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STANDARDS

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## **Acoustics — Attenuation of sound during propagation outdoors —**

### **Part 1:**

Calculation of the absorption of sound by the atmosphere

*Acoustique — Atténuation du son lors de sa propagation à l'air libre —  
Partie 1: Calcul de l'absorption atmosphérique*



Reference number  
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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9613-1 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Sub-Committee SC 1, *Noise*.

ISO 9613 consists of the following parts, under the general title *Acoustics — Attenuation of sound during propagation outdoors*:

- *Part 1: Calculation of the absorption of sound by the atmosphere*
- *Part 2: A general method of calculation*

Annexes A, B, C, D, E and F of this part of ISO 9613 are for information only.

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## **Introduction**

The aim of this International Standard is to specify methods of calculating the attenuation of sound propagating outdoors in order to predict the level of environmental noise at distant locations from various sound sources.

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# Acoustics — Attenuation of sound during propagation outdoors —

## Part 1:

## Calculation of the absorption of sound by the atmosphere

### 1 Scope

This part of ISO 9613 specifies an analytical method of calculating the attenuation of sound as a result of atmospheric absorption for a variety of meteorological conditions when the sound from any source propagates through the atmosphere outdoors.

For pure-tone sounds, attenuation due to atmospheric absorption is specified in terms of an attenuation coefficient as a function of four variables: the frequency of the sound, and the temperature, humidity and pressure of the air. Computed attenuation coefficients are provided in tabular form for ranges of the variables commonly encountered in the prediction of outdoor sound propagation:

- frequency from 50 Hz to 10 kHz,
- temperature from  $-20\text{ °C}$  to  $+50\text{ °C}$ ,
- relative humidity from 10 % to 100 %, and
- pressure of 101,325 kPa (one atmosphere).

Formulae are also provided for wider ranges suitable for particular uses, for example, at ultrasonic frequencies for acoustical scale modelling, and at lower pressures for propagation from high altitudes to the ground.

For wideband sounds analysed by fractional-octave band filters (e.g. one-third-octave band filters), a method is specified for calculating the attenuation due to atmospheric absorption from that specified for pure-tone sounds at the midband frequencies. An alternative spectrum-integration method is described in annex D. The spectrum of the sound may be wide-

band with no significant discrete-frequency components or it may be a combination of wideband and discrete frequency sounds.

This part of ISO 9613 applies to an atmosphere with uniform meteorological conditions. It may also be used to determine adjustments to be applied to measured sound pressure levels to account for differences between atmospheric absorption losses under different meteorological conditions. Extension of the method to inhomogeneous atmospheres is considered in annex C, in particular to meteorological conditions that vary with height above the ground.

This part of ISO 9613 accounts for the principal absorption mechanisms present in an atmosphere devoid of significant fog or atmospheric pollutants. The calculation of sound attenuation by mechanisms other than atmospheric absorption, such as refraction or ground reflection, is described in ISO 9613-2.

### 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9613. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9613 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2533:1975, *Standard Atmosphere*.

ISO 266:1975, *Acoustics — Preferred frequencies for measurements*.