

**AKUSTIKA. MASINATE JA SEADMETE MÜRA. TÖÖKOHA
JA MUUDE MÄÄRATUD ASUKOHTADE
HELIRÕHUTASEME MÄÄRAMINE KOOS
KESKKONNAOLUDEST TULENEVATE LIGIKAUDSETE
KORREKTSIOONIDE KOHALDAMISEGA**

**Acoustics - Noise emitted by machinery and equipment -
Determination of emission sound pressure levels at a
work station and at other specified positions applying
approximate environmental corrections
(ISO 11202:2010 + ISO 11202:2010/Amd 1:2020)**

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 11202:2010+A1:2021 sisaldab Euroopa standardi EN ISO 11202:2010 ja selle muudatuse A1:2021 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 11202:2010+A1:2021 consists of the English text of the European standard EN ISO 11202:2010 and its amendment A1:2021.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas. Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 15.05.2010, muudatus A1 19.05.2021.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation. Date of Availability of the European standard is 15.05.2010, for A1 19.05.2021.
Muudatusega A1 lisatud või muudetud teksti algus ja lõpp on tekstis tähistatud sümbolitega A1 A1 . Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The start and finish of text introduced or altered by amendment A1 is indicated in the text by tags A1 A1 . The standard is available from the Estonian Centre for Standardisation and Accreditation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 17.140.20

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardimis- ja Akrediteerimiskeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardimis-ja Akrediteerimiskeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardimis-ja Akrediteerimiskeskusega: Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation and Accreditation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation and Accreditation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation and Accreditation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Acoustics - Noise emitted by machinery and equipment -
Determination of emission sound pressure levels at a work
station and at other specified positions applying approximate
environmental corrections (ISO 11202:2010 + ISO
11202:2010/Amd 1:2020)

Acoustique - Bruit émis par les machines et équipements -
Détermination des niveaux de pression acoustique
d'émission au poste de travail et en d'autres positions
spécifiées en appliquant des corrections d'environnement
approximatives (ISO 11202:2010 + ISO 11202:2010/Amd
1:2020)

Akustik - Geräuschabstrahlung von Maschinen und Geräten
- Bestimmung von Emissions-Schalldruckpegeln am
Arbeitsplatz und an anderen festgelegten Orten unter
Anwendung angenäherter Umgebungskorrekturen (ISO
11202:2010 + ISO 11202:2010/Amd 1:2020)

This European Standard was approved by CEN on 22 April 2010. Amendment A1 was approved by CEN on 14 April 2021.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard and its amendment the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard and its amendment A1 exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Foreword

This document (EN ISO 11202:2010) has been prepared by Technical Committee ISO/TC 43 “Acoustics” in collaboration with Technical Committee CEN/TC 211 “Acoustics” the secretariat of which is held by DS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2010, and conflicting national standards shall be withdrawn at the latest by November 2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 11202:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 11202:2010 has been approved by CEN as a EN ISO 11202:2010 without any modification.

A1 Amendment A1 European foreword

This document (EN ISO 11202:2010/A1:2021) has been prepared by Technical Committee ISO/TC 43 "Acoustics" in collaboration with Technical Committee CEN/TC 211 "Acoustics" the secretariat of which is held by DIN.

This Amendment to the European Standard EN ISO 11202:2010 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2021, and conflicting national standards shall be withdrawn at the latest by November 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 11202:2010/Amd 1:2020 has been approved by CEN as EN ISO 11202:2010/A1:2021 without any modification. **A1**

Contents

Page

Foreword	iv
Amendment A1 foreword	v
Introduction	vi
1 Scope	1
1.1 General	1
1.2 Types of noise and noise sources	1
1.3 Test environment	2
1.4 Work station and other specified positions	2
2 Normative references	2
3 Terms and definitions	3
4 Instrumentation	8
4.1 General	8
4.2 Calibration	8
5 Procedures to determine the local environmental correction, K_{3A}	9
5.1 General	9
5.2 Identifiable dominant source	9
5.3 Dominant source not identifiable	9
5.4 Selection of method to be used	9
6 Test environment	10
6.1 General	10
6.2 Criterion for the adequacy of the test environment	10
6.3 Enclosed work station positions	10
6.4 Criteria for background noise	10
6.4.1 General	10
6.4.2 Corrections for background noise	11
6.5 Ambient conditions during measurements	11
7 Measured quantities	12
8 Quantities to be determined	12
9 Mounting and operation of source under test	13
9.1 General	13
9.2 Location of source	13
9.3 Mounting of source	13
9.3.1 General	13
9.3.2 Hand-held machines	14
9.3.3 Base-mounted and wall-mounted machines	14
9.4 Auxiliary equipment	14
9.5 Operation of source during test	14
10 Microphone positions	15
10.1 General	15
10.2 Microphone position(s) for a seated operator	15
10.3 Microphone position(s) for a standing, stationary operator	16
10.4 Microphone position(s) for an operator moving along a specified path	16
10.5 Microphone positions for bystanders and for unattended machines	16
11 Measurements	17

11.1	Measurement time interval.....	17
11.1.1	General.....	17
11.1.2	Steady noise.....	17
11.1.3	Non-steady noise.....	17
11.1.4	Measurements in frequency bands.....	17
11.1.5	Summarization of sub-measurement time intervals.....	17
11.2	Measurement procedure.....	18
11.2.1	General.....	18
11.2.2	Repetition of measurements.....	18
11.2.3	Procedure for impulsive noise.....	18
12	Measurement uncertainty.....	19
12.1	Methodology.....	19
12.2	Determination of σ_{omc}	19
12.3	Determination of σ_{R0}	20
12.3.1	General.....	20
12.3.2	Round robin test.....	20
12.3.3	Modelling approach for σ_{R0}	21
12.4	Typical upper bound values of σ_{R0}	21
12.5	Total standard deviation, σ_{tot} , and expanded uncertainty, U	21
13	Information to be recorded.....	22
13.1	General.....	22
13.2	Source under test.....	22
13.3	Test conditions.....	22
13.4	Acoustic environment.....	23
13.5	Instrumentation.....	23
13.6	Location of work station(s).....	23
13.7	Noise data.....	23
14	Test report.....	24
Annex A (normative)	Environmental correction for a work station — Determination of the local environmental correction, K_3.....	25
Annex B (normative)	Criteria for background noise for measurements in frequency bands.....	31
Annex C (informative)	Guidance on the development of information on measurement uncertainty.....	33
Annex D (informative)	Principles of the methodology.....	42
Annex E (informative)	Example of a test table.....	44
Annex ZA (informative)	Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered \square_{A1}.....	45
	Bibliography.....	46

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 11202 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This second edition cancels and replaces the first edition (ISO 11202:1995), which has been technically revised.

A1 Amendment A1 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).

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).

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

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

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. **A1**

Introduction

This International Standard specifies a method for determining the emission sound pressure levels at a work station and at other well defined positions, in the vicinity of a machine or piece of equipment, *in situ*. It is one of a series (ISO 11200^[15] to ISO 11205^[19]) which specifies various methods for determining the emission sound pressure level at a work station and at other specified positions of a machine or equipment. ISO 11200^[15] gives guidance on the choice of the method to be used to determine the emission sound pressure levels of machinery and equipment.

The method specified in this International Standard differs from those of ISO 11201^[16] in determining and applying a local environmental correction. It differs from ISO 11204^[18] by using an approximate method to determine the directivity of the sound radiation of a machine with a reduced number of measurement positions or even with no additional measurement. The acoustical properties of the room have to be determined to qualify the test environment and to determine a correction for local environmental influences applied to the measured sound pressure levels. With the method specified in this International Standard, results of accuracy grade 2 (engineering grade) or accuracy grade 3 (survey grade) are obtained.

For the determination of the local environmental correction two procedures are specified in this International Standard.

The first procedure (see A.1) is based on the assumption that a well-defined part of the machine, visible from and with free propagation conditions to the work station or the specified position, radiates the sound responsible for the sound pressure level at this position. With this assumption, only a sound pressure measurement at the work station and an acoustical qualification of the room are necessary to determine the local environmental correction.

The second procedure (see A.2) is generally applicable. No assumptions about the directivity of the radiation or the source location are necessary, because this directivity is determined using an approximate method with few additional measurement positions. The approximate character of this method is taken into account in qualifying the grade of accuracy of the result.

In general, the emission sound pressure levels are less than or equal to those that occur when the machinery or equipment is operating in its normal surroundings. This is because the sound pressure levels are determined by excluding the effects of background noise, as well as the effects of reflections other than those from the reflecting plane on which the machine under test is placed. For determination or calculation of the sound pressure level at the operator's position with the machine operating in a room, both sound power level and sound pressure level are required (as well as information on the room properties or reflections and noise from other sound sources or machines). A method of calculating the sound pressure levels in the vicinity of a machine operating alone in a workroom is given in ISO/TR 11690-3^[20]. Commonly observed differences are 1 dB to 5 dB, but in extreme cases the difference may be even greater.

Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections

1 Scope

1.1 General

This International Standard specifies a method for determining the emission sound pressure levels of machinery or equipment, at a work station and at other specified positions nearby, *in situ*. A work station is occupied by an operator and may be located in open space, in the room where the source under test operates, in a cab fixed to the source under test, or in an enclosure remote from the source under test. One or more specified positions may be located in the vicinity of a work station, or in the vicinity of an attended or unattended machine. Such positions are sometimes referred to as bystander positions.

Emission sound pressure levels are determined as A-weighted levels. Additionally, levels in frequency bands and C-weighted peak emission sound pressure levels can be determined in accordance with this International Standard, if required.

NOTE 1 The contents of the series ISO 11200^[15] to ISO 11205^[19] are summarized in ISO 11200^[15].

Methods are given for determining a local environmental correction (subject to a specified limiting maximum value) to be applied to the measured sound pressure levels in order to eliminate the influence of reflecting surfaces other than the plane on which the source under test is placed. This correction is based on the equivalent sound absorption area of the test room and on radiation characteristics (source location or directivity at the work station).

With the method specified in this International Standard, results of accuracy grade 2 (engineering grade) or accuracy grade 3 (survey grade) are obtained. Corrections are applied for background noise and, as described above, for the acoustic environment. Instructions are given for the mounting and operation of the source under test and for the choice of microphone positions for the work station and for other specified positions. One purpose of the measurements is to permit comparison of the performance of different units of a given family of machines, under defined environmental conditions and standardized mounting and operating conditions.

NOTE 2 The data obtained can also be used for the declaration and verification of emission sound pressure levels as specified in ISO 4871^[9].

1.2 Types of noise and noise sources

The method specified in this International Standard is suitable for all types of noise (steady, non-steady, fluctuating, isolated bursts of sound energy, etc.) defined in ISO 12001.

The method specified in this International Standard is applicable to all types and sizes of noise sources.

NOTE Throughout this International Standard the words “machine” and “source under test” are used to represent either a machine or a piece of equipment.

1.3 Test environment

The type of test environment influences the accuracy of the determination of emission sound pressure levels. For this International Standard, any room meeting prescribed requirements is applicable. These requirements on the room are less strict than those of ISO 11201^[16], in particular regarding the acoustical quality of the environment.

1.4 Work station and other specified positions

This International Standard is applicable to work stations and other specified positions where emission sound pressure levels are to be determined.

Appropriate positions where measurements may be made include the following:

- a) work station located in the vicinity of the source under test; this is the case for many industrial machines and domestic appliances;
- b) work station within a cab which is an integral part of the source under test; this is the case for many industrial trucks and earth-moving machines;
- c) work station within a partial or total enclosure (or behind a screen) supplied by the manufacturer as an integral part of the source under test;
- d) work station partially or totally enclosed by the source under test — this situation may be encountered with some large industrial machines;
- e) bystander positions occupied by individuals not responsible for the operation of the source under test, but who may be in its immediate vicinity, either occasionally or continuously;
- f) other specified positions, not necessarily work stations or bystander positions.

The work station may also lie on a specified path along which an operator moves (see 10.4).

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 3744, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane*

ISO 3746, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

ISO 5725 (all parts), *Accuracy (trueness and precision) of measurement methods and results*

ISO 12001, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code*

IEC 60942:2003, *Electroacoustics — Sound calibrators*

IEC 61260:1995, *Electroacoustics — Octave-band and fractional-octave-band filters* (amended by IEC 61260/Amd.1:2001)

IEC 61672-1:2002, *Electroacoustics — Sound level meters — Part 1: Specifications*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. More detailed definitions can be found in noise test codes for specific types of machines.

3.1

emission

⟨acoustics⟩ airborne sound radiated by a well-defined noise source (e.g. the machine under test)

NOTE Noise emission descriptors can be incorporated into a product label and/or product specification. The basic noise emission descriptors are the sound power level of the source itself and the emission sound pressure levels at a work station and/or at other specified positions (if any) in the vicinity of the source.

3.2

emission sound pressure

p

sound pressure, at a work station or another specified position near a noise source, when the source is in operation under specified operating and mounting conditions on a reflecting plane surface, excluding the effects of background noise as well as the effects of reflections other than those from the plane or planes permitted for the purpose of the test

NOTE Emission sound pressure is expressed in pascals.

3.3

emission sound pressure level

L_p

ten times the logarithm to the base 10 of the ratio of the square of the emission sound pressure, p , to the square of a reference value, p_0 , expressed in decibels

$$L_p = 10 \lg \frac{p^2}{p_0^2} \text{ dB} \quad (1)$$

where the reference value, p_0 , is 20 μPa

NOTE The emission sound pressure level is determined at a work station or another specified position in accordance with either a noise test code for a specific family of machines or, if no noise test code exists, one of the standards of the series ISO 11200^[15] to ISO 11205^[19].

3.4

time-averaged emission sound pressure level

$L_{p,T}$

ten times the logarithm to the base 10 of the ratio of the time average of the square of the emission sound pressure, p , during a stated time interval of duration, T (starting at t_1 and ending at t_2), to the square of a reference value, p_0 , expressed in decibels