INTERNATIONAL STANDARD

ISO 17201-5

First edition
2010-02-01

Acoustics — Noise from shooting ranges —

Part 5: Noise management

Acoustique — Bruit des stands de tir —

Partie 5: Gestion du bruit

Reference number
ISO 17201-5:2010(E)

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

Published in Switzerland

Contents

Page

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 17201-5 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

ISO 17201 consists of the following parts, under the general title *Acoustics — Noise from shooting ranges*:

— *Part 1: Determination of muzzle blast by measurement*

— *Part 2: Estimation of muzzle blast and projectile sound by calculation*

— *Part 3: Guidelines for sound propagation calculations*

— *Part 4: Prediction of projectile sound*

— *Part 5: Noise management*

Introduction

The initiative to prepare a standard on impulse noise from shooting ranges was taken by the Association of European Manufacturers of Sporting Ammunition (AFEMS), in April 1996 by the submission of a formal proposal to CEN (see doc. CEN N 1085). After consultation in CEN in 1998, CEN/TC 211, *Acoustics*, asked ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise* to prepare ISO 17201 (all parts).

This part of ISO 17201 provides guidance for noise management of shooting activity at shooting ranges. It deals with the control of the noise received outside shooting ranges at specified reception points based either on measured or calculated data.

In general, national or regional environmental authorities specify how sound from shooting ranges should comply with guidelines, rules or regulations made by the relevant authorities. In situations with no official regulations, the management of a shooting range may use the method specified in this part of ISO 17201.

NOTE Conflicting national guidelines, rules or regulations can prevent the application of methods described in this part of ISO 17201.

Looking through various regulations used worldwide, many different approaches for noise control are found. In some countries, the long-term equivalent continuous sound pressure level is used to limit sound levels from shooting. In other countries, noise control is managed by limiting the level of one shot or by the difference between the long-term rating level and background sound pressure level, etc. This part of ISO 17201 gives a method for noise management to control the equivalent continuous sound pressure level by managing the number of shots for each combination of weapon type, ammunition type, the locations of firing, and the firing direction that is used in a shooting range. The weighting of the number of shots is related to the sound exposure levels produced by each combination at the reception points. By directly relating the number of shots to the limiting values, management objectives such as minimizing the noise load in the neighbourhood can be met.

Acoustics — Noise from shooting ranges —

Part 5: Noise management

1 Scope

This part of ISO 17201 gives guidelines for noise management of shooting activity at shooting ranges. The control of the noise received outside shooting ranges at specified reception points based either on measured or calculated sound exposure levels is specified. This part of ISO 17201 can also be used in the planning of new or reconstruction of existing ranges. It is intended to comply with all relevant local rules and regulations which imply a conversion of sound exposure level to other indicators as given in ISO 17201-3.

This part of ISO 17201 applies to weapons with calibres of less than 20 mm or explosive charges of less than 50 g TNT equivalent and pressures of less than 1 kPa at the reception point.

NOTE National or other regulations, which could be more stringent, can apply.

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 1996-2, *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of environmental noise levels*

ISO 17201-1:2005, *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 17201-3, *Acoustics — Noise from shooting ranges — Part 3: Guidelines for sound propagation calculations*

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

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 terms and definitions given in ISO 17201-1 and the following apply.

3.1
event duration
T
stated time interval, long enough to encompass all significant sound of a stated event at a **reception point** (3.22)

NOTE 1 The event duration is expressed in seconds.

NOTE 2 Adapted from ISO 17201-1:2005, 3.5.

3.2
sound exposure
E_T
integral of the square of the sound pressure, p, over a stated time interval or event of duration T (starting at t_1 and ending at t_2)

$$E_T = \int_{t_1}^{t_2} p^2(t)\,\mathrm{d}t \tag{1}$$

NOTE 1 Sound exposure is expressed in square pascal seconds.

NOTE 2 Adapted from ISO 17201-1:2005, 3.6.

NOTE 3 Because of practical limitations of the measuring instruments, p^2 is always understood to denote the square of a frequency-weighted and frequency-band-limited sound pressure. If a specific frequency weighting as specified in IEC 61672-1 [6] is applied, this should be indicated by appropriate subscripts: e.g. $E_{A,1\,h}$ denotes the A-weighted sound exposure over 1 h.

NOTE 4 When applied to a single event, the quantity is called “single event sound exposure” and the symbol E is used without subscript.

NOTE 5 This definition is technically in accordance with ISO 80000-8:2007 [5], 8-18.

3.3
sound exposure level
L_E
ten times the logarithm to the base 10 of the ratio of the **sound exposure** (3.2), E_T, to a reference value, E_0, expressed in decibels

$$L_E = 10\,\lg\frac{E_T}{E_0}\ \mathrm{dB} \tag{2}$$

where the reference value, E_0, is $(20\ \mu\mathrm{Pa})^2\mathrm{s} = 4 \times 10^{-10}\ \mathrm{Pa}^2\mathrm{s}$

NOTE 1 Adapted from ISO 17201-1:2005, 3.7.

NOTE 2 Application of specific frequency weightings as specified in IEC 61672-1 [6] is indicated by appropriate subscripts.

NOTE 3 When applied to a single event, the quantity is called “single event sound exposure level” and the symbol L_E is used without further subscript.

NOTE 4 This definition is technically in accordance with ISO 80000-8:2007 [5], 8-24.

3.4
total sound
totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far

[ISO 1996-1:2003 [1].3.4.1]

See Figure 1.

3.5
specific sound
component of the **total sound** (3.4) that can be specifically identified and which is associated with a specific source

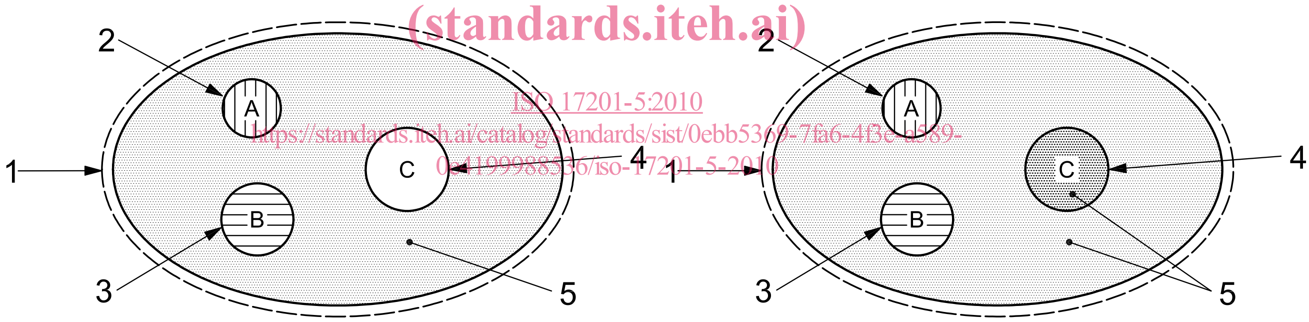
[ISO 1996-1:2003 [1].3.4.2]

See Figure 1.

3.6
residual sound
total sound (3.4) remaining at a given position and situation when the **specific sounds** (3.5) under consideration are suppressed

[ISO 1996-1:2003 [1], 3.4.3]

See Figure 1.



a) **Three specific sounds (3.5) A, B and C under consideration — the residual sound (3.6) and the total sound (3.4) are also shown**

b) **Two specific sounds (3.5) A and B under consideration — the residual sound (3.6) and the total sound (3.4) are also shown**

Key

1 total sound
2 specific sound A
3 specific sound B
4 specific sound C
5 residual sound

NOTE 1 The lowest residual sound level is obtained when all specific sounds are suppressed.

NOTE 2 In Figure 1 a), the dotted area indicates the residual sound when sounds A, B, and C are suppressed.

NOTE 3 In Figure 1 b), the residual sound includes the specific sound C since it is not under consideration.

Figure 1 — Total, specific and residual sound designation

3.7
background sound pressure level
$L_{A,N}$
equivalent continuous sound pressure level of **residual sound** (3.6) for a specified period of time

NOTE 1 Background sound pressure level is expressed in decibels.

NOTE 2 The time should be chosen with respect to the rating time period.

NOTE 3 The background sound pressure level depends on many parameters (such as time of the day and of the year, wind speed, traffic, etc.) so that the level is expected to vary randomly.

3.8
background sound pressure spectrum
spectrum obtained by averaging over all spectra obtained during the specified time T without unusual events or during periods where the level is below a specified percentile level

3.9
source combination
k
combination of specified weapon, ammunition, firing location, and firing direction used in the shooting range

3.10
immission class
class, of width 3 dB, to which a **source combination** (3.9) is assigned on the basis of the A-weighted long-term sound exposure level $L_{E,A}$ at a specified **reception point** (3.22)

NOTE The long-term averaged sound exposure level is defined in ISO 1996-1:2003 [1], 3.2.2.

3.11
immission class 0
immission class (3.10) with the highest long-term sound exposure level $L_{E,A,max}$ at a specified **reception point** (3.22)

NOTE 1 To determine the upper limit of immission class 0, 1,5 dB is added to $L_{E,,A,max}$ and the result is rounded to the nearest integer:

$$L_{up}(0) = \text{round}\,(L_{E,A,max} + 1{,}5\ \text{dB})$$

The lower limit is obtained by subtracting 3 dB from $L_{up}(0)$:

$$L_{lo}(0) = L_{up}(0) - 3\ \text{dB}$$

NOTE 2 The immission class limits are usually different for differently situated reception points.

NOTE 3 If the range is used under all weather conditions, the maximum value refers to the long-term average of these conditions. If the use is linked to specific weather conditions, the maximum value refers to the long-term average for those conditions.

NOTE 4 The operator “round” is used to denote rounding to the nearest integer.

3.12
immission class i
immission class (3.10) with an upper limit that is $3i$ dB, where i is an integer, below the upper limit of **immission class 0** (3.11)

NOTE With an increasing immission class number, the upper limit of the immission class decreases according to the equation:

$$L_{\text{up}}(i) = L_{\text{up}}(0) - 3i \text{ dB}$$

3.13
N % exceedance level
$L_{N(T)}$
time-weighted and frequency-weighted sound pressure level that is exceeded for N % of the time interval T considered

EXAMPLE $L_{p,\text{AF},95,1\text{h}}$ is the A-frequency weighted, F-time-weighted sound pressure level exceeded for 95 % of 1 h.

NOTE 1 The N % exceedance level is expressed in decibels.

NOTE 2 Adapted from ISO 1996-1:2003, 3.1.3.

3.14
event index
number of shooting events of limited duration of which the time- and frequency-weighted level exceeds a given value for a given time period, such as time of day, day of the week or their combinations

NOTE The event index counts the number of events exceeding a specific level at the reception point.

3.15
event index limit
limit that should not be exceeded by the **event index** (3.14)

3.16
immission class factor
C_k
weighting factor of a **source combination** (3.9), k, of which the sound exposure level at a **reception point** (3.22) falls within **immission class** i (3.12):

$$C_k = 2^{-i} \tag{3}$$

EXAMPLE Shots in immission classes $i = 3$ and $i = 5$ have weights 1/8 and 1/32, respectively, with the result that four shots in immission class $i = 5$ are equivalent to one shot in immission class $i = 3$.

3.17
quota count
QC
n_{Q}
sound dose as sound energy/time at a **reception point** (3.22) resulting from all shots fired on a range during a specific time period expressed as an equivalent number of shots of **immission class 0** (3.11)

3.18
quota count limit
QCL
$n_{\text{Q, lim}}$
upper limit number of the **quota count** (3.17) which is related to the permissible or pursued limiting level

3.19
immission class level
$L_{E,\text{A},i}$
A-weighted sound exposure level of shots which represents an **immission class** (3.10), set to –1 dB of the upper limit of the immission class:

$$L_{E,\text{A},i} = L_{\text{up}}(i) - 1 \text{ dB} \tag{4}$$

NOTE The immission class level is expressed in decibels.

3.20
equivalent continuous sound pressure level
$L_{p,\mathrm{eq}T}$
ten times the logarithm to the base 10 of the ratio of the time-average of the square of the 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

$$L_{p,T} = L_{p,\mathrm{eq}T} = 10 \lg \left[\frac{\frac{1}{T}\int_{t_1}^{t_2} p^2(t)\,\mathrm{d}t}{p_0^2} \right] \mathrm{dB}$$

where the reference value, p_0, is 20 µPa

[ISO/TR 25417:2007[4], 2.3]

NOTE The A-weighted equivalent continuous sound pressure level, $L_{\mathrm{A,eq}}$, due to shots of the shooting range under evaluation, is calculated from the sound exposure level of all shots according to:

$$L_{\mathrm{A,eq}} = 10 \lg \left(\frac{t_0}{T_\mathrm{p}} \sum_{j=1}^{N} 10^{0{,}1 L_{E,\mathrm{A},j}} \right) \mathrm{dB} \qquad (5)$$

where

t_0 is the reference time, 1 s;

$L_{E,\mathrm{A},j}$ is the sound exposure level, in decibels, of shot j;

N is the total number of shots;

T_p is the evaluation period, in seconds.

3.21
sound emergence
E_m
increase from **background sound pressure level** $L_{\mathrm{A},N}$ (3.7) to total A-weighted equivalent continuous sound pressure level, $L_{\mathrm{A,eq}}$, due to shooting sound

NOTE 1 Adapted from ISO 1996-1:2003 [1], 3.4.7.

NOTE 2 $E_\mathrm{m} = L_{\mathrm{A,eq}} - L_{\mathrm{A},N}$.

NOTE 3 The sound emergence is expressed in decibels.

3.22
reception point
point of interest within the context of noise management

3.23
evaluation period
T_p
time period to be assessed by the rating level

NOTE The evaluation period is expressed in seconds.

EXAMPLE For a daytime period of 16 h: "16 × 3 600 s daytime".