

BRITISH STANDARD

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61094-3 : 1996
IEC 1094-3 :
1995**

Specification for

Measurement microphones

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

The European Standard EN 61094-3 : 1995 has the status of a
British Standard

ICS 17.140.50; 33.160.50

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee EPL/29, Electroacoustics, upon which the following bodies were represented:

- British Association of Otolaryngologists
- British Hearing Aid Industry Association
- British Medical Association
- British Society of Audiology
- British Telecommunications plc
- Confederation of British Industry
- Department of Health
- Department of Trade and Industry (National Physical Laboratory)
- Health and Safety Executive
- Institute of Acoustics
- Institute of Sound and Vibration Research
- Institution of Electrical Engineers
- Medical Research Council
- Ministry of Defence
- Royal Aeronautical Society
- Royal National Institute for Deaf people
- Society of Environmental Engineers
- University of Exeter

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National foreword

This British Standard has been prepared by Technical Committee EPL/29 and is the English language version of EN 61094-3 : 1995, *Measurement microphones Part 3: Primary method for free-field calibration of laboratory standard microphones by the reciprocity technique*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1094-3, first edition 1995, and supersedes BS 5679 : 1979 which is withdrawn.

Cross-references

Publication referred to	Corresponding British Standard
IEC 50(801) : 1994	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 3 <i>Terms particular to telecommunications and electronics</i> Group 08 : 1995 <i>Acoustics and electroacoustics</i>
EN 61094-1 : 1994 (IEC 1094-1 : 1992)	BS EN 61094 <i>Specification for measurement microphones</i> Part 1 : 1995 <i>Specifications for laboratory standard microphones</i>
EN 61094-2 : 1993 (IEC 1094-2 : 1992)	Part 2 : 1994 <i>Primary method for pressure calibration of laboratory standard microphones by the reciprocity technique</i>

Compliance with a British Standard does not of itself confer immunity from legal obligations.

ICS 17.140.50; 33.160.50

Descriptors: Electroacoustics, microphones, laboratory equipment, standard measures, acoustic measurements, sound pressure, effectiveness, calibration

English version

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

(IEC 1094-3 : 1995)

Microphones de mesure

Partie 3: Méthode primaire pour l'étalonnage en
champ libre des microphones étalons de
laboratoire par la méthode de réciprocité
(CEI 1094-3 : 1995)

Meßmikrofone

Teil 3: Primärverfahren zur Freifeld-Kalibrierung
von Laboratoriums-Normalmikrofonen nach der
Reziprozitätsmethode
(IEC 1094-3 : 1995)

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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.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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

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 **Documents**
Document Sharing Hub

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.

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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.