INTERNATIONAL STANDARD

ISO 31-7

Second edition
1992-09-01

Quantities and units —

Part 7: Acoustics

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Grandeurs et unités —

Partie 7: Acoustique

ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/23c0292a-6c39-4718-9f96-70019b898fac/iso-31-7-1992

Reference number
ISO 31-7:1992(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.

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

International Standard ISO 31-7 was prepared by Technical Committee ISO/TC 12, *Quantities, units, symbols, conversion factors.*

ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/23c0292a-6c39-4718-9f96-700196b898fac/iso-31-7-1992

This second edition cancels and replaces the first edition (ISO 31-7:1978). The major technical changes from the first edition are the following:

— the decision by the International Committee for Weights and Measures (Comité International des Poids et Mesures, CIPM) in 1980 concerning the status of supplementary units has been incorporated;

— the special remark on logarithmic quantities and units has been elaborated;

— the annex on CGS units has been deleted.

The scope of Technical Committee ISO/TC 12 is standardization of units and symbols for quantities and units (and mathematical symbols) used within the different fields of science and technology, giving, where necessary, definitions of these quantities and units. Standard conversion factors for converting between the various units also come under the scope of the TC. In fulfilment of this responsibility, ISO/TC 12 has prepared ISO 31.

© ISO 1992
All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland
Printed in Switzerland

ISO 31 consists of the following parts, under the general title *Quantities and units*:

— *Part 0: General principles*

— *Part 1: Space and time*

— *Part 2: Periodic and related phenomena*

— *Part 3: Mechanics*

— *Part 4: Heat*

— *Part 5: Electricity and magnetism*

— *Part 6: Light and related electromagnetic radiations*

— *Part 7: Acoustics*

— *Part 8: Physical chemistry and molecular physics*

— *Part 9: Atomic and nuclear physics*

— *Part 10: Nuclear reactions and ionizing radiations*

— *Part 11: Mathematical signs and symbols for use in the physical sciences and technology*

— *Part 12: Characteristic numbers*

— *Part 13: Solid state physics*

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/23c0292a-6c39-4718-9f96-70019b898fac/iso-31-7-1992

Introduction

0.1 Arrangement of the tables

The tables of quantities and units in ISO 31 are arranged so that the quantities are presented on the left-hand pages and the units on the corresponding right-hand pages.

All units between two full lines belong to the quantities between the corresponding full lines on the left-hand pages.

Where the numbering of an item has been changed in the revision of a part of ISO 31, the number in the preceding edition is shown in parentheses on the left-hand page under the new number for the quantity; a dash is used to indicate that the item in question did not appear in the preceding edition.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

0.2 Tables of quantities

ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/iso/23e0...-6c39-4718-9f96-700196b898ab/iso-31-7-1992

The most important quantities within the field of this document are given together with their symbols and, in most cases, definitions. These definitions are given merely for identification; they are not intended to be complete.

The vectorial character of some quantities is pointed out, especially when this is needed for the definitions, but no attempt is made to be complete or consistent.

In most cases only one name and only one symbol for the quantity are given; where two or more names or two or more symbols are given for one quantity and no special distinction is made, they are on an equal footing. When two types of italic (sloping) letter exist (for example as with ϑ, θ; φ, ϕ; g, g) only one of these is given. This does not mean that the other is not equally acceptable. In general it is recommended that such variants should not be given different meanings. A symbol within parentheses implies that it is a "reserve symbol", to be used when, in a particular context, the main symbol is in use with a different meaning.

0.3 Tables of units

0.3.1 General

Units for the corresponding quantities are given together with the international symbols and the definitions. For further information, see ISO 31-0.

The units are arranged in the following way:

a) The names of the SI units are given in large print (larger than text size). The SI units have been adopted by the General Conference on Weights and Measures (Conference Générale des Poids et Mesures, CGPM).

The SI units and their decimal multiples and sub-multiples are recommended, although the decimal multiples and sub-multiples are not explicitly mentioned.

b) The names of non-SI units which may be used together with SI units because of their practical importance or because of their use in specialized fields are given in normal print (text size).

These units are separated by a broken line from the SI units for the quantities concerned.

c) The names of non-SI units which may be used temporarily together with SI units are given in small print (smaller than text size) in the "Conversion factors and remarks" column.

d) The names of non-SI units which should not be combined with SI units are given only in annexes in some parts of ISO 31. These annexes are informative and not integral parts of the standard. They are arranged in three groups:

1) special names of units in the CGS system;

2) names of units based on the foot, pound and second and some other related units;

3) names of other units.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

0.3.2 Remark on units for quantities of dimension one

The coherent unit for any quantity of dimension one is the number one (1). When the value of such a quantity is expressed, the unit 1 is generally not written out explicitly. Prefixes shall not be used to form multiples or sub-multiples of this unit. Instead of prefixes, powers of 10 may be used.

ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/23c0292a-6e39-4f18-9f96-70019b898fac/iso-31-7-1992

EXAMPLES

Refractive index $n = 1{,}53 \times 1 = 1{,}53$

Reynolds number $Re = 1{,}32 \times 10^3$

Considering that plane angle is generally expressed as the ratio between two lengths, and solid angle as the ratio between an area and the square of a length, the CIPM specified in 1980 that, in the International System of Units, the radian and steradian are dimensionless derived units. This implies that the quantities plane angle and solid angle are considered as dimensionless derived quantities. The units radian and steradian may be used in expressions for derived units to facilitate distinction between quantities of different nature but having the same dimension.

0.4 Numerical statements

All numbers in the "Definition" column are exact.

When numbers in the "Conversion factors and remarks" column are exact, the word "exactly" is added in parentheses after the number.

0.5 Special remarks

0.5.1 General

The explanations in the "Definition" column for quantities assume that systems will normally be linear.

When it is necessary to use subscripts to avoid confusion between similar symbols in different fields, the subscript "a" is recommended for use in acoustics.

0.5.2 Remark on logarithmic quantities and units

The expression for the time dependence of a damped harmonic oscillation can be written either in real notation or as the real part of a complex notation

$$F(t) = A\mathrm{e}^{-\delta t} \cos\ \omega t = \mathrm{Re}\left(A\mathrm{e}^{(-\delta + \mathrm{j}\omega)t}\right)$$

This simple relation involving δ and ω can be obtained only when e (base of natural logarithms) is used as the base of the exponential function. The coherent SI unit for the damping coefficient δ and the angular frequency ω is second to the power minus one, 1/s. Using the special names neper, Np, and radian, rad, for the units of δt and ωt respectively, the units for δ and ω become neper per second, Np/s, and radian per second, rad/s, respectively. Neper and radian are special names for the "dimensionless" unit one, 1. The neper is used as a unit for logarithmic quantities; the radian is used as a unit for plane angles and for the phase of circular functions.

Corresponding variation in space is treated in the same manner

$$F(x) = A\mathrm{e}^{-\alpha x} \cos\ \beta x = \mathrm{Re}(A\mathrm{e}^{-\gamma x}), \qquad \gamma = \alpha + \mathrm{j}\beta$$

iTeh STANDARD PREVIEW

where the unit for α is neper per metre, Np/m, and the unit for β is radian per metre, rad/m.

(standards.iteh.ai)

In ISO 31, the level of a field quantity is therefore defined as the natural logarithm of a ratio of two amplitudes, $L_F = \ln(F/F_0)$, and is hence a quantity of dimension one. The unit neper (= the number 1) is the level of a field quantity when $F/F_0 = \mathrm{e}$.

ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/2e0e0f2a-6c39-4718-9f96-70019b898fac/iso-31-7-1992

Since power is often proportional to the square of an amplitude, a factor 1/2 is introduced in the definition of the level of a power quantity $L_P = (1/2) \ln(P/P_0)$ in order to make the level of the power quantity under these circumstances equal to the level of the field quantity.

In practice the non-coherent unit degree, ...°, ($1° = \pi/180$ rad) is often used for angles and the non-coherent unit bel, B, [1 B = (1/2) ln 10 Np ≈ 1,151 293 Np] based on common logarithms (base 10) for logarithmic quantities. Instead of the bel, its sub-multiple the decibel, dB, is commonly used.

Quantities and units —

Part 7:
Acoustics

1 Scope

This part of ISO 31 gives names and symbols for quantities and units of acoustics. Where appropriate, conversion factors are also given.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 31. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 31 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/
70019b898fac/iso-31-7-1992

ISO 16:1975, *Acoustics — Standard tuning frequency (Standard musical pitch).*

ISO 31-2:1992, *Quantities and units — Part 2: Periodic and related phenomena.*

ISO 131:1979, *Acoustics — Expression of physical and subjective magnitudes of sound or noise in air.*

3 Names and symbols

The names and symbols for quantities and units of acoustics are given on the following pages.

ACOUSTICS				Quantities
Item No.	**Quantity**	**Symbol**	**Definition**	**Remarks**
7-1	period, periodic time	T	Time of one cycle	
7-2	frequency	f, ν	$f = 1/T$	For the standard tuning frequency (standard musical pitch), see ISO 16.
7-3	frequency interval		For two tones, the binary logarithm of the ratio of the higher frequency to the lower frequency	
7-4	angular frequency, pulsatance	ω	$\omega = 2\pi f$	
7-5	wavelength	λ	Distance in the direction of propagation of a periodic wave between two successive points where at a given time the phase is the same	
7-6 (—)	repetency, wavenumber	σ	$\sigma = 1/\lambda$	The vector quantities $\boldsymbol{\sigma}$ and $\boldsymbol{k}$ corresponding to repetency and angular repetency are called wave vector and propagation vector respectively.
7-7 (*7-6.1*)	angular repetency, angular wavenumber	k	$k = 2\pi\sigma$	
7-8 (*7-7.1*)	volumic mass, mass density, density	ϱ	Mass divided by volume	

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/23c0292a-6c39-4718-9f96-70019b898fac/iso-31-7-1992

Units				ACOUSTICS
Item No.	**Name of unit**	**International symbol for unit**	**Definition**	**Conversion factors and remarks**
7-1.a	second	s		
7-2.a	hertz	Hz	1 Hz = 1 s^{-1}	1 Hz is the frequency of a periodic phenomenon of which the period is 1 s.
7-3.a	octave		The frequency interval between f_1 and f_2 is one octave if $f_2/f_1 = 2$	The numerical value of the frequency interval in octaves is given by $\mathrm{lb}(f_2/f_1)$, $(f_2 \geqslant f_1)$.
7-4.a 7-4.b	radian per second reciprocal second, second to the power minus one	rad/s s^{-1}		
7-5.a	metre	m		
7-6.a	reciprocal metre, metre to the power minus one	m^{-1}		
7-7.a 7-7.b	radian per metre reciprocal metre, metre to the power minus one	rad/m m^{-1}		
7-8.a	kilogram per cubic metre	kg/m^3		

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/23c0292a-6c39-4718-9f96-70019b898fac/iso-31-7-1992

© ISO

ACOUSTICS (*continued*)				Quantities
Item No.	**Quantity**	**Symbol**	**Definition**	**Remarks**
7-9.1 (*7-8.1*)	static pressure	p_s	Pressure that would exist in the absence of sound waves	
7-9.2 (*7-8.2*)	(instantaneous) sound pressure	p, (p_a)	Difference between the instantaneous total pressure and the static pressure	When any of the quantities 7-9.2 to 7-13 inclusive is periodic, its symbol is often used without modification for its root-mean-square (r.m.s.) value.
7-10 (*7-9.1*)	(instantaneous) sound particle displacement	ξ, (x)	Instantaneous displacement of a particle in a medium from what would be its position in the absence of sound waves	
7-11 (*7-10.1*)	(instantaneous) sound particle velocity	u, v	$u = \frac{\partial \xi}{\partial t}$	
7-12 (*7-11.1*)	(instantaneous) sound particle acceleration	a	$a = \frac{\partial u}{\partial t}$	
7-13 (*7-12.1*)	(instantaneous) volume flow rate	q, U, (q_V)	Instantaneous rate of volume flow due to a sound wave	
7-14.1 (*7-13.1*)	velocity of sound, (phase velocity)	c, (c_a)	$c = \frac{\omega}{k} = \lambda f$	
7-14.2 (—)	group velocity	c_g	$c_g = \frac{d\omega}{dk}$	
7-15 (*7-14.1*)	sound energy density, volumic sound energy	w, (w_a), (e)	Mean sound energy in a given volume divided by that volume	If the energy density varies with time, the mean must be taken over an interval during which the sound may be considered statistically stationary.
7-16 (*7-15.1*)	sound power	P, P_a	Power emitted, transferred or received as sound waves	
7-17 (*7-16.1*)	sound intensity	I, J	For unidirectional sound power, sound power through a surface normal to the direction of propagation divided by the area of the surface	

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/23c0292a-6c39-4718-9f96-700f9b898fac/iso-31-7-1992

Units				ACOUSTICS (*continued*)
Item No.	**Name of unit**	**International symbol for unit**	**Definition**	**Conversion factors and remarks**
7-9.a	pascal	Pa		bar (bar), 1 bar = 100 kPa (exactly)
7-10.a	metre	m		
7-11.a	metre per second	m/s		
7-12.a	metre per second squared	m/s^2		
7-13.a	cubic metre per second	m^3/s		
7-14.a	metre per second	m/s		
7-15.a	joule per cubic metre	J/m^3		
7-16.a	watt	W		
7-17.a	watt per square metre	W/m^2		

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO 31-7:1992
https://standards.iteh.ai/catalog/standards/sist/23c0292a-6c39-4718-9f96-70019b898fac/iso-31-7-1992