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Standards Secretariat
Acoustical Society of America
335 East 45th Street
New York, New York 10017

AMERICAN NATIONAL STANDARD
Specification for a Manikin for Simulated *in-situ*
Airborne Acoustic Measurements

ABSTRACT

The present standard describes a manikin for airborne acoustic measurements. It comprises a head with external ears and ear canals, and a torso that simulate a median human adult. It is intended primarily as an instrument for measuring the acoustic gain of hearing aids under simulated *in situ* conditions. Both geometric and acoustical response descriptions are given.

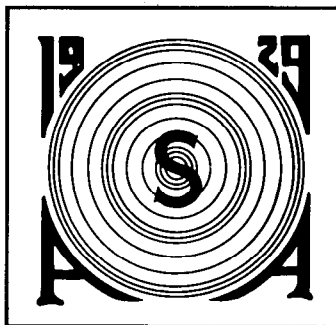
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This standard was approved by the American National Standards Institute as ANSI S3.36-1985 on 17 July 1985.

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FOREWORD

[This Foreword is not a part of American National Standard Specification for a Manikin for Simulated *in situ* Airborne Acoustic Measurements, S3.36-1985 (ASA Catalog No 58-1985).]

This is a new standard which is intended to compliment a standard on measurement of characteristics of hearing aids under *in situ* conditions (ANSI S3.35-1985). Reference may be made to that standard for information on one application. Other applications were considered during the preparation of this standard, however, it was concluded that it would be premature to propose them at this time. At the time of preparation of this standard there was a parallel effort in IEC TC-29, SC-29C Working Group 9. That working group was submitting a report at approximately the same time this standard underwent approval steps. The IEC report and this standard have many aspects of similarity. The one main exception is that a different structure for simulation of the external ear is specified in each case. There was similar parallel activity on the description of a method of *in situ* measurement of hearing aid characteristics in IEC Technical Committee 29 Working Group 6 and in Accredited Standards Committee S3, Working Group 48 (S3-48).

This standard was developed under the jurisdiction of Accredited Standards Committee S3 using the American National Standards Institute (ANSI) Procedures.

The scope of Accredited Standards Committee S3 on Bioacoustics was:

Standards, specifications, methods of measurement and test, and terminology, in the fields of psychological and physiological acoustics, including aspects of general acoustics, shock and vibration which pertain to biological safety, tolerance, and comfort.

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H. E. von Gierke
L. Wilber
W. Yost
R. W. Young

Working Group S3-67 on Manikins which assisted the committee in preparation of this standard, had the following membership:

M D Burkhard, *Chairman*

W. A. Yost
E D Burnett

D Preves
H R Silbiger

G F Kuhn

Suggestions for improvement of this standard will be welcome. They should be sent to the Standards Manager, Acoustical Society of America, 335 East 45th Street, New York, NY 10017.

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American National Standard

Specification for a Manikin for Simulated *in-situ* Airborne Acoustic Measurement

0 INTRODUCTION

0.1 General

0.1.1 This standard describes a head and torso simulator for hearing aid measurements. The head and torso simulator is intended for airborne acoustic measurements and is not suitable for measurements which depend on vibration conduction paths such as bone conduction. The head and torso simulator has been designed to provide acoustic diffractions similar to those encountered around the median human head and torso, and as such may be useful for other acoustical measurements. At present it has, however, only been validated for hearing aids and other applications will require additional studies.

0.1.2 Information relating to other applications are presented in appendices, which do not form part of the standard.

0.2 References

References to other documents:

ANSI S3.25-1979: American National Standard for an Occluded Ear Simulator.

IEC Publication 711: Occluded-ear simulator for the measurement of earphones coupled to the ear by ear inserts.

ANSI S3.35-1985: American National Standard Methods of Measurement of Performance of Hearing Aids under Simulated *in-situ* Working Conditions.

ANSI S1.10-1966: Calibration of Microphones.

1 SCOPE

1.1 This standard describes a manikin which is intended to simulate the acoustical effects of a median human adult, including diffractions affecting the hearing aid performance on a person. The manikin consists of a head mounted on a torso that extends to the waist. The head is equipped with pinnae and cylindrical cavities with acoustic impedance terminations and microphones located at positions corresponding to those of eardrums on a median human adult.

NOTES:

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

(2) It is emphasized that the median values were drawn from the population samples described in the bibliography (see Appendix C).

1.2 The manikin is described by the acoustical performance requirements of this standard. Physical dimensions of a manikin that meets these requirements are

provided for information but are not part of the standard.

2 DEFINITIONS

(Refer also to Figs. 1, 2, 3, and 4.)

2.1 manikin (head and torso simulator): for the purposes of this standard, a 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. The head includes two pinna simulators and contains at least one ear simulator.

2.2 pinna simulator: a device which has the approximate shape and dimensions of a median adult human pinna.

2.3 ear simulator: for the purposes of this standard, a device which simulates the acoustic properties of the ear canal from the entrance of the ear canal at the concha and including the eardrum. It comprises an ear canal extension joined to an occluded ear simulator at a reference plane and consists essentially of a principal cavity, acoustic impedance elements, and a calibrated microphone. The design of the simulator is such that the sound pressure at the microphone corresponds approximately to the sound pressure existing at the human eardrum.

2.4 ear simulator reference plane: a plane perpendicular to the axis of the ear canal cavity, at the junction between the occluded ear simulator and the ear canal extension.

2.5 occluded ear simulator: an ear simulator which simulates the inner part of the ear canal, from the tip of an ear insert (earmold), i.e., the reference plane of the ear simulator, to the eardrum.

2.6 ear canal extension: a device that connects the junction of the concha of the pinna simulator and the ear canal with the occluded ear simulator at the reference plane.

2.7 reference point of the manikin: the point bisecting the line joining the centers of the openings of the ear canals (at the junction between concha and ear canal).

2.8 plane of symmetry of the manikin: a plane perpendicular to the line between the ears and 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.

2.9 axis of rotation of the manikin: a straight line passing through the reference point of the manikin and ly-