

IEEE Standard Letter Symbols and Abbreviations for Quantities Used in Acoustics

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on Quantities, Units, and Letter Symbols

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(Revision of
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IEEE Standard for Letter Symbols and Abbreviations for Quantities Used in Acoustics

Sponsor

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Abstract: Tables of letter symbols and abbreviations for quantities in the science and technology of acoustics are contained in this standard. Recommendations for their use are also provided. Specialties within acoustics that make use of the letter symbols and abbreviations within this standard include, but are not limited to: speech, hearing, music, noise control, vibration, shock, sonar, and transducers. Although remarks and limited short-form information are provided for many of the symbols and abbreviations contained in this standard, definitions and methods of calculating the various quantities are outside the scope of this standard.

Keywords: abbreviations, acoustics, acoustical quantities, acoustical unit symbols, acoustical units, electroacoustics, IEEE 260.4™, scientific, scientific typography, scientific symbols, standard acoustical abbreviations, standard acoustical letter symbols

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Introduction

This introduction is not part of IEEE Std 260.4™-2018, IEEE Standard for Letter Symbols and Abbreviations for Quantities Used in Acoustics.

This standard is a revision of ANSI/IEEE 260.4™-1996. Major changes in this revision include the following:

- A systematic review of the previous version, including the addition of many new symbols and abbreviations in all categories, as well the deletion of obsolete items.
- Both the normative references and the bibliography have been revised and updated.
- The basic differences between letter symbols and abbreviations are clarified. The usage guidelines for letter symbols are also clarified and made consistent with international standards and current practice to the greatest extent possible.
- Script font is now preferred for mathematical operators and transforms, consistent with textbook usage.
- Since the usage of levels in acoustics is ubiquitous, special attention is given to remarks regarding levels in this revision. In particular, letter symbols for the levels of weighted quantities are detailed in an effort to reduce confusion and make usage more consistent across the various specialties within the field of acoustics.
- A number of deprecated abbreviations remain, and this is noted for each such occurrence.
- Table 1 through Table 10 are renumbered so that most significant digit of the item numbers within each table corresponds to the table number, making each table—and the items within them—easier to reference.

Acknowledgments

As Chair of the Working Group for the revision to IEEE Std 260.4™-1996, I am pleased to recognize the support of the Acoustical Society of America for its willingness to participate in the revision of this standard. Without the support of its Standards Director, Christopher J. Struck, who notified participants in the Acoustical Society of America to seek their involvement and the dedicated ASA members who volunteered to become members of the Working Group, the revision of this standard would not have been possible.

Contents

1. Overview	1
1.1 Scope	1
1.2 Purpose	1
2. Normative references.....	1
3. General principles	2
3.1 Letter symbols for quantities, unit symbols, and abbreviations	2
3.2 Remarks concerning quantity symbols	2
3.3 Remarks concerning unit symbols	3
3.4 The International System of Units (SI)	4
3.5 Usage of unit symbols	5
3.6 Unit symbols to be used with limited character sets	6
3.7 Alphabets and typography	6
4. Principles applicable to letter symbols and abbreviations for quantities used in acoustics	7
4.1 Time-varying quantities.....	7
4.2 Average values	8
4.3 Quantities per unit volume, area, or length.....	8
4.4 Sequence for double subscripts to multiplying operators	8
4.5 Remarks concerning levels.....	8
4.6 Remarks concerning abbreviations.....	11
5. Information about the tables.....	12
Annex A (informative) Alphabetical cross-reference of terms.....	48
Annex B (informative) Bibliography.....	60

IEEE Standard for Letter Symbols and Abbreviations for Quantities Used in Acoustics

1. Overview

1.1 Scope

This standard provides a set of letter symbols for quantities and abbreviations and recommendations for their use in the science and technology of acoustics. The science and technology of acoustics includes sound, ultrasound, and infrasound in all media. Gases, especially air; liquids, especially water; and solids are examples of media with which acoustics is concerned. Specialties within acoustics that make use of the letter symbols and abbreviations within this standard include, but are not limited to: speech, hearing, music, noise control, vibration, shock, sonar, and transducers. Although remarks and limited short-form information are provided for many of the symbols and abbreviations contained herein, definitions and methods of calculating the various quantities are outside the scope of this standard.

1.2 Purpose

The purpose of this standard is to clarify the technical literature of acoustics by providing a standard set of letter symbols for use in mathematical formulations and a standard set of abbreviations for use in text, especially in tabulations and on graphs. This standard also encourages the treatment of levels according to the standard rules for all quantities and units and clarifies the basic differences among quantity symbols, unit symbols, and abbreviations.

2. Normative references

The following referenced documents are indispensable for the application of this standard (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this standard is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ASTM/IEEE Std SI10™, American National Standard for Metric Practice.¹

IEEE Std 260.1™, IEEE Standard Letter Symbols for Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).^{2, 3}

¹ ASTM publications are available from the American Society for Testing and Materials (<http://www.astm.org/>).

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3. General principles

3.1 Letter symbols for quantities, unit symbols, and abbreviations

Letter symbols include symbols for physical quantities (quantity symbols) and symbols for units in which these quantities are measured (unit symbols).

“Letter symbol” as a technical term does not have the same meaning as either “name” or “abbreviation.” A *letter symbol* represents a physical quantity or a unit and is therefore independent of language. An *abbreviation* is a letter or a combination of letters (sometimes including an apostrophe or a full stop, i.e., a period) that by convention represents a word or a name in a particular language; hence, an abbreviation is likely to be different in a different language. For example, the letter symbol for electromotive force is *E*, whereas the abbreviation is “emf” in English, “fem” in French, and “EMK” in German. Additionally, the unit names “ampere” and “second” have sometimes been abbreviated amp and sec, respectively, but this usage is now deprecated. The standard unit symbols for ampere and second are A and s, respectively.

The term “physical quantity” as used in this standard means a measurable attribute of phenomena or matter. Some examples are length, mass, and time.

A quantity symbol is generally—but not always—a single letter specified as to style of type font (e.g., bold, italic) and modified when appropriate by one or more subscripts or superscripts. For example, the quantity symbol for electric current is ***I*** and the quantity symbol for Reynolds number is ***Re***. In a given work, the same letter symbol shall appear consistently throughout for the same physical quantity regardless of the units employed or of special values assigned.

A unit symbol is a letter or group of letters (for example, mm for millimeter), or in a few cases a special sign, that is commonly used in place of the name of a unit. Unit symbols have sometimes been treated in the same manner as general abbreviations, but the recommendations of the International Committee for Weights and Measures (CIPM) and of many other international and national bodies concerned with standardization emphasize the symbolic character of these designations and rigidly prescribe the manner in which they shall be treated. This concept of the unit symbol is therefore adopted in this standard. The use of either the unit symbol or the full name of the unit itself is always permitted.

3.2 Remarks concerning quantity symbols

Quantity symbols are used in mathematical expressions in a way consistent with good mathematical usage. The product of two quantities *a*, *b*, is indicated by writing *ab*. The quotient is indicated by writing:

$$\frac{a}{b}, a/b, \text{ or } ab^{-1}$$

If more than one slash (/) is used in any algebraic term, parentheses shall be inserted to remove any ambiguity. Thus, $(a/b)/c$ and $a/(b/c)$ are acceptable, but $a/b/c$ is not.

Subscripts and superscripts are widely used with quantity symbols. Several subscripts and superscripts, sometimes separated by commas, are often attached to a single letter. But, so far as logical clarity permits, subscripts and superscripts shall not be attached to other subscripts and superscripts. A symbol that has been modified by a superscript shall be enclosed in parentheses before an exponent is attached.

Conflicts that occur because different quantities are assigned identical symbols in the same or different standard symbol lists shall be resolved in one of the following ways:

³ IEEE publications are available from The Institute of Electrical and Electronics Engineers (<http://standards.ieee.org/>).

- a) By use of a reserve symbol (alternative symbol) if one is listed
- b) By use of a subscript or superscript selected by the author for one or more of the conflicting requirements
- c) By use of uppercase letters as variants for lowercase letters and vice versa, but only if no ambiguity results

3.3 Remarks concerning unit symbols

A Roman (upright) type font shall be used for unit symbols, even when the surrounding text is in an italic font. In general, unit symbols are lowercase letters, except for a very few that use special signs (such as ° for degree). If, however, the symbol is for a unit whose name is derived from a proper name, uppercase roman type is used for the first letter.⁴

As a further exception to the general rule, the symbol L is used for liter to avoid confusion between the lowercase letter l and the numeral 1. Some additional exceptions arise in the special cases where symbols are joined, as in eV, the symbol for electron volt, and in mmHg, the symbol for conventional millimeter of mercury, a unit of pressure. The distinction between uppercase and lowercase letters shall be followed, even if the symbol appears in applications where the other lettering is uppercased. The form of unit symbols is the same for both singular and plural, and they are not followed by a period except at the end of a sentence.

In the complete expression for a quantity, a space shall be left between the numerical value and the unit symbol. For example, write 35 mm, not 35mm, and 2.371 m, not 2.371m. When the quantity is used in an adjectival sense, a hyphen is often used in lieu of a space between the number and the unit name or between the number and the symbol.

Examples:

A 3-meter pole

The length of the pole is 3 meters.

A 3.5-mm gap

The width of the gap is 3.5 mm.

EXCEPTION: No space is left between the numerical value and the symbols for degree, minute, and second of plane angle.

When a compound unit is formed by division of one unit by another, its unit symbol is constructed in one of the following forms:

$$\text{m/s, ms}^{-1} \text{ or } \frac{\text{m}}{\text{s}}$$

In simple cases use of the slash is preferred, but in no case shall more than one slash, or a slash followed by a product, be used in the same expression unless parentheses are inserted to avoid ambiguity. For example, write:

$$\text{J}/(\text{mol} \cdot \text{K}) \text{ or } \text{J} \cdot \text{mol}^{-1} \cdot \text{K}^{-1} \text{ or } (\text{J}/\text{mol})/\text{K}$$

$$\text{but not } \text{J} / \text{mol} / \text{K} \text{ or } \text{J} / \text{mol} \cdot \text{K}$$

⁴ Many units are derived from proper names. Examples include the ampere, for which the letter symbol is A, and the kelvin, for which the letter symbol is K. Prefixes are considered separately (see Table ii).

In complicated cases, negative powers shall be used for clarity.⁵

Letter symbols and mathematical notation shall not be mixed with unit names in the same expression. For example, write joules per kilogram or J/kg. Do not write joules/kilogram or joules/kg or J/kilogram.

3.4 The International System of Units (SI)

In this standard, some units are identified as SI units. These units belong to the International System of Units (Système International d'Unités), which is the name given in 1960 by the General Conference on Weights and Measures (Conférence Générale des Poids et Mesures) to the coherent system of units built upon the base units in Table i.

This standard uses the spellings meter, liter, and deca in accordance with common U.S. usage.

NOTE—The alternative spellings metre, litre, and deka may also be used. The spelling of some unit names varies from language to language. One of the principal advantages of unit symbols is that they are language invariant.⁶

Table i—SI base units

Physical quantity	Unit
length	meter
mass	kilogram
time	second
electric current	ampere
thermodynamic temperature	kelvin
amount of substance	mole
luminous intensity	candela

The prefixes in Table ii are used to indicate decimal multiples or submultiples of SI units.

Compound prefixes, formed by the concatenation of two or more SI prefixes, are not to be used.

For example, use:

nm *not* mμm

pF *not* μμF

For historical reasons, although the SI unit of mass is the kilogram (kg), the SI prefixes are attached to the gram (g). Thus, milligram (mg), not microkilogram (μkg).

⁵ The notation for products and quotients of unit symbols is intentionally made more explicit than that given in 4.3 for quantity symbols because some unit symbols are composed of more than one letter.

⁶ Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

Table ii—SI prefixes

Multiple	SI prefix	Symbol
10^{24}	yotta	Y
10^{21}	zetta	Z
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^2	hecto	h
10	deka	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a
10^{-21}	zepto	z
10^{-24}	yocto	y

If values are required outside the range covered by the prefixes, they shall be expressed using powers of ten applied to the unit in question. Thus, 10^{34} J.

An exponent attached to a symbol containing a prefix indicates that the multiple or submultiple of the unit (the unit with its prefix) is raised to the power expressed by the exponent.

For example:

$$\text{cm}^3 \equiv (10^{-2} \text{ m})^3 = 10^{-6} \text{ m}^3$$

$$\mu\text{N}^{-1} = (10^{-6} \text{ N})^{-1} = 10^6 \text{ N}^{-1}$$

$$\text{mm}^2/\text{s} \equiv (10^{-3} \text{ m})^2/\text{s} = 10^{-6} \text{ m}^2/\text{s}$$

where

$\equiv$ indicates “equality by definition”

For further information concerning metric practice and the SI, refer to ASTM/IEEE Std SI10™.⁷

3.5 Usage of unit symbols

The use of unit symbols in place of full names of the units is frequently desirable where space is restricted. Their use presupposes that the reader will find them intelligible. When an unfamiliar unit symbol is first used in text, it shall either be followed by its name in parentheses or the name shall be followed by the symbol in parentheses; it is acceptable to use the unit symbol alone thereafter.

NOTE—Explanatory notes or keys should be included where appropriate on drawings and in tabular matter.

Attachment of letters to a unit symbol as a means of giving information about the quantity under consideration is incorrect. Thus MWe for “megawatts electrical (power),” Vac for “volts ac,” and kJt for “kilojoules thermal (energy)” are not acceptable. For this reason, no attempt shall be made to construct SI equivalents of the non-SI abbreviations “psia” and “psig,” so often used to distinguish between absolute

⁷ Information on references can be found in Clause 2.

and gauge pressure. If the context leaves any doubt as to which is meant, the word pressure has to be qualified appropriately. For example (in SI units):

“...at a gauge pressure of 13 kPa” or

“...at an absolute pressure of 13 kPa”

When space limitations make it necessary to juxtapose information about the quantity being measured with the unit name or unit symbol, such information shall be separated from the unit symbol by a space, by a comma followed with a space, or the equivalent. Thus, the following examples are appropriate for use on nameplates, gauge scale plates, table headings, graph labels, etc.:

Rating –5 V ac

kPa, gauge

kPa (abs)

On the other hand, letters are sometimes attached to a unit symbol where needed to properly identify the unit involved. In symbols such as inHg, mmHg, and ftH₂O, the suffixes are needed to identify the units, which are units of pressure, not of length. Similarly, it is proper to write Btu_{IT}, cal_{th}, gal_{US}, etc., to distinguish from the related but different units Btu₆₀, cal₁₅, gal_{UK}, etc.

3.6 Unit symbols to be used with limited character sets

Refer to Clause 6 of IEEE Std 260.1-2004 for a detailed discussion.

3.7 Alphabets and typography

Letter symbols are mainly restricted to the English and Greek alphabets. Greek letters that are easily confused with English letters shall be avoided. The type families that are used for text in modern book and journal publishing all include italic (oblique) type faces and related roman (upright) faces. The former are used for quantity symbols, and the latter, for unit symbols. The distinctions are discussed more fully in the following paragraphs. (In the context of this standard, the term roman is used simply to mean upright in contrast with oblique and carries no connotation regarding serifs, line widths, or the like.) In situations where roman and italic fonts are not both available, care shall be taken to avoid confusion between quantities and units. For example, an underline is frequently used to indicate italic type, and where an underline can be provided, as in manual typewriting, this practice is often helpful.

Unconventional typefaces are not be used for letter symbols. Script and Old English faces, for example, are not appropriate for unit symbols. Such special faces have seen limited use for quantity symbols, but good modern practice avoids them. Arabic numerals are always presented in roman type.

NOTE—Script font may be used for special mathematical operators and transforms.

Symbols for physical quantities and constants, mathematical variables, indices, and general functions are printed in italic type. For example:

<i>A</i>	area
<i>e</i>	elementary electric charge
<i>x, y, z</i>	Cartesian coordinates
<i>i, j, k, m, n</i>	indices
<i>f(x)</i>	function of <i>x</i>

Symbols for units of measurement, mathematical constants, specific mathematical functions, and operators are printed in roman type. For example:

cm	centimeter
e	base of natural logarithms
$\sin(x)$	sine of x
dx	differential of x

Subscripts, superscripts, and indices are governed by the preceding principles. Those that are letter symbols for quantities or for indices are printed in italic type, while all others (e.g., special functions, numerical indices, exponents, and abbreviations) are printed in roman type. For example:

C_p	heat capacity at constant pressure p
a_{ij} , a_{45}	matrix elements
$J_2(z)$, $J_n(z)$	Bessel functions
I_i , I_o	input current, output current
x_{avg}	average value of x

For indicating the vector character of a quantity, boldface italic type is used. The preferred presentation also shows the vector symbol over the letter symbol. For example:

$\vec{F}$, <i>F</i>	force
$\vec{H}$, <i>H</i>	magnetic field strength

Ordinary italic type is used to represent the magnitude of a vector quantity. When tensor quantities of second or higher order are to be represented by a single letter, bold sans serif type shall be used, for example, (**R**, **B**).

Script font is preferred for special mathematical operators and transforms. For example:

$\mathcal{F}\{ \}$	Fourier transform operator
$\mathcal{F}^{-1}\{ \}$	inverse Fourier transform operator
$\mathcal{H}\{ \}$	Hilbert transform operator
$\mathcal{R}_e\{ \}$	real part of a complex expression
$\mathcal{I}_m\{ \}$	imaginary part of a complex expression
$\mathcal{L}\{ \}$	Laplace transform operator

4. Principles applicable to letter symbols and abbreviations for quantities used in acoustics

4.1 Time-varying quantities

When subscripts are used to denote various values associated with a time-varying quantity, the subscripts (for the values indicated) shall conform to the following list:

	<u>Preferred</u>	<u>Reserve</u>
peak value	pk	PK

average value	avg	AVG
root-mean square value	rms	RMS
maximum value	max	MAX
minimum value	min	MIN

4.2 Average values

The average value of a quantity with respect to time shall be indicated by a superscript bar, i.e., $\bar{p}$. Likewise, the spatial average shall be indicated by enclosing the symbol in elbow brackets, i.e., $\langle w \rangle$.

4.3 Quantities per unit volume, area, or length

It is recommended that quantities per unit volume, area, or length be represented, where practical, by lowercase letters corresponding to the uppercase letters that represent the total quantities, or by the uppercase letter with the subscript v, a, or l, except for those quantities for which this standard gives a specific symbol for the quantity per unit volume, area, or length.

4.4 Sequence for double subscripts to multiplying operators

The sequence of double subscripts to the multiplying coefficients (mutual impedances, resistances, transconductances, etc.) that occur in systems of equations is to be determined as follows:

- The first subscript in the symbol shall agree with the subscript of the quantity resulting from the multiplication.
- The second subscript shall agree with that of the multiplicand.

For example:

$$V_1 = Z_{11}I_1 + Z_{12}I_2 + Z_{13}I_3$$

4.5 Remarks concerning levels

A level is treated like any other quantity; as such, it is acceptable for a level to be represented by a quantity symbol with a subscript, as listed in Table 10, Table 11, and Table 12. The numerical value of a level, when expressed in bels (B), is determined by calculating the base 10 logarithm of the ratio of a power quantity to a fixed reference value of the same power quantity. When the level is expressed in nepers (Np), the numerical value is determined by calculating half the base e logarithm of the ratio of a power quantity to a fixed reference value of the same power quantity. When the level is expressed in decibels (dB), it is determined by calculating ten times the ratio of a power quantity to a fixed reference value of the same power quantity. The decibel is, by far, the most common among these three methods of quantification. The numerical value of a level is incomplete unless the reference quantity is stated. For field quantities (e.g. sound pressure, voltage, velocity) for which the square of the quantity is proportional to power or energy, levels in decibels are commonly expressed as ten times the logarithm of a squared field quantity to the squared reference value. For quantities that are not proportional to a power quantity or to a field quantity (e.g., impedance or admittance), expression of these quantities as levels is deprecated. Refer to ISO 80000-3, Quantities and Units—Space and Time [B35], ANSI/ASA S1.1-2013, Acoustical Terminology [B4], or ASTM C634-13e1, Standard Terminology Relating to Building and Environmental Acoustics [B18] for further information.⁸

⁸ The numbers in brackets correspond to those of the bibliography in Annex B.

4.5.1 Notation for expressing the reference of a level

The preferred presentation of a level representing a quantity x with respect to a reference quantity x_{ref} is to identify the reference to the right of the appropriate unit symbol. For example:

15 dB re 20 μPa
77 dB re 20 micropascals
−10 Np re 1 A
72 dB re 1 pW
50 dB re 1 $\mu\text{V/m}$
42 dB re 1 microvolt per meter
7.2 dB re 1 pW

where

re means “with reference to”

NOTE—There is a space before and after “re.”

In the event the reference quantity is unity, it is recommended that the numeral “1” be indicated to avoid confusion.

When a constant reference quantity is explained in the text and used repeatedly in a given context, the reference quantity does not need to be restated at each subsequent use; however, to avoid any possible confusion, it is recommended that the reference quantity be explicitly stated in all cases.

Other methods of expressing the reference value for a level exist, but these are not preferred. For example:

Preferred:

$$L_p = 45 \text{ dB re } 20 \mu\text{Pa}$$

Not Preferred:

$$L_{p(\text{re } 20\mu\text{Pa})} = 45 \text{ dB}$$

$$L_{p/20\mu\text{Pa}} = 45 \text{ dB}$$

$$L_p(\text{re } 20\mu\text{Pa}) = 45 \text{ dB}$$

In the event the quantity being described is the difference between two levels, which must be of like kind, (e.g., share the same stated reference value, weighting factor, time constant), the reference value need not be stated. For example:

“Between 8:00 AM and 9:00 AM, the sound pressure level at the site was measured to be 67 dB re 20 μPa . Between 1:00 PM and 2:00 PM, the sound pressure level at the site was measured to be 78 dB re 20 μPa . This difference of 11 dB is sufficient to conclude...”

NOTE—The use of the unit symbol “dB” for both sound power levels and sound pressure levels has caused confusion between the two even though they represent very different quantities. To help distinguish between a sound power level and a sound pressure level (e.g., in product literature intended for persons not familiar with acoustic nomenclature), the descriptor “sound pressure level” or the descriptor “sound power level” should explicitly be stated in association to the presented quantity to avoid any confusion.

4.5.2 Indication of the level of a frequency weighted quantity

In acoustics, one of the most ubiquitous quantities is sound pressure level (L_p). Often, a frequency weighting (e.g., “A”, “C”) is applied to the sound pressure prior to calculation of the level. With any level calculated from a frequency weighted quantity, the unit of measurement is unchanged; it is still the decibel, bel, or neper. The improper practice of indicating weighting by attaching letters to the unit symbol (e.g., dBA or PNdB) has led to the incorrect belief that such levels are calculated with a different reference value. Such attachments of letters to the unit symbol are, therefore, strongly deprecated in all cases. The decibel, bel, or neper themselves are never weighted; the symbols dB, B, and Np are unit symbols, and are neither quantity symbols nor abbreviations for level.

Any qualification of a level shall be indicated not by attaching letters to the unit symbol dB, B, or Np, but by attaching appropriate subscripts to the quantity symbol or by using an appropriate abbreviation instead of the quantity symbol, as shown in Table 8, Table 9, and Table 10. A sound pressure level of 42 dB re 20 μ Pa that has been measured with A-weighting applied and a time constant consistent with the “Fast” designation shall be described as shown:

$$L_{AFast} = 42 \text{ dB re } 20 \mu\text{Pa}$$

or

$$L_{AF} = 42 \text{ dB re } 20 \mu\text{Pa}$$

Special notice is made with respect to the deprecated “dBA” unit symbol, generally taken to mean that A-weighting has been applied to whatever measured quantity is being described. In several contexts, the unit symbol “dB” for decibels has been understood to imply that A-weighting has been applied. This usage is strongly deprecated; however, many documents pertaining to acoustics (especially in the context of community noise) still exist under this paradigm. Therefore, care shall be taken to help ensure that the actual frequency weighting as applied, if any, has been correctly indicated.

Note that the uppercase letter indicating the frequency weighting is actually a one-letter abbreviation, not a letter symbol. Therefore, it follows the rules for abbreviations. In particular, the one-letter abbreviations for frequency weighting are not italicized, but shall appear in roman font when used in text as well as when used in a subscript. See 4.6 for details concerning abbreviations.

4.5.3 Sequence of subscripts for a level

A succession of subscripts on the quantity symbol for a level (generally, “ L ”, but other quantity symbols for a level exist) identifies the kind of level and the frequency-wise and time-wise modifications of it. For example, L_{PA} represents the level of a power, for which the symbol is P ; the A signifies that A-weighting was applied prior to calculation of the level. P is a letter symbol and follows the rules for letter symbols; A is an abbreviation and follows the rules for abbreviations.

In airborne acoustics, the absence of a first subscript for the kind of level is an indication that the symbol L represents a sound pressure level, although it is strongly recommended that this be made clear in any accompanying text. The subscripts then signify additional information about the sound pressure level. For example:

L_{AS} represents the level of an A-weighted sound pressure using a standard “Slow” time constant.

L_{C8h} represents the level of a C-weighted sound pressure, averaged over an 8-hour time period.

A list of all possible combinations of concatenated subscripts for levels within this standard is impractical. However, the most common examples for use in acoustics are found in Table 6 through Table 10. Many of these levels have strict specifications on how they are to be calculated that are defined elsewhere in the literature. Such specifications, calculations, and definitions are outside the scope of this standard. It is strongly recommended that all quantity symbols be explicitly defined for their given context to ensure clarity.

4.6 Remarks concerning abbreviations

An abbreviation is a shortened form of a word or phrase, used to represent the complete form. The shortened form is obtained by omission of some letters; even all of the letters of some words. The abbreviations recommended in this standard use capital letters.

4.6.1 Use of abbreviations

Abbreviations are to be used only where necessary to save space and time. The time saved by a writer who uses an abbreviation is often less than the time lost by each reader who has to find its meaning. An abbreviated term shall be spelled out in full at its first appearance in text, followed by the abbreviation in parentheses.

NOTE—A glossary may be provided for the convenience of the reader.

Abbreviations for the names of quantities are used as nouns because the names they stand for are nouns or noun phrases.

NOTE—Quantity abbreviations may also be used as adjectives. For example: “the day-night average sound level limit” may be abbreviated to “the DNL limit.” As a further example, the statement, “The day-night average sound level limit is 92 decibels, A-weighted sound level at 15 meters” can be shortened to “The DNL limit at 15 m is 92 dB.”

Abbreviations shall not immediately follow a unit symbol. For example, instead of “92 dBDNL,” use “DNL: 92 dB.”

4.6.2 International use

Abbreviations should be carefully considered, and perhaps especially avoided, in publications and drawings that are intended for circulation internationally because they are formed from words that often differ from one language to another. In this respect, abbreviations stand in contrast to letter symbols for quantities and units that are standardized internationally.

4.6.3 Mathematics

Abbreviations shall not be used in mathematical formulations. Letter symbols shall be used instead.

Often, the operator “log” is used for the base-10 logarithm and “ln” is used for the base-e logarithm. To eliminate ambiguity, throughout this standard the base of the logarithm is indicated by a subscript, e.g., $\log_{10}$ for a base-10 logarithm.

4.6.4 Sequence of letters in an abbreviation

The original sequence of letters in the words and of words in any phrase is to be maintained in an abbreviation. As an example, day-night average sound level is abbreviated to DNL; the single letter L in this context serves as the abbreviation for average sound level. LDN or Ldn is not a correct abbreviation for day-night average sound level because LDN or Ldn is not a shortened form of the full phrase.

In phrases and abbreviations in this standard for levels of time-varying quantities, the averaging time is stated first, the limiting frequency band (if any) is stated second, any additional information about the quantity next, and, finally, the fact that it is a level. For example, 8HAL is the abbreviation for an 8-hour average, A-weighted sound pressure level.

4.6.5 Invariance of form

The form of an abbreviation shall be invariant. Syntactical endings shall not be used. For example, an “s” shall not be added to indicate plural.

4.6.6 Subscripts

Subscripts shall not be used in abbreviations. However, it is possible for abbreviations to be used in a subscript.

4.6.7 Punctuation

Except as shown in specific examples in this standard, punctuation marks shall not be used as part of an abbreviation.

5. Information about the tables

Table 1 through Table 10 list quantities, grouped in several categories, and give quantity symbols for each. Informative information regarding many of the quantity symbols and abbreviations can be found in the Remarks column. Bibliographical references, where appropriate, are given in the Remarks column and appear in brackets with an uppercase B. In addition, Table 8, Table 9, and Table 10 give standard abbreviations for the quantities listed. Abbreviations are usually not appropriate for the quantities listed in Table 1 through Table 7. Only abbreviations are given for some quantities that are not operated on mathematically and that, therefore, do not require letter symbols. To aid in identifying these quantities, their units based on the International System of Units (SI) and their standard unit symbols are included.

A quantity shall be represented by the standard symbol appearing in the tables, regardless of the units in which it is expressed. Those quantity symbols that are separated by a comma are alternatives on equal standing. A symbol enclosed in parentheses is a reserve symbol to be used only when there is a specific need to avoid a conflict.

Table 1, Table 2, Table 3, and Table 5 contain quantities of interest in acoustics, many of whose symbols have already been standardized for broad fields of application.

Table 4 contains quantities of radiation and light. These symbols are included for their use in photo-acoustical detection, for their relationship to symbols for electromagnetic radiation, and for their use in light and optical analogies to acoustical wave behavior.

Table 6 through Table 10 cover letter symbols and abbreviations commonly used in the field of acoustics.

Quantity symbols and abbreviations are listed alphabetically by symbol or abbreviation in Table 11 and Table 12, respectively, for ready reference. Finally, all quantities, together with variants of their names, are listed alphabetically by name in Annex A.

Letter symbols and abbreviations for dimensionless quantities are indicated as “(numeric)” in the “Unit based on international system” or “Unit symbol” column, respectively.

Table 1—Space and time: Symbols for quantities⁹

Item	Quantity	Quantity symbol	Unit based on international system	Unit symbol	Remarks
1.1	angle, plane	$\alpha, \beta, \gamma, \theta, \varphi, \psi$	radian, (numeric)	rad	Other Greek letters are permitted where no conflict results.
1.2	angle, solid	$\Omega, (\omega)$	steradian, (numeric)	sr	
1.3	length	l, L	meter	m	
1.4	width, breadth	b, w	meter	m	
1.5	height	h	meter	m	
1.6	thickness	d	meter	m	
1.7	radius, distance from source	r, R	meter	m	
1.8	diameter	d, D	meter	m	
1.9	length of path, line segment, distance	s	meter	m	
1.10	wavelength	λ	meter	m	
1.11	wave number	k	radian per meter	rad/m	$k = 2\pi/\lambda$
1.12	area	$A, (S)$	square meter	m ²	
1.13	volume	V, v	cubic meter	m ³	
1.14	time	t	second	s	
1.15	period, time of one cycle	T	second	s	
1.16	time constant	$\tau, (T)$	second	s	
1.17	frequency	$f, (\nu)$	hertz	Hz	1 Hz is the frequency of a periodic phenomenon with a period of 1 second.
1.18	bandwidth	B	hertz	Hz	

⁹ See Annex A for the alphabetical cross-reference list of terms.