BRITISH STANDARD

BS EN
21683 : 1994
ISO 1683 : 1983

Acoustics — Preferred reference quantities for acoustic levels

The European Standard EN 21683 : 1994 has the status of a British Standard

Acoustique — Grandeurs normales de référence pour les niveaux acoustiques

Akustik — Bevorzugte Bezugswerte für akustische Pegel

UDC 534 6

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United Kingdom	British Standards Institution

This British Standard, having been prepared under the direction of the Environment and Pollution Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on
15 September 1994

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National foreword

This British Standard has been prepared under the direction of the Environment and Pollution Standards Policy Committee and is the English language version of EN 21683 : 1994 *Acoustics — Preferred reference quantities for acoustic levels* published by the European Committee for Electrotechnical Standardization (CEN), which is identical with ISO 1683 : 1983 *Acoustics — Preferred reference quantities for acoustic levels*, published by the International Organization for Standardization (ISO).

Compliance with a British Standard does not of itself confer immunity from legal obligations.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

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June 1994

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Descriptors: acoustics, acoustic measurement, sound pressure quantities, units of measurement

English version

Acoustics — Preferred reference quantities for acoustic levels

(ISO 1683 : 1983)

Acoustique — Grandeurs normales de référence pour les niveaux acoustiques
(ISO 1683 : 1983)

Akustik — Bevorzugte Bezugswerte für akustische Pegel
(ISO 1683 : 1983)

This European Standard was approved by CEN on 1994-06-06. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard 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 Central Secretariat or to any CEN member.

This European Standard exists 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 21683 : 1994 E

Foreword

As a result of the positive result of the Primary Questionnaire procedure, the International Standard ISO 1683 : 1983 *Acoustics — Preferred reference quantities for acoustic levels* was submitted to formal vote. The result was positive.

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

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 December 1994 and conflicting national standards shall be withdrawn at the latest by December 1994.

The Standard was approved and in accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdon.

Acoustics — Preferred reference quantities for acoustic levels

0 Introduction

0.1 Various kinds of levels expressed in decibels have become common for acoustic measurements in gases, liquids and solid structures. A reference quantity, which is preferably independent of the medium, is needed for each kind of level.

For airborne sound, a special reference sound pressure is preferred according to widespread use and legal implication.

0.2 For several kinds of levels, different reference quantities have been used from time to time. Thus, for clarity, it is necessary to indicate which reference quantity is being employed.

0.3 The magnitude of a reference quantity determines whether the level for a particular variable quantity is positive or negative. For general measurements and many engineering specifications, it is desirable that levels of a given kind be consistently positive (or consistently negative) rather than both positive and negative.

0.4 In general, a reference quantity should have a magnitude of one and its unit should be a derived SI unit formed by the use of an SI prefix [for example micronewton (μN), nanometer per second (nm/s), picowatt (pW)]. See ISO 1000.

0.5 Only one reference quantity should apply for each given kind of level.

0.6 The purpose of this International Standard is the adoption of a preferred set of reference quantities of convenient magnitudes. This International Standard provides standard reference quantities for use when and if levels are employed. The use of levels is not made mandatory.

1 Scope and field of application

This International Standard specifies reference quantities and gives definitions of some levels for acoustics. It applies to oscillatory quantities.

2 References

ISO 31/2, *Quantities and units of periodic and related phenomena.*

ISO 31/7, *Quantities and units of acoustics.*

ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units.*

ISO 2041, *Vibration and shock — Vocabulary.*

IEC Publication 27-3, *Letter symbols to be used in electrical technology — Part 3 : Logarithmic quantities and units.*

3 Definitions

3.1 acoustic levels : see table 1. Various acoustic levels expressed in decibels are listed in table 1. When the multiplying factor is twenty, the numerator of the ratio is understood to be a root-mean-square value of a field quantity, unless otherwise specified. When the multiplying factor is ten, the numerator of the ratio is understood to be a time average value of a power-like quantity unless otherwise specified. For definitions of levels, see ISO 31/2, ISO 31/7 and ISO 2041.

3.2 decibel : See ISO 31/2, ISO 31/7 and ISO 2041.

3.3 reference quantity : The denominator of the ratio whose logarithm is taken to form a level. See table 1.

Table 1 — Various acoustic levels expressed in decibels

Designation	Definition
Sound pressure level	$L_p = 20 \lg (p/p_0)$ dB
Vibratory velocity level	$L_v = 20 \lg (v/v_0)$ dB
Vibratory acceleration level	$L_a = 20 \lg (a/a_0)$ dB
Vibratory force level	$L_F = 20 \lg (F/F_0)$ dB
Power level	$L_W = 10 \lg (P/P_0)$ dB
Intensity level	$L_I = 10 \lg (I/I_0)$ dB
Energy density level	$L_w = 10 \lg (w/w_0)$ dB
Energy level	$L_E = 10 \lg (E/E_0)$ dB

NOTE — For power level, the symbol L_P may also be used.

4 Reference quantities

4.1 Preferred reference quantities

Preferred reference quantities expressed in SI units are listed in table 2.

4.2 Sound pressure reference quantity

Two reference quantities for sound pressure are listed in table 2. One is to be used exclusively for airborne sound, even though not in accordance with 0.4; it is preferred because of its widespread current use and its legal status in defining allowable sound pressure levels. The other is to be used for sound in all media other than air.

4.3 Vibratory velocity reference quantity

One reference vibratory velocity is listed in table 2. The value of 1 nm/s is based on the current estimate of minimum expected vibratory velocity that is in accordance with 0.3 and 0.4.

NOTE — For airborne and structure-borne sound, a reference velocity of higher value, 50 nm/s, is also in use. This has the property that the intensity level, the sound pressure level and the vibratory velocity level for a progressive plane wave in air are almost equal in magnitude. However, the requirements of 0.4 and 0.5 are not fulfilled.

4.4 Vibratory acceleration reference quantity

One reference vibratory acceleration is listed in table 2. The value of 1 $\mu m/s^2$ is based on the current estimate of minimum expected vibratory acceleration that is in accordance with 0.3 and 0.4.

NOTE — For structure-borne sound, a reference acceleration of higher value, 10 $\mu m/s^2$, is also in use. However, the requirements of 0.4 and 0.5 are not fulfilled.

4.5 Notation for expressing the reference of a level

A reference quantity may be introduced by **re**, which indicates that the level is "with reference to" and may be so read (see IEC Publication 27-3). For example, "the sound power level, **re** 1 pW, is equal to 135 dB".

Table 2 — Preferred reference quantities expressed in SI units

Medium	Reference quantity
Air	$p_0 = 20\ \mu Pa = 2 \times 10^{-5}$ Pa
Media other than air	$p_0 = 1\ \mu Pa = 10^{-6}$ Pa
All media	$a_0 = 1\ \mu m/s^2 = 10^{-6}\ m/s^2$
	$v_0 = 1$ nm/s $= 10^{-9}$ m/s
	$F_0 = 1\ \mu N = 10^{-6}$ N
	$P_0 = 1$ pW $= 10^{-12}$ W
	$I_0 = 1\ pW/m^2 = 10^{-12}\ W/m^2$
	$w_0 = 1\ pJ/m^3 = 10^{-12}\ J/m^3$
	$E_0 = 1$ pJ $= 10^{-12}$ J

National annex NA (informative)

Committees responsible

The United Kingdom participation in the preparation of this European Standard was entrusted by the Environment and Pollution Standards Policy Committee (EPC/-) to Technical Committee EPC/1, upon which the following bodies were represented:

Association of Consulting Engineers
British Broadcasting Corporation
British Occupational Hygiene Society
British Telecommunications plc
Department of Health
Department of the Environment (Building Research Establishment)
Department of Trade and Industry (National Physical Laboratory)
Health and Safety Executive
Institute of Acoustics
Institute of Occupational Hygienists
Institute of Sound and Vibration Research
Institution of Electrical Engineers
Royal Institute of British Architects
Society of Environmental Engineers

National annex NB (informative)

Cross-references

Publication referred to	Corresponding British Standard
	BS 5775 *Specification for quantities, units and symbols*
ISO 31-2 : 1992	Part 2 : 1993 *Periodic and related phenomena*
ISO 31-7 : 1992	Part 7 : 1993 *Acoustics*
ISO 1000 : 1992	BS 5555 : 1993 *Specification for SI units and recommendations for the use of their multiples and of certain other units*
ISO 2041 : 1990	BS 3015 : 1991 *Glossary of terms relating to mechanical vibration and shock*

BS EN 21683 : 1994
ISO 1683 : 1983

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