BS ISO 26101:2017

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Acoustics — Test methods for the qualification of free-field environments

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National foreword

This British Standard is the UK implementation of ISO 26101:2017. It supersedes BS ISO 26101:2012, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EH/1, Acoustics.

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

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 43, *Acoustics*.

This second edition cancels and replaces the first edition (ISO 26101:2012), which has been technically revised. The main changes are as follows:

— the term "acoustic centre" was replaced by "mathematical origin of the traverse" in several places in the document to provide clarification of terminology;

— the minimum traverse path length was reduced from 1/2 wavelength to 1/4 wavelength;

— Figure B.1 has been added.

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Introduction

This document describes the divergence loss method of measurement of performance of an environment designed to provide a free sound field or free sound field over a reflecting plane. An acoustical environment is a free sound field if it has bounding surfaces that absorb all sound energies incident upon them. This is normally achieved using specialized test environments, such as anechoic or hemi-anechoic chambers. In practice, these provide a controlled free sound field for acoustical measurements in a confined space within the facility.

The purpose of this document is to promote uniformity in the method and conditions of measurement when qualifying free sound field environments.

It is expected that the qualification procedures outlined in this document will be referred to by other International Standards and industry test codes. In such cases, these documents making reference to this document may specify qualification criteria appropriate for the test method and may require specific traverse paths.

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Acoustics — Test methods for the qualification of free-field environments

1 Scope

This document specifies methodology for qualifying acoustic spaces as anechoic and hemi-anechoic spaces meeting the requirements of a free sound field.

This document specifies discrete-frequency and broad-band test methods for quantifying the performance of anechoic and hemi-anechoic spaces, defines the qualification procedure for an omni-directional sound source suitable for free-field qualification, gives details of how to present the results and describes uncertainties of measurement.

This document has been developed for qualifying anechoic and hemi-anechoic spaces for a variety of acoustical measurement purposes. It is expected that, over time, various standards and test codes will refer to this document in order to qualify an anechoic or hemi-anechoic space for a particular measurement.

In the absence of specific requirements or criteria, Annex A provides qualification criteria and measurement requirements to qualify anechoic and hemi-anechoic spaces for general purpose acoustical measurements.

This document describes the divergence loss method for measuring the free sound field performance of an acoustic environment.

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.

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

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

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

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
free sound field
sound field in a homogeneous, isotropic medium free of boundaries

[SOURCE: ISO/TR 25417:2007, 2.17]

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3.2
anechoic space
volume which has been qualified as a sound field in a homogeneous, isotropic medium free of boundaries

3.3
hemi-anechoic space
volume above a reflecting plane which has been qualified as a sound field in a homogeneous, isotropic medium free of boundaries

3.4
acoustic centre
<for a sound source and for a given test signal> position of the point from which approximately spherical wave fronts appear to diverge

3.5
background noise
sum of all the signals except the one under investigation

Note 1 to entry: Background noise can include contributions from airborne sound, structure-borne vibration and electrical noise in instrumentation.

3.6
divergence loss
reduction in sound pressure along a straight path due to the spreading of sound when a sound wave propagates away from a source

3.7
frequency range of interest
contiguous one-third-octave-band frequencies from the lowest to the highest frequencies to be qualified, inclusive

3.8
referencing document
standard or test code that refers to this document for the purpose of specifying the qualification method of an *anechoic* (3.2) or *hemi-anechoic space* (3.3)

4 Allowable deviations from inverse square law

The theoretical reduction in mean-square sound pressure along a straight path due to spherical propagation of a sound wave in a free sound field shall be hereafter referred to as the inverse square law.

For a space to be deemed anechoic or hemi-anechoic, as defined by criteria in a referencing document, the deviations of the measured sound pressure levels from those estimated using the inverse square law, obtained according to this document, shall not exceed the values specified by the referencing document.

In the absence of specific criteria for the allowable deviations in a referencing document, the criteria in Annex A shall be used to qualify anechoic and hemi-anechoic spaces for general purpose acoustical measurements.

The allowable deviations specified by a referencing document may be more or less stringent than the criteria given in Annex A.

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5 Measurement of free sound field performance

5.1 Divergence loss method

5.1.1 Principle

The divergence loss method shall be used to quantify the performance of an anechoic or hemi-anechoic space within a test environment and to determine the spatial limits of this qualified anechoic or hemi-anechoic space.

The free sound field performance is evaluated by quantifying the contributions of both the direct and the reflected components of acoustic energy.

The spatial decrease of sound pressure emitted from a test sound source shall be compared with the decrease of sound pressure that would occur in an ideal free sound field.

5.1.2 Instrumentation and measuring equipment

5.1.2.1 General

The instrumentation system for measuring sound pressure level, including the microphone and cable, shall be operated within the limit of the linearity errors specified for a Class 1 sound level meter according to IEC 61672-1.

The microphone shall be nominally omni-directional (taking into account any supplementary equipment connected to it, such as the protective grid and mounting arrangement).

For measurements in one-third-octave bands, the filters used shall meet the requirements for Class 1 specified in IEC 61260-1.

NOTE For measurements above 5 kHz, this method will normally require a microphone of diameter equivalent to that of a WS2F microphone, as described in IEC 61094-4[2], or less.

5.1.2.2 Test sound source

A sound source approximating a point source over the frequency range of interest shall be used for the qualification measurement. The source shall be

a) compact and of acoustical performance, such that the location of the acoustic centre of the source is known to be located close enough to the origin of the microphone traverses specified in 5.1.3.2 to allow fitting of the sound pressure level versus distance data without an adjustment for the acoustic centre of the source,

b) in compliance with the directionality criteria in Table B.1, when measured according to the procedure in Annex B, so as to ensure the source radiates energy in all directions,

c) able to generate sufficient sound power over the frequency range of interest to yield sound pressure levels at least 6 dB above the background noise levels for all points on each microphone traverse, or while the microphone is moving for continuous traverse systems,[3] and

d) of high stability so that the radiated sound power (due to the source, associated signal generation and amplification electronics) as measured by a monitor microphone located at an arbitrary fixed position in the test environment does not vary significantly at the frequency of measurement during the time taken to complete the measurements for each microphone traverse. If the stability of the source varies by more than ±0,2 dB then the monitor microphone shall be used to apply a correction according to Formula (1):

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