the approximately spherical wavefronts, as observed in a small region around the observation point, appear to diverge.

NOTES

- 1 The acoustic centre of a reciprocal transducer when used as a receiver is coincident with the acoustic centre when used as a transmitter.
- 2 This definition only applies to regions of the sound field where spherical, or approximately spherical wavefronts are observed.

3.4 equivalent point-transducer: Transducer which, when located at the position of an acoustic centre of a microphone, simulates the transmitting and receiving characteristics of that microphone for a given direction and range of distance.

3.5 electrical transfer impedance: For a system of two acoustically coupled microphones, the quotient of the open-circuit voltage of the microphone used as receiver by the input current through the electrical terminals of the microphone used as transmitter.

Unit: ohm (Ω)

NOTE - This impedance is defined for the ground-shield configuration given in 7.2 of IEC 1094-1.

3.6 acoustical transfer impedance: For a system of two acoustically coupled microphones, the quotient of the sound pressure acting on the diaphragm of the microphone used as receiver by the short-circuit volume velocity produced by the microphone used as transmitter.

Unit: pascal second per cubic metre ($\text{Pa}\cdot\text{s}/\text{m}^3$)

3.7 principal axis of a microphone: Line through the centre of and perpendicular to the diaphragm of the microphone.

3.8 free-field conditions: Free-field conditions prevail when a sound wave can propagate freely without disturbances of any kind.

4 Reference environmental conditions

The reference environmental conditions are:

- temperature $t_r = 23,0 \text{ }^{\circ}\text{C}$;
- static pressure $p_{s,r} = 101,325 \text{ kPa}$;
- relative humidity $H_r = 50 \text{ } \%$.

NOTE - The reference temperature is chosen to be $23,0 \text{ }^{\circ}\text{C}$ because practical considerations require that most calibrations be carried out at, or near, this temperature.