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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Electroacoustics – Specifications for personal sound exposure meters

Electroacoustique – Spécifications des exposimètres acoustiques individuels

IEC 61252:1993-06+AMD1:2000-10+AMD2:2017-04 CSV(en-fr)

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IEC 61252:1993-06+AMD1:2000-10+AMD2:2017-04 CSV(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROACOUSTICS –

SPECIFICATIONS FOR PERSONAL SOUND EXPOSURE METERS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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IEC 61252 edition 1.2 contains the first edition (1993-06) [documents 29(CO)162 and 29(CO)168], its amendment 1 (2000-10) [documents 29/457/FDIS and 29/471/RVD] and its amendment 2 (2017-04) [documents 29/910/CDV and 29/936/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61252 has been prepared by IEC technical committee 29: Electroacoustics.

Specifications in this International Standard for personal sound exposure meters are consistent, insofar as practical, with comparable specifications in IEC 60804 for integrating sound level meters. The four principal technical differences from the specifications in the 1985 issue of IEC 60804 are:

a) sound exposure is measured and displayed rather than equivalent-continuous frequency-weighted sound pressure level or sound exposure level;

b) accuracy of squaring and integrating short-duration signals is specified by measurement of the sound exposure of a sequence of repeated constant-amplitude, 1 ms and 10 ms duration, 4 kHz tonebursts rather than by measurement of the response to single 4 kHz tonebursts of varying amplitudes with durations ranging from 1 ms to 1 s, each single toneburst being accompanied by a continuous, in-phase, low-level, 4 kHz background signal;

c) specifications for a personal sound exposure meter include a limitation on the difference between the sound exposure indicated in response to positive-going and negative-going unipolar pulses; and

d) requirements are not specified for the directional response of the microphone of a personal sound exposure meter intended to be worn on a person.

This International Standard includes two informative annexes. Annex A provides a table of selected sound exposures and corresponding normalized 8-h-average sound levels. Annex B describes recommendations for tests to verify the performance of a personal sound exposure meter.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

According to this International Standard, a personal sound exposure meter is intended to measure sound exposure as the time integral of the square of the instantaneous A-frequency-weighted sound pressure. This operating principle underlies the measurement of sound exposure level according to IEC 60804. It is the "equal-energy exchange rate" whereby a doubling (or halving) of the integration time of a constant sound level yields a two-fold increase (or decrease) of sound exposure. Similarly, an increase (or decrease) of 3 dB in a constant input sound level for a constant integration time yields a doubling (or halving) of the sound exposure.

Noise dose meters usually have been designed to indicate noise dose as a percentage of a legal limit. The limit and its definition vary from country to country and are subject to change. To facilitate international comparison of sound exposure records with numerical values of convenient magnitude, this International Standard specifies an instrument that indicates sound exposure in pascal-squared hours. An indication of sound exposure with a unit other than pascal-squared hours is permitted provided the manufacturer specifies a procedure for converting the indication to pascal-squared hours, for example, a display of "dose" as a fraction or a percentage of a specified sound exposure in pascal-squared hours.

The principal application for a personal sound exposure meter is the measurement of sound exposure in the vicinity of a person's head; e.g., for assessment of potential hearing impairment according to Standards such as ISO 1999. The microphone of a personal sound exposure meter may be worn on the shoulder, collar, or other location close to one ear. For many practical situations, such as in a factory where the sound-incidence angle may vary widely during the course of workday, the sound exposure indicated by an instrument worn on a person is likely to be different from that which would be measured in the absence of the person. The influence of the person wearing a personal sound exposure meter should be considered when estimating the sound exposure that would have been measured with the person absent.

ELECTROACOUSTICS –

SPECIFICATIONS FOR PERSONAL SOUND EXPOSURE METERS

1 Scope

1.1 Sound exposure is a physical measure that accounts for both the sound pressure and its duration, at a given location, through an integral-over-time of the square of instantaneous frequency-weighted sound pressure.

1.2 This International Standard is applicable to instruments for measurement of A-frequency-weighted sound exposure resulting from steady, intermittent, fluctuating, irregular, or impulsive sounds. Instruments complying with the specifications of this International Standard are intended to be worn on a person to measure sound exposure. Measurements of sound exposure in the workplace may be useful for determinations of occupational noise exposure, in accordance with ISO 1999 and ISO 9612.

1.3 This International Standard specifies acoustical and electrical performance requirements for personal sound exposure meters of one accuracy grade. The accuracy grade corresponds to that for an integrating sound level meter which complies with the Type 2 requirements of IEC 60804 for an A-weighted sound pressure level range from 80 dB to 130 dB and a nominal frequency range from 63 Hz to 8 kHz.

1.4 Tolerances on deviations of an instrument's performance from specified design goals represent the performance capabilities of practical instruments. Personal sound exposure meters are required to operate within the tolerances of this International Standard over specified ranges of environmental conditions.

2 Normative references

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

IEC 60050(801):1984, *Advance edition of the International Electrotechnical Vocabulary, Chapter 801, Acoustics and electroacoustics*

IEC 60651:1979, *Sound level meters*

IEC 60801-2:1984, *Electromagnetic compatibility for industrial-process measurement and control equipment – Part 2: Electrostatic discharge requirements*

IEC 60801-3:1984, *Electromagnetic compatibility for industrial-process measurement and control equipment – Part 3: Radiated electromagnetic field requirements*

IEC 60804:1985, *Integrating-averaging sound level meters*

IEC 60942:1988, *Sound calibrators*

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

IEC 61000-4-3:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-20:2010, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*

IEC 61000-6-1:1997, *Electromagnetic compatibility (EMC) – Part 6: Generic standards – Section 1: Immunity for residential, commercial and light-industrial environments*

IEC 61000-6-2:1999, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

CISPR 22:1997, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

CISPR 61000-6-3:1996, *Electromagnetic compatibility (EMC) – Part 6: Generic standards – Section 3: Emission standard for residential, commercial and light-industrial environments*

ISO 266:1975, *Acoustics – Preferred frequencies for measurements*

ISO 1683:1983, *Acoustics – Preferred reference quantities for acoustic levels*

ISO 1999:1990, *Acoustics – Determination of occupational noise exposure and estimation of noise-induced hearing impairment*

ISO 9612:199X, *Acoustics – Guidelines for the measurement and assessment of exposure to noise in the working environment* *

3 Definitions

For the purposes of this International Standard, the following definitions apply. Definitions are consistent with corresponding definitions in IEC 60050(801).

3.1
sound exposure
time integral of squared, instantaneous A-frequency-weighted sound pressure over a specified event, for example, a working day

NOTE 1 Although the primary SI unit for sound exposure is the pascal-squared second, for measurements of sound exposure in the workplace, the more-convenient derived unit, the pascal-squared hour, is used in this International Standard.

NOTE 2 In symbols, (A-weighted) sound exposure is

$$E = \int_{t_1}^{t_2} p_A{}^2 (t)\, \mathrm{d}\, t \qquad (1)$$

where $p_A{}^2(t)$ is the square of instantaneous A-frequency-weighted sound pressure as a function of time t for an integration time period starting at t_1 and ending at t_2. The unit of sound exposure E is pascal-squared hours if A-weighted sound pressure p_A is in pascals and the running time t in hours.

* At present, at the stage of draft.

3.2
equivalent-continuous A-weighted sound pressure level; time-average sound level
in decibels, ten times the logarithm to the base ten of the ratio of the time-mean-square, A-frequency-weighted sound pressure, during an averaging time period T, to the square of the standard reference sound pressure

NOTE 1 In symbols, equivalent-continuous A-weighted sound pressure level $L_{Aeq,T}$, or time-average sound level, is given by:

$$L_{Aeq,T} = 10 \lg \{[(1/T) \int_0^T p_A^{\,2}(t)\,\mathrm{d}t\,] / p_0^{\,2}\} \quad (2)$$

where running time t and averaging time T are expressed in the same units, $p_A(t)$ is the instantaneous A-weighted sound pressure in pascals, and p_0 is the reference sound pressure of twenty micropascals (20 μPa) per ISO 1683.

NOTE 2 Equivalent-continuous A-weighted sound pressure level during the averaging time period T is related to the total sound exposure occurring within that period by

$$E = (p_0^2\,T)\,[10^{0,1 \times L_{Aeq,T}}] \quad (3)$$

or, alternatively, by

$$L_{Aeq,T} = 10 \lg [E / (p_0^2\,T)] \quad (4)$$

where the unit of time is the same for both sound exposure and averaging time.

3.3
normalized 8-h-average sound level
in decibels, level of the time-mean-square, A-weighted sound pressure during a normalization time period T_n of 8 h such that the sound exposure therefrom is equal to that of a time-varying sound at a place where total sound exposure occurs within a time period not necessarily 8 h

NOTE 1 In symbols, a normalized 8-h-average sound level (letter symbol $L_{Aeq,8hn}$), relative to the reference sound pressure p_0 and the 8 h normalization time period T_n, is given by:

$$L_{Aeq,8hn} = 10 \lg [E / (p_0^2\,T_n)] \quad (5)$$

NOTE 2 For computations, a simpler form of Eq.(5) for normalized 8-h-average sound level in decibels is obtained, for sound exposure E in pascal-squared hours, after substituting the values of 20 micropascals for p_0 and 8 h for T_n, as

$$L_{Aeq,8hn} = 10 \lg [(E \times 10^9) / 3{,}2] \quad (6)$$

NOTE 3 When a total sound exposure is described indirectly by an equivalent-continuous A-weighted sound pressure level $L_{Aeq,T}$, for an averaging time T greater or less than the normalization time period of 8 h, normalized 8-h-average sound level may be determined from

$$L_{Aeq,8hn} = L_{Aeq,T} + 10 \lg (T/T_n) \quad (7)$$

NOTE 4 Annex A provides a table of normalized 8-h-average sound levels and corresponding sound exposures. For example, a sound exposure of 1 Pa^2h (irrespective of the period of time over which it is measured) corresponds to a normalized 8-h-average sound level of nearly 85 dB; a sound exposure of 3,2 Pa^2h corresponds exactly to a normalized 8-h-average sound level of 90 dB.

NOTE 5 Normalized 8-h-average sound level in Eq.(5) is identical to "daily personal noise exposure $L_{EP,d}$ in decibels" defined in Article 2 of the "European Communities Council Directive of 12 May 1986 on the protection of workers from the risks related to exposure to noise at work" (Directive 86/188/EEC).

NOTE 6 Normalized 8-h-average sound level in Eq.(5) is also the same as "noise exposure level normalized to a nominal 8 h working day, $L_{EX,8h}$" defined in ISO 1999.

3.4
sound level range
in decibels, lower and upper time-average, A-weighted sound pressure levels without exponential time weighting, specified by the manufacturer, within which linearity requirements of this International Standard are met

3.5
sound exposure range
range between an upper and a lower sound exposure, both to be specified by the manufacturer, within which the requirements of this International Standard are met and which are displayed on the sound exposure indicator

3.6
reference direction
direction of sound incidence specified by the manufacturer for determining the absolute acoustical sensitivity and frequency response

3.7
reference frequency
frequency of 1 kHz for determining the absolute acoustical sensitivity

3.8
reference sound pressure level
sound pressure level specified by the manufacturer for determining the absolute acoustical sensitivity

3.9
reference integration time
integration time specified by the manufacturer for determining the absolute acoustical sensitivity

3.10
reference sound exposure
calculated sound exposure corresponding to the reference sound pressure level, at the reference frequency, applied for the reference integration time

The following definition applies in addition to those specified in IEC 61000-4-2, IEC 61000-4-3, IEC 61000-6-1, IEC 61000-6-2, and CISPR 61000-6-3.

3.11
reference orientation (of a personal sound exposure meter)
orientation of a personal sound exposure meter that corresponds to the meter as worn in normal use by a person standing upright and facing the principal direction of an emitter or receiver of radio-frequency electromagnetic fields

4 General performance requirements

4.1 A personal sound exposure meter is a combination of a microphone, an amplifier with the required A-frequency weighting, a device to square the frequency-weighted sound pressure signal, an integrator over time, an indicator of sound exposure, and a latching overload indicator. Sound exposures that have been accumulated during a measurement period are retained in the memory until the instrument is reset and are not deleted by triggering of the latching overload indicator.

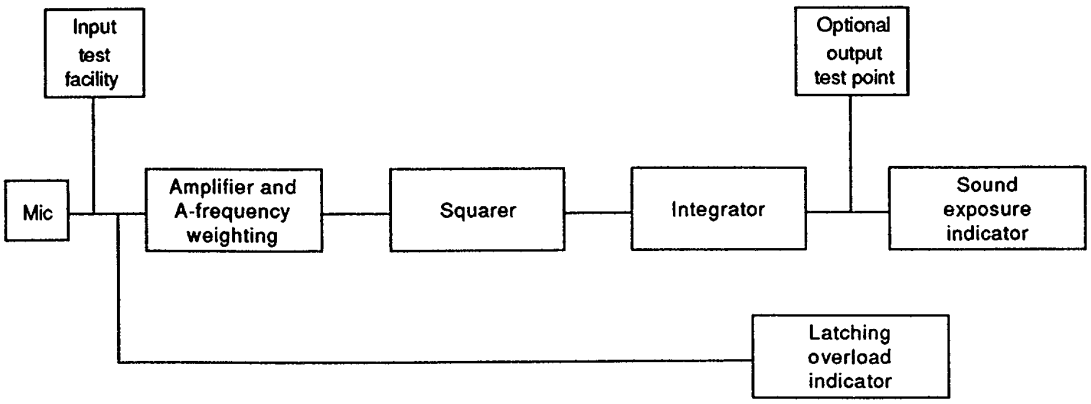

Figure 1 – Functional elements of a personal sound exposure meter

4.2 Because only its overall performance is important, an actual instrument need not be separable into individual functional elements. However, for convenient description of required characteristics, the instrument is considered as if it were a combination of the separate elements shown in figure 1.

4.3 The manufacturer shall provide the means to substitute an electrical input signal in place of the microphone, for the purpose of performing tests on the complete instrument without the microphone.

NOTE The manufacturer may provide an accessible input test point or recommend and provide a dummy microphone or equivalent input adapter (electrical or non-electrical) for performing electrical tests on the instrument.

4.4 An optional (but preferred) accessible output test point may be provided.

4.5 The sound exposure indicator may be built into, or be separate from, the wearable part of an instrument. The quantity indicated is sound exposure, either as a direct indication or as a fraction or percentage of a manufacturer-specified sound exposure. If sound exposure is not indicated directly in pascal-squared hours (Pa^2h), the manufacturer shall provide suitable means to convert the indication to sound exposure in pascal-squared hours.

4.6 The smallest increment of sound exposure displayed by the indicator shall be not greater than 0,1 Pa^2h. The sound exposure range shall be at least from 0,1 Pa^2h to 99,9 Pa^2h.

4.7 The sound level range shall extend at least from 80 dB to 130 dB.

4.8 The manufacturer shall state in the Instruction Manual the sound exposure range and the sound level range.

4.9 If the manufacturer-specified ranges of sound exposure and sound level exceed the minimum requirements of this International Standard, all specifications and associated tolerances shall apply to the ranges stated by the manufacturer.

4.10 If the specified lower boundary of the sound level range is less than 80 dB, the lower boundary of the sound exposure range shall be less than 0,1 Pa^2h.

4.11 Specifications in subsequent clauses for the acoustical and electrical performance of a personal sound exposure meter are applicable for the reference conditions of clause 5. Clause 12 provides requirements for limits on the changes in the sensitivity of a personal sound exposure meter when used under environmental conditions different from the reference conditions.