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Acoustics - Noise from shooting ranges - Part 2: Estimation of muzzle blast and projectile sound by calculation (ISO 17201-2:2006)

Akustik - Geräusche von Schießplätzen - Teil 2: Bestimmung des Mündungsknalls und des Geschossgeräusches durch Berechnung (ISO 17201-2:2006)

Acoustique - Bruit des stands de tir - Partie 2: Estimation de la détonation a la bouche et du bruit du projectile par calcul (ISO 17201-2:2006)

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95.020	Vojaška tehnika. Vojaške zadeve. Orožje	Military engineering. Military affairs. Weapons
97.220.10	Športni objekti	Sports facilities

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EUROPEAN STANDARD
NORME EUROPÉENNE
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EN ISO 17201-2

July 2006

ICS 97.220.10; 95.020; 17.140.20

English Version

Acoustics - Noise from shooting ranges - Part 2: Estimation of muzzle blast and projectile sound by calculation (ISO 17201-2:2006)

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Management Centre: rue de Stassart, 36 B-1050 Brussels

EN ISO 17201-2:2006 (E)**Foreword**

This document (EN ISO 17201-2:2006) 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of an identical text or by endorsement, at the latest by January 2007, and conflicting national standards shall be withdrawn at the latest by January 2007.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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 United Kingdom.

Endorsement notice

The text of ISO 17201-2:2006 has been approved by CEN as EN ISO 17201-2:2006 without any modifications.

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INTERNATIONAL
STANDARD

ISO
17201-2

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2006-07-01

**Acoustics — Noise from shooting
ranges —**

Part 2:

**Estimation of muzzle blast and projectile
sound by calculation**

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Acoustique — Bruit des stands de tir —

*Partie 2: Estimation de la détonation à la bouche et du bruit du projectile
par calcul*

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Fax + 41 22 749 09 47
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ISO 17201-2:2006(E)

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 17201-2 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 4: Prediction of projectile sound*

The following parts are under preparation:

- *Part 3: Guidelines for sound propagation calculations*
- *Part 5: Noise management*

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

Introduction

Two basic sources dominate the shooting sound from firearms: the muzzle blast and the projectile sound. These two sources are basically different. The explosion blast from devices can be treated as muzzle blast.

The muzzle blast is caused by the expanding gases of the propellant at the muzzle. The muzzle blast can be modelled based on essentially less spherical volume of these gases at that moment when the expansion speed becomes subsonic.

The projectile sound is caused by the supersonic flight of the projectile along the trajectory from the muzzle to the target or to a point on the trajectory where the projectile speed becomes subsonic. The projectile sound stems from a section of the trajectory that coherently radiates a shock wave into a certain direction.

In general, the procedures for estimating the source energy depends on the estimation of energies that are involved in related processes. The procedures give estimates for the fraction of these energies that transforms into acoustic energy. The result of the estimation is a set of acoustical source data with respect to energy, direction and frequency content.

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Acoustics — Noise from shooting ranges —

Part 2:

Estimation of muzzle blast and projectile sound by calculation

1 Scope

This part of ISO 17201 specifies methods for estimating the acoustic source data of muzzle blast and explosions and the source data of projectile sound on the basis of non-acoustic data for firearms with calibres less than 20 mm and explosions less than 50 g TNT equivalent.

This part of ISO 17201 addresses those cases where no source measurements exist or where the data necessary to calculate projectile sound according to ISO 17201-4 are unknown. An example of this situation would be measuring projectile sound from shot guns pellets. This part of ISO 17201 can also be used as an interpolation method between measurements of muzzle blast.

Source data are given in terms of spectral angular source energy covering the frequency range from 12,5 Hz to 10 kHz and can be used as data input for sound propagation calculation.

This part of ISO 17201 is not applicable to the prediction of sound levels for the assessment of hearing damage and cannot be used to predict sound pressure levels or sound exposure levels below a specific distance where linear acoustics does not 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 17201-1:2005, *Acoustics — Noise from shooting ranges — Part 1: Determination of muzzle blast by measurement*

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

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 General

3.1.1

air density

ρ

density of air for the estimation conditions

NOTE The air density is expressed in kilograms per cubic metre (kg/m³).

ISO 17201-2:2006(E)**3.1.2
angular frequency**

ω
frequency multiplied by 2π

NOTE The angular frequency is expressed in radians per second (rad/s) in all formulae.

**3.1.3
coordinate system (x, y)**

plane coordinate system describing geometry, where the x -axis denotes the line of fire with $x = 0$ at the muzzle, and the y -axis measures the perpendicular distance from the line of fire in any plane around the line of fire

NOTE 1 The sound field of projectile sound is rotational symmetric around the line of fire.

NOTE 2 The coordinates are given in metres (m).

**3.1.4
cosine-coefficients**

$c_{1,2,\dots,N}$
coefficients of the cosine-transform used to describe the directivity of the angular source energy

**3.1.5
deceleration angle**

ε
difference between the radiation angle at the beginning and end of a part of the trajectory

NOTE The deceleration angle is expressed in radians (rad) in all formulae.

**3.1.6
specific chemical energy**

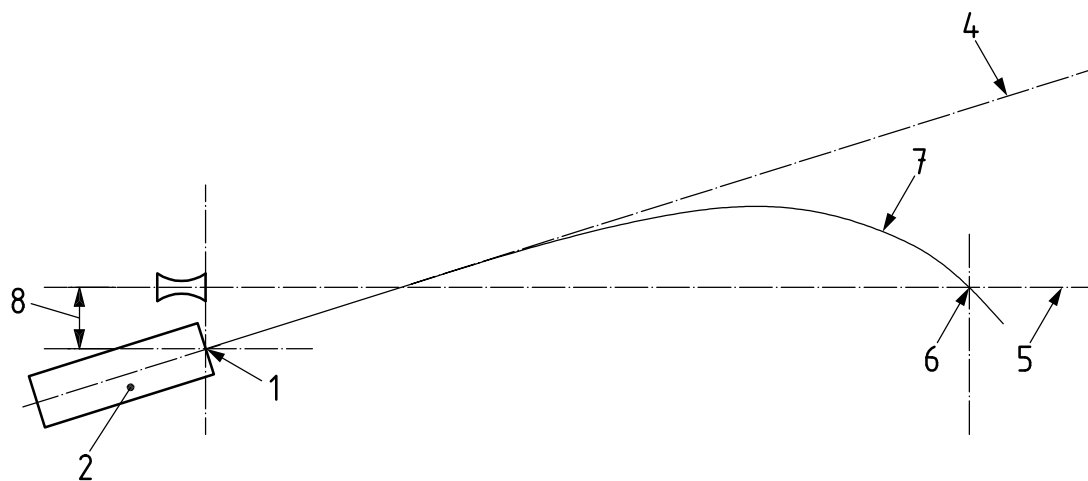
u
specific chemical energy content of the propellant

NOTE The specific chemical energy is usually expressed in joules per kilogram (J/kg)

**3.1.7
line of fire**
continuation of the axis of the barrel

See Figure 1.

NOTE Ballistic trajectories can be described as a sequence of straight lines. Then the methods apply to each segment. Corrections of the aiming device are ignored.



a) Side or elevation view



b) Top or plan view

Key

- 1 muzzle
- 2 barrel
- 3 sight
- 4 line of fire
- 5 line of sight
- 6 target
- 7 trajectory
- 8 height of sight

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Figure 1 — Line of fire and line of sight**3.1.8****projectile sound source energy** Q_p

acoustic energy from a trajectory length of one metre

NOTE 1 The projectile sound source energy is expressed in joules (J).

NOTE 2 See also 3.3.6.

3.1.9**propellant mass** m_c

mass of the propellant

NOTE The propellant mass is expressed in kilograms (kg).