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

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CONTENTS

FOREWORD ... 3
INTRODUCTION ... 5
1 Scope ... 6
2 Normative references ... 6
3 Terms and definitions ... 6
4 Construction ... 11
4.1 General ... 11
4.2 Geometrical dimensions of the manikin ... 11
4.2.1 Torso ... 11
4.2.2 Head ... 18
4.2.3 Pinna ... 24
4.2.4 Ear simulator ... 28
4.2.5 Materials ... 29
4.2.6 Markings ... 29
4.2.7 Tolerances ... 29
4.3 Acoustical characteristics of the manikin ... 29
4.3.1 Free field frequency response ... 29
4.3.2 Tolerances ... 29
4.3.3 Openings ... 30
5 Calibration ... 30
5.1 Atmospheric reference conditions ... 30
5.2 Calibration method ... 30
5.2.1 General ... 30
5.2.2 Test space and measurement equipment ... 30
5.2.3 Measurement of sound pressure level ... 31
5.2.4 Alignment of manikin azimuth and elevation ... 31
5.2.5 Test for sound leakage ... 31
6 Maximum permitted expanded uncertainty of measurements ... 32
Annex A (informative) Ear canal sound pressure ratio ... 34
Bibliography ... 35

Figure 1 – Manikin geometrical references ... 9
Figure 2 – Coordinate scheme for azimuth and elevation angles ... 10
Figure 3 – Illustration of manikin head and torso dimensions ... 12
Figure 4 – Cross-sections of torso (tolerance ± 4 mm) ... 17
Figure 5 – Cross-sections of head (tolerance ± 2,5 mm) ... 23
Figure 6 – Illustration of manikin pinna dimensions ... 24
Figure 7 – Cross-sections of right pinna (tolerance ± 1,5 mm) ... 28

Table 1 – Head and torso dimensions for the manikin and average human data ... 12
Table 2 – Pinna dimensions for the manikin ... 24
Table 3 – Free field frequency response of the manikin ... 32
Table 4 – Values of U_{max} for basic measurements ... 33
Table A.1 – Ear canal sound pressure ratio ... 34

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROACOUSTICS – SIMULATORS OF HUMAN HEAD AND EAR –

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

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

Enquiry draft	Report on voting
29/716/DTS	29/729A/RVC

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

A list of all parts of the 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 publication 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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

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INTRODUCTION

This technical specification describes a head and torso simulator for hearing aid measurements. It has been developed as a revision of IEC/TR 60959 (1990). The main changes, as compared to the technical report, are the insertion of maximum permitted expanded measurement uncertainties and additional references in the Bibliography. A future IEC Standard which will include additional models of head and torso simulators for hearing aid measurements is planned.

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ELECTROACOUSTICS – SIMULATORS OF HUMAN HEAD AND EAR –

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

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1 Scope

This part of IEC 60318 describes a head and torso simulator (manikin) intended for the measurement of air-conduction hearing aids in the frequency range from 100 Hz to 10 000 Hz. The device consists of a head mounted on a torso that extends to the waist. The head is equipped with simulated pinnae and with cylindrical cavities having acoustic impedance terminations and microphones located at positions corresponding to those of the eardrums in a median human adult. It has been designed to provide acoustic diffraction similar to that encountered around the median human head and torso.

The device with its present pinna simulator, however, is not suitable for the measurement of all types of hearing aids. For example, most in-the-ear (ITE) and completely-in-the-canal (CIC) hearing aids cannot be measured correctly.

The manikin is specified in terms of both, its geometrical dimensions and its acoustical properties.

NOTE 1 Measurement results obtained with a manikin may differ substantially from similar results obtained on an individual person, due to anatomical variations.

NOTE 2 The median values of the human head and torso were drawn from the population samples described in [5][1].

NOTE 3 It is acknowledged that devices conforming to this part of IEC 60318 are also used as the basis for applications extending beyond this Scope. In such cases it is recommended that any design variations that are necessary are documented, and that a statistical analysis of the measurement data be carried out to determine the level of repeatability that can be achieved. It will also be necessary to consider the relevance of the measurements made with the head and torso simulator to the application in question.

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 60318-4, *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*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement* (GUM:1995)

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. Reference is also made to Figure 1 and Figure 2.

[1] Numbers in square brackets refer to the Bibliography.

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3.1
manikin
head and torso simulator extending downward from the top of the head to the waist and designed to simulate the acoustic diffraction produced by a median adult human head and torso

NOTE The head includes two pinna simulators, and contains at least one ear simulator.

3.2
pinna simulator
device which has the approximate shape and dimensions of a median adult human pinna

3.3
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 In this technical specification it comprises an ear canal extension and an occluded ear simulator.

3.4
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 An occluded ear simulator is standardised in IEC 60318-4.

3.5
ear canal extension
device that provides a connection between the ear canal of an occluded ear simulator and the aperture of a device simulating the concha

3.6
reference plane of the occluded ear simulator
plane perpendicular to the axis of the ear canal, at the junction between the occluded ear simulator and the ear canal extension

3.7
reference point of the manikin
point bisecting the line joining the centres of the openings of the ear canals (at the junction between concha and ear canal)

3.8
plane of symmetry of the manikin
virtual plane passing through the reference point of the manikin that divides the left and right portions of the manikin into symmetrical halves, left and right to be interpreted as for the human torso (see Figure 1)

NOTE No real human is perfectly symmetrical.

3.9
axis of rotation of the manikin
straight line about which the manikin can be rotated, passing through the reference point of the manikin and 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 (see Figure 1)

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3.10
reference plane of the manikin
plane perpendicular to the axis of rotation that contains the reference point of the manikin

3.11
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

3.12
test axis
line joining the test point and the centre of the sound source (see Figure 2)

3.13
test plane
plane perpendicular to the test axis and containing the test point

3.14
azimuth angle of sound incidence
θ
angle between the plane of symmetry of the manikin (see Figure 2) and the plane defined by the axis of rotation and the test axis; when the manikin faces the sound source, the azimuth angle of sound incidence is defined as 0°

NOTE 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°.

3.15
elevation angle of sound incidence
α
angle between the reference plane of the manikin and the test axis (see Figure 2); when the vertex points towards the sound source, the elevation angle is defined as +90°

NOTE When the test axis lies in the reference plane, the elevation angle is defined as 0°.

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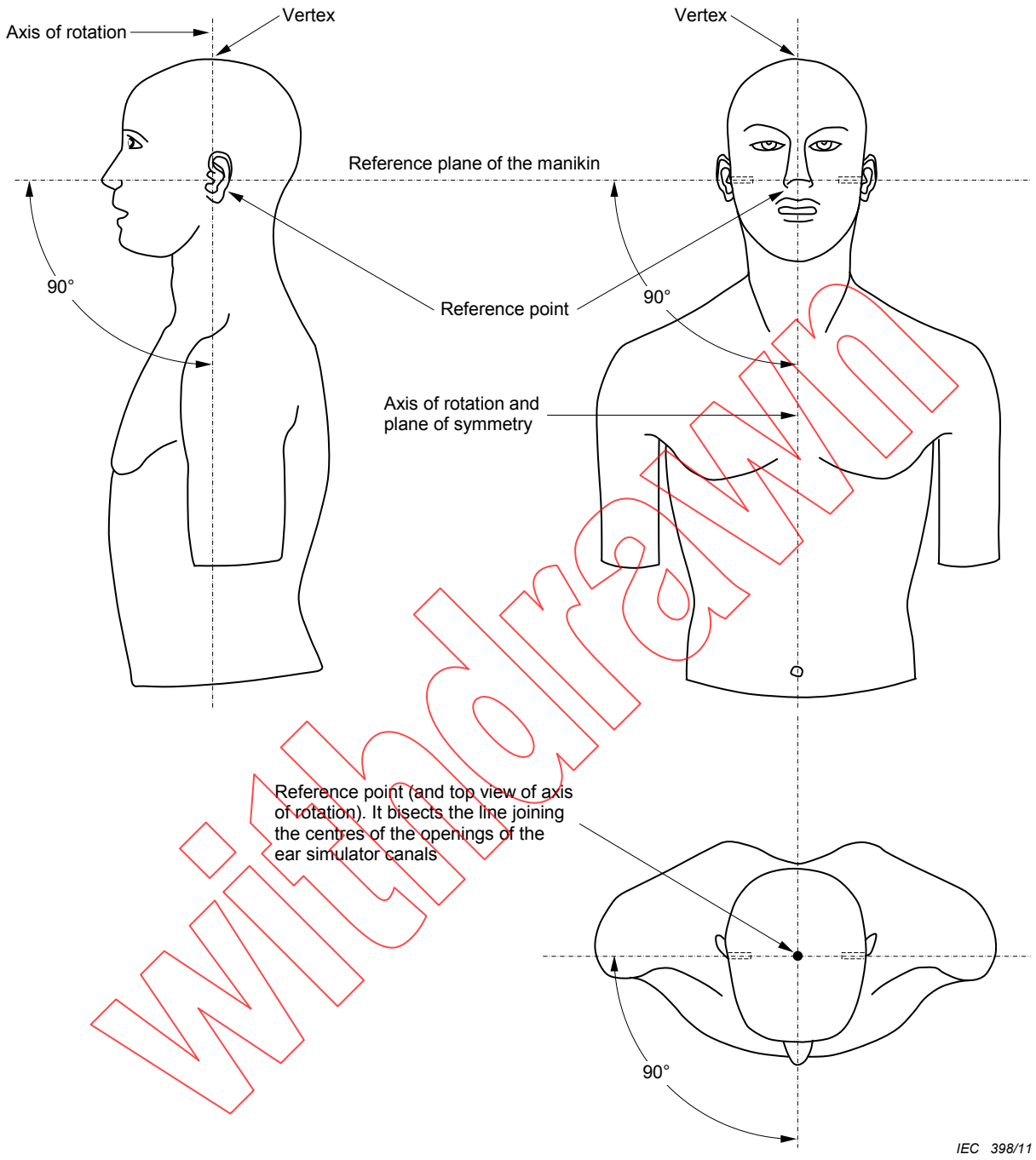

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NOTE The reference point is the reference point of the manikin.

Figure 1 – Manikin geometrical references

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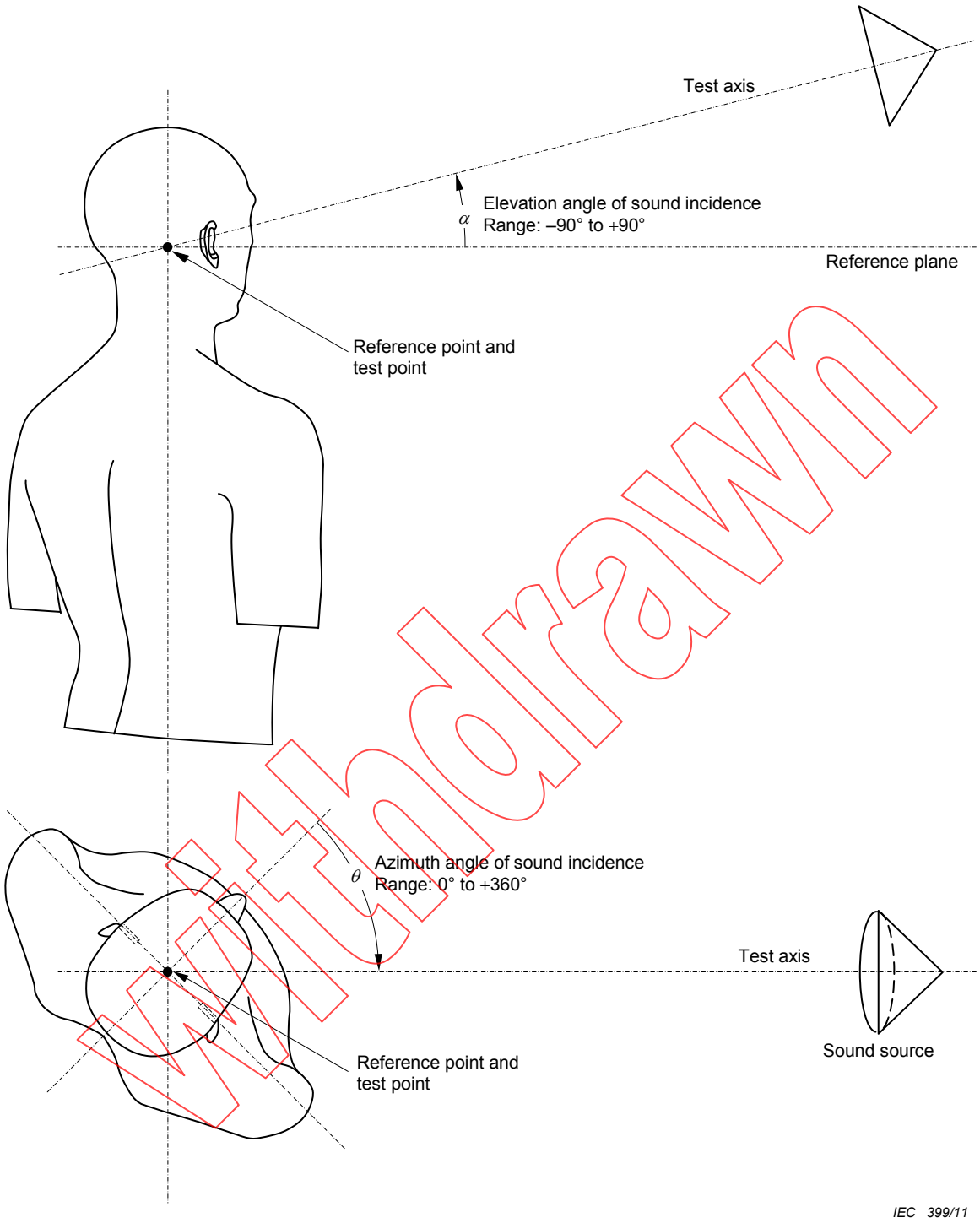

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NOTE The reference point is the reference point of the manikin.

Figure 2 – Coordinate scheme for azimuth and elevation angles

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