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Electroacoustics — Simulators of human head and ear

Part 7: Head and torso simulator for the measurement of air-conduction hearing aids

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee EPL/29, Electroacoustics.

A list of organizations represented on this committee can be obtained on request to its secretary.

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TECHNICAL SPECIFICATION

colour inside

Electroacoustics – Simulators of human head and ear – Part 7: Head and torso simulator for the measurement of air-conduction hearing aids

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 17.140.50

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROACOUSTICS – SIMULATORS OF HUMAN HEAD AND EAR –

Part 7: Head and torso simulator for the measurement of air-conduction hearing aids

FOREWORD

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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 60318-7, which is a Technical Specification, has been prepared by IEC technical committee 29: Electroacoustics.

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This publication contains attached files in the form of 3D PDF files. These files are intended to be used as a complement and do not form an integral part of the publication.

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) the document is based on the designs of three different commonly used types of manikins;
b) the cross sections of the head and torso and pinna simulators of the previous edition are replaced by maximum and minimum values of their geometric dimensions;
c) the diffuse field frequency response of the manikin is added;
d) the usable frequency range is extended to 100 Hz to 16 000 Hz;
e) in addition to the cylindrical ear canal extension a tapered ear canal extension is added;
f) design examples of one anatomically shaped manikin and of two different geometrically shaped manikins are given in the annexes;
g) the relationship between tolerance interval, corresponding acceptance interval and the maximum permitted uncertainty of measurement are given in an annex;
h) 3D representations of three different types of pinna simulators are given in an annex.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
29/907/DTS	29/921A/RVDTS

Full information on the voting for the approval of this technical specification 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.

A list of all parts of IEC 60318 series, published under the general title *Electroacoustics – Simulators of human head and ear*, can be found on the IEC website.

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

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

A bilingual version of this publication may be issued at a later date.

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ELECTROACOUSTICS – SIMULATORS OF HUMAN HEAD AND EAR –

Part 7: Head and torso simulator for the measurement of air-conduction hearing aids

1 Scope

This document, which is a Technical Specification, describes a head and torso simulator, or manikin, intended for the measurement of air-conduction hearing aids in the frequency range from 100 Hz to 16 000 Hz.

The manikin described in this document is intended for airborne acoustic measurements only. It is not suitable for measurements which depend upon vibration transmission paths such as bone conduction, or for measurements requiring the simulation of bone or tissue.

This document specifies the manikin in terms of both its geometrical dimensions and its acoustical properties. Only manikins compliant with both sets of specifications are in conformance with this document.

WARNING – It is acknowledged that devices conforming to this document are used as the basis for applications extending beyond this scope, for example the measurement of sound sources close to the ear or of hearing protection devices. In such cases, it is recommended that any necessary design variations are documented, and that a statistical analysis of the measurement data is carried out to determine the level of repeatability that can be achieved. It will also be necessary to assess the relevance of the measurements made with the head and torso simulator to the application in question.

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 60118-8, *Electroacoustics – Hearing aids – Part 8: Methods of measurement of performance characteristics of hearing aids under simulated* in situ *working conditions*

IEC 60318-4, *Electroacoustics – Simulators of human head and ear – Part 4: Occluded-ear simulator for the measurement of earphones coupled to the ear by means of ear inserts*

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

ISO/IEC Guide 98-4, *Uncertainty of measurement – Role of measurement uncertainty in conformity assessment*

ISO 3:1973, *Preferred numbers – Series of preferred numbers*

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3 Terms and definitions

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
manikin
head and torso simulator
simulator of a median adult human head and part of the torso extending in total from the top of the head to the waist and designed to simulate the sound pick-up characteristics and acoustic diffraction

Note 1 to entry The head and torso simulator includes two pinna simulators, and at least one occluded-ear simulator.

3.2
manikin type
designation of the manikin as either anatomical or geometrical in shape

3.3
pinna simulator
device which has the approximate shape and dimensions of a median adult human pinna

3.4
ear simulator
device for measuring the acoustic output of sound sources where the sound pressure is measured by a calibrated microphone coupled to the source so that the overall acoustic impedance of the device approximates that of the normal human ear at a given location and in a given frequency band

Note 1 to entry In this document, an ear simulator comprises an ear canal extension and an occluded-ear simulator (see 4.2.4).

3.5
occluded-ear simulator
ear simulator which approximates the acoustic transfer impedance of the inner part of the ear canal, from the tip of an ear insert to the eardrum

Note 1 to entry An occluded-ear simulator is standardised in IEC 60318-4.

3.6
ear canal extension
device that provides a connection between the occluded-ear simulator and the aperture of the device simulating the concha

3.7
reference plane of the occluded-ear simulator
plane perpendicular to the axis of the cavity of the simulator, chosen to pass through the position normally occupied by the tip of an ear mould in a human ear canal

3.8
reference point of the manikin
point bisecting the line joining the right and left ear canal entrance points (EEP, see 3.17)

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3.9
plane of symmetry of the manikin
plane passing through the reference point of the manikin that divides the left and right portions of the manikin into symmetrical halves, within the allowed tolerances, where left and right is interpreted as for the human torso

Note 1 to entry See Figure 1.

3.10
axis of rotation of the manikin
straight line about which the manikin can be rotated, passing through the reference point of the manikin, lying in the plane of symmetry of the manikin, and having a direction that would be vertical if the manikin were mounted in a position corresponding to that of a standing person

Note 1 to entry See Figure 1.

3.11
reference plane of the manikin
plane perpendicular to the axis of rotation that contains the reference point of the manikin

Note 1 to entry See Figure 1.

3.12
test point
reproducible position in the test space at which the sound pressure level is measured with the manikin absent and at which the reference point of the manikin is to be located for test purposes

Note 1 to entry See Figure 2.

3.13
test axis
line joining the test point and the centre of the sound source

Note 1 to entry See Figure 2.

3.14
test plane
plane perpendicular to the test axis and containing the test point

3.15
azimuth angle of sound incidence
angle between the plane of symmetry of the manikin and the plane defined by the axis of rotation of the manikin and the test axis

Note 1 to entry When the manikin faces the sound source, the azimuth angle of sound incidence is defined as 0°. When the right ear of the manikin faces the sound source, the angle is defined as +90°. When the left ear of the manikin faces the sound source, the angle is defined as +270°.

Note 2 to entry See Figure 2.

3.16
elevation angle of sound incidence
angle between the reference plane of the manikin and the test axis

Note 1 to entry When the vertex points towards the sound source the elevation angle is defined as +90°. When the test axis lies in the reference plane of the manikin, the elevation angle is defined as 0°.

Note 2 to entry See Figure 2.

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3.17
ear canal entrance point
EEP
point located at the centre of the manikin ear canal at the junction between concha and ear canal extension

3.18
transverse plane of the manikin
plane perpendicular to the plane of symmetry of the manikin and containing the axis of rotation

3.19
reference position of the manikin
position of the manikin in the test space where the reference point of the manikin coincides with the test point, and the azimuth and elevation angles are both equal to zero

3.20
manikin free-field frequency response
difference, as a function of frequency, between the sound pressure level at the ear simulator microphone with the reference point of the manikin at the test point within a free-field measurement environment and the sound pressure level at the test point with the manikin absent

3.21
manikin diffuse-field frequency response
difference, as a function of frequency, between the sound pressure level at the ear simulator microphone with the reference point of the manikin at the test point within a diffuse-field measurement environment and the sound pressure level at the test point with the manikin absent

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