
**Acoustics — Framework for calculating a
distribution of sound exposure levels for
impulsive sound events for the purposes
of environmental noise assessment**

*Acoustique — Cadre pour le calcul d'une distribution des niveaux
d'exposition sonore pour les sons impulsionnels pour les besoins de
l'évaluation du bruit environnemental*



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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 13474 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

It cancels and replaces ISO/TS 13474:2003, which has been technically revised.

Introduction

The aim of this International Standard is to provide a framework for the evaluation of descriptor quantities for use in environmental noise assessment. Part of this framework includes an engineering method for calculating a statistical distribution of event sound exposure levels at locations which are some distance from high-energy impulsive sound sources. It is specifically intended for environmental noise assessment and not for the assessment of the risk of damage to buildings or the risk of injury to animals or people.

In ISO 9613-2, the immission level from sources such as traffic and industry is calculated for a so-called “downwind” condition. The long-term average level is estimated using a correction factor, C_{met} . This concept holds for distances where sound from such sources is assessed as environmental noise. ISO 9613-2 excludes impulses in its scope and holds only for A-weighting, for near-ground sources and receivers and for distances up to about 1 000 m. For high-energy impulsive sound sources, the impulsive sound event duration is short, and low frequencies are more prominent than for traffic and industrial sound sources. Lower-frequency sounds are generally less attenuated over a given distance in the atmosphere than higher frequencies and, as a consequence, the level-influencing effects of propagation over much larger distances need to be taken into account.

A general outline is given of a method that takes into account ground reflection, shielding by topography and the meteorological effects of refraction and turbulence. Starting from the source strength, this method calculates a distribution of immission levels for a set of replica atmospheres, each replica being a specific combination of atmospheric-absorption class and excess-attenuation class. To carry out practical calculations using the procedure, it is useful to exploit the statistical contribution of the meteorological and ground surface conditions. In particular, histograms of the frequencies of occurrence of the wind velocity, wind direction, temperature, humidity and atmospheric stability can be used to describe the classes. From the distribution of the immission levels, a number of assessment metrics can be obtained. For instance, the long-term averaged immission level can be calculated as a weighted average. The weighting factors are determined by the probability of occurrence of each replica atmosphere during the relevant time period for the location of interest.

Acoustics — Framework for calculating a distribution of sound exposure levels for impulsive sound events for the purposes of environmental noise assessment

1 Scope

This International Standard specifies the framework of an engineering method for calculating a statistical distribution of sound exposure levels for impulsive sound events for the purposes of environmental noise assessment. This International Standard is applicable to impulse sounds propagating over large distances (e.g. 0,5 km to 30 km) from sources such as mine blasting, artillery fire and bomb explosions, using conventional explosives of moderate charge mass (e.g. 0,05 kg to 1 000 kg of TNT equivalent). The effects of meteorological conditions and terrain upon sound propagation are considered.

2 Normative references

The following referenced documents are indispensable for the application 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 1996-1, *Acoustics — Description, measurement and assessment of environmental noise — Part 1: Basic quantities and assessment procedures*

ISO 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 9613-1, *Acoustics — Attenuation of sound during propagation outdoors — Part 1: Calculation of the absorption of sound by the atmosphere*

ISO 9613-2, *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation*

ISO 17201-1, *Acoustics — Noise from shooting ranges — Part 1: Determination of muzzle blast by measurement*

ISO 17201-2, *Acoustics — Noise from shooting ranges — Part 2: Estimation of muzzle blast and projectile sound by calculation*

ISO 17201-4, *Acoustics — Noise from shooting ranges — Part 4: Prediction of projectile sound*

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

VDI MSR 8/559, *Standard Method to Measure the Sound Exposure Emissions and Immissions from Large Weapons (Standardmethode zur Messung der Geräuschemissionen und -immissionen von schweren Waffen)*, Edmund Buchta (ed.), in *Meß-, Steuerungs- und Regelungstechnik*, No. 8/559, Fortschritt-Berichte, VDI Verlag, Düsseldorf, 1996 (in English and German)