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Acoustics — Attenuation of sound during propagation outdoors —

Part 2: Engineering method for the prediction of sound pressure levels outdoors

Acoustique — Atténuation du son lors de sa propagation à l'air libre —

Partie 2: Méthode d'ingénierie pour la prédiction des niveaux de pression acoustique en extérieur

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Foreword

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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 document 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*, Subcommittee SC 1, *Noise*.

This second edition cancels and replaces the first edition (ISO 9613-2:1996), which has been technically revised.

The main changes are as follows:

— subdivision of extended sources improved (more detailed to decrease uncertainty with software implementations);

— improved classification of the source-directivity;

— improved and more detail specified in the determination of the ground factor G (projection to horizontal plane);

— integration of a correction for A_{gr} to account for the decreasing ground effect for small values of distance/height – harmonizing the General method 7.3.1 and the Simplified method 7.3.2;

— modified definition of the mean height h_m for the application of the Simplified method 7.3.2;

— integration of the strategy to calculate screening as it was developed with ISO/TR 17534-3;

— modified specification of the barrier attenuation D_z and the correction for meteorological effects K_{met} to eliminate well known shortcomings with low barriers and large source-to-receiver distances;

— inclusion of clear specifications on how to combine vertical and lateral diffraction (from ISO/TR 17534-3);

— improved specification of the minimal extension (width or height) of a reflecting surface;

— multi-reflections up to higher orders (in accordance with ISO/TR 17534-3);

— reflections at vertical cylindrical surfaces;

— additional to the simple method for the attenuation of foliage without any parameter dependencies of the old version ISO 9613-2:1996, A.2.2, a new and more detailed method including the influence of forestal parameters (see A.2.3);

— the directivity correction D_c for chimney stacks (see Annex B);

— proposal for a meteorological correction derived from the local wind-climatology (see Annex C);

— calculation of sound pressure levels caused by wind turbines (see Annex D).

A list of all parts in the ISO 9613 series can be found on the ISO website.

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.

Introduction

The ISO 1996 series[1][2][3] of standards specifies methods for the description of noise outdoors in community environments. Other standards specify methods for determining the sound power levels emitted by various noise sources, such as machinery and specified equipment (ISO 3740 series[4]), or industrial plants (ISO 8297[5]). This document is intended to bridge the gap between these two types of standards, to enable noise levels in the community to be predicted from sources of known sound emission. The method described in this document is general in the sense that it may be applied to a wide variety of noise sources and covers most of the major mechanisms of attenuation. There are, however, constraints on its use, which arise principally from the description of environmental noise in the ISO 1996 series.

This version includes the modifications developed for reasons of quality assurance if the method is implemented in software as described in ISO 17534-1[6] and ISO/TR 17534-3[7] and some improvements to make the applied strategy fit for broad software-based application.

Acoustics — Attenuation of sound during propagation outdoors —

Part 2: Engineering method for the prediction of sound pressure levels outdoors

1 Scope

This document specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level (as described in ISO 1996-series) under meteorological conditions favourable to propagation from sources of known sound emission.

These conditions are for downwind propagation or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs in clear, calm nights. Inversion conditions over extended water surfaces are not covered and may result in higher sound pressure levels than predicted from this document (see e.g. References [11] and [12]).

The method also predicts a long-term average A-weighted sound pressure level as specified in ISO 1996-1 and ISO 1996-2. The long-term average A-weighted sound pressure level encompasses levels for a wide variety of meteorological conditions.

Guidance has been provided to derive a meteorological correction based on the angular wind distribution relevant for the reference or long-term time interval as specified in ISO 1996-1:2016, 3.2.1 and 3.2.2. Examples for reference time intervals are day, night, or the hour of the night with the largest value of the sound pressure level. Long-term time intervals over which the sound of a series of reference time intervals is averaged or assessed representing a significant fraction of a year (e.g. 3 months, 6 months or 1 year).

The method specified in this document consists specifically of octave band algorithms (with nominal mid-band frequencies from 63 Hz to 8 kHz) for calculating the attenuation of sound which originates from a point sound source, or an assembly of point sources. The source (or sources) may be moving or stationary. Specific terms are provided in the algorithms for the following physical effects:

— geometrical divergence;

— atmospheric absorption;

— ground effect;

— reflection from surfaces;

— screening by obstacles.

Additional information concerning propagation through foliage, industrial sites and housing is given in Annex A. The directivity of chimney-stacks to support the sound predictions for industrial sites has been included with Annex B. An example how the far-distance meteorological correction C_0 can be determined from the local wind-climatology is given in Annex C. Experiences of the last decades how to predict the sound pressure levels caused by wind turbines is summarized in Annex D.

The method is applicable in practice to a great variety of noise sources and environments. It is applicable, directly, or indirectly, to most situations concerning road or rail traffic, industrial noise sources, construction