BS ISO 226:2023

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Acoustics — Normal equal-loudness-level contours

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National foreword

This British Standard is the UK implementation of ISO 226:2023. It supersedes BS ISO 226:2003, which is withdrawn.

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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).

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This document was prepared by Technical Committee ISO/TC 43, *Acoustics*.

This third edition cancels and replaces the second edition (ISO 226:2003), which has been technically revised.

The main changes are as follows:

— clarification of the scope in the introduction;

— updated bibliography;

— alignment with ISO 389-7 regarding the 0 phon data;

— correction of systematic errors that lead to minor changes in the entire data up to 0,6 dB.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Curves defining combinations of pure tones in terms of frequency and sound pressure level, which are perceived as equally loud, express a fundamental property of the human auditory system and are of basic importance in the field of psychoacoustics. Such equal-loudness-level contours were specified in the previous editions of this document.

NOTE 1 In this document, only the equal-loudness-level contours for pure tones are specified because of insufficient equal-loudness-level data for other sounds. Nevertheless, this International Standard could be applicable to one-third-octave or narrower bands of noise. It may be less valid for broader bands of noises or noises with prominent tones.

NOTE 2 For the calculation of loudness of arbitrary signals or the calculation of the tonal loudness other standards must be applied (e.g., for loudness of arbitrary stationary and non-stationary (time-varying) sounds: ISO 532-1[2], for loudness of arbitrary stationary sounds: ISO 532-2[3], for tonal loudness and tonality: ECMA-418-2[4]). The tonal loudness is the loudness of the tonal components of a complex sound as the basis for the tonality calculation in Reference [4].

During the technical revision of this document, it was decided to maintain separate documents for the specification of the threshold and supra-threshold data. The threshold values are specified in ISO 389 7[1], as a part of the series of International Standards concerning reference zero values for the calibration of audiometric equipment. The equal-loudness-level contours are presented in this document.

NOTE 3 The equal-loudness-level values given by this document differ from those of the previous edition of ISO 226, although the differences are small, i.e., up to 0,6 dB for the entire range of data. This change was caused by the application of an improved model for the perception of loudness as described in Reference [5]. The normal equal-loudness-level contours for pure tones in this document are essentially identical to those described in Reference [5] since both are based on the same equal-loudness-level data. The only difference is the low equal-loudness levels at 20 Hz caused by the revision of ISO 389-7 in 2019, which introduced a 0,4 dB change in the normative hearing threshold at that frequency.

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Acoustics — Normal equal-loudness-level contours

1 Scope

This document specifies combinations of sound pressure levels and frequencies of pure continuous tones which are perceived as equally loud by human listeners. The specifications are based on the following conditions:

a) the sound field in the absence of the listener consists of a free progressive plane wave;

b) the source of sound is directly in front of the listener;

c) the sound signals are pure tones;

d) the sound pressure level is measured at the position where the centre of the listener's head would be, but in the absence of the listener;

e) listening is binaural;

f) the listeners are otologically normal persons in the age range from 18 years to 25 years inclusive.

The data are given in graphical form in Annex A and in numerical form in Annex B for the preferred frequencies in the one-third-octave series from 20 Hz to 12 500 Hz, inclusive, in accordance with ISO 266.

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 266, *Acoustics — Preferred frequencies*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
otologically normal person
person in a normal state of health who is free from all signs or symptoms of ear disease and from obstructing wax in the ear canals, and who has no history of undue exposure to noise, exposure to potentially ototoxic drugs or familial hearing loss

3.2
free field
sound field where the boundaries of the room exert a negligible effect on the sound waves

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