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**Acoustics — Preferred reference values  
for acoustical and vibratory levels**

*Acoustique — Valeurs de référence recommandées pour les niveaux  
acoustiques et vibratoires*

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# Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Specifications</b> .....	<b>2</b>
4.1 Reference values for airborne sound quantities .....	2
4.2 Reference values for sound quantities in liquids .....	2
4.3 Reference values for vibratory quantities .....	3
<b>Bibliography</b> .....	<b>4</b>

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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](http://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](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

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

This third edition cancels and replaces the ~~second edition~~ (ISO 1683:2008), which has been technically revised.

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## Introduction

Various kinds of acoustical and vibratory levels expressed in decibels are commonly used in acoustics. In order to establish a uniform basis for the expression of those levels, a set of agreed reference values is needed.

The reference value determines whether the level for a particular quantity is positive or negative. For general measurements and many engineering specifications, it is desirable that levels of a given kind be consistently positive (or consistently negative) rather than both positive and negative.

In general, a reference value is expressed as the number one and a derived SI unit formed by the use of an appropriate SI prefix.

The values specified in this International Standard represent the values internationally adopted.

For airborne sound, a special reference value for sound pressure is stated according to widespread use and legal implications.

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# Acoustics — Preferred reference values for acoustical and vibratory levels

## 1 Scope

This International Standard specifies reference values used in acoustics, in order to establish a uniform basis for the expression of acoustical and vibratory levels.

The reference values are mandatory for use in acoustics for sounds in air and other gases, sounds in water and other liquids, and for structure-borne sound, but can also be used in other applications.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable to its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2041, *Mechanical vibration, shock and condition monitoring — Vocabulary*

ISO/TR 25417, *Acoustics — Definitions of basic quantities and terms*

ISO 80000-8, *Quantities and units — Part 8: Acoustics*

## 3 Terms and definitions

ISO 1683:2015

For the purposes of this document, the terms and definitions given in ISO 2041, ISO/TR 25417, ISO 80000-8, and the following apply.

### 3.1

#### reference value

quantity value used as a basis for comparison with values of quantities of the same kind

[SOURCE: ISO/IEC Guide 99:2007, 5.18]

Note 1 to entry: For the purposes of this International Standard, a reference value is expressed in terms of a number and an appropriate unit of measurement used to form a ratio of dimension one when defining a logarithmic quantity.

## 4 Specifications

### 4.1 Reference values for airborne sound quantities

Reference values for various sound quantities in air and other gases are given in [Table 1](#).

**Table 1 — Reference values for sound quantities in air and gases**

Quantity	Reference value <sup>a</sup>
Sound pressure	20 $\mu\text{Pa}$
Sound exposure	$(20 \mu\text{Pa})^2 \text{ s}$
Sound power	1 pW
Sound energy	1 pJ
Sound intensity	1 pW/m <sup>2</sup>
<sup>a</sup> The reference value used to establish a level for a certain acoustical quantity should always be stated together with the respective level.	

### 4.2 Reference values for sound quantities in liquids

Reference values for various sound quantities in water and other liquids are given in [Table 2](#).

**Table 2 — Reference values for sound quantities in water and other liquids**

Quantity	Reference value <sup>a</sup>
Sound pressure <sup>b</sup>	1 $\mu\text{Pa}$
Sound exposure	1 $\mu\text{Pa}^2 \text{ s}$
Sound power	1 pW
Sound energy	1 pJ
Sound intensity	1 pW/m <sup>2</sup>
Sound particle displacement	1 pm
Sound particle velocity	1 nm/s
Sound particle acceleration	1 $\mu\text{m/s}^2$
Distance <sup>c</sup>	1 m
<sup>a</sup> The reference value used to establish a level for a certain acoustical quantity should always be stated together with the respective level.	
<sup>b</sup> A sound pressure level with a reference value of 1 $\mu\text{Pa}$ is numerically $10 \lg(20^2/1^2)$ dB, which is approximately 26,0 dB greater than the sound pressure level for the same sound pressure but with a reference value of 20 $\mu\text{Pa}$ .	
<sup>c</sup> The reference value for distance is used to form reference values for compound quantities, such as the product of sound pressure and distance (for which the reference value is 1 $\mu\text{Pa m}$ ) or sound exposure and squared distance (for which the reference value is 1 $\mu\text{Pa}^2 \text{ m}^2 \text{ s}$ ). Ratios of these compound quantities to other sound quantities lead to further compound quantities with dimensions of distance (with reference value 1 m) or area (with reference value 1 m <sup>2</sup> ).	



### 4.3 Reference values for vibratory quantities

Reference values for various vibratory quantities are given in [Table 3](#).

**Table 3 — Reference values for vibratory quantities**

Quantity	Reference value <sup>a</sup>
Vibratory displacement	1 pm
Vibratory velocity <sup>b</sup>	1 nm/s
Vibratory acceleration	1 $\mu\text{m/s}^2$
Vibratory force	1 $\mu\text{N}$
<p><sup>a</sup> The reference value used to establish a level for a certain vibratory quantity should always be stated together with the respective level.</p> <p><sup>b</sup> In connection with structure-borne sound, a reference value of 50 nm/s is also in use. In this event, the vibratory velocity level takes values close to the associated sound pressure and sound intensity levels.</p>	

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