

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 31 PART III

QUANTITIES AND UNITS OF MECHANICS

1st EDITION

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BRIEF HISTORY

The ISO Recommendation R 31, Part III, *Quantities and Units of Mechanics*, was drawn up by Technical Committee ISO/TC 12, *Quantities, Units, Symbols, Conversion Factors and Conversion Tables*, the Secretariat of which is held by the Danish Standards Association, Dansk Standardiseringsråd (DS).

The ISO/TC 12 Secretariat drew up two drafts in succession, the second of which was studied in detail by the Technical Committee during its fourth meeting, held in Copenhagen in November 1957. The Secretariat then prepared a third draft proposal, which was approved as a Draft ISO Recommendation.

It should be noted that the following international organizations have had these draft proposals sent to them and have taken part in the discussions at the meetings of Technical Committee ISO/TC 12:

International Commission on Illumination
International Committee on Weights and Measures
International Electrotechnical Commission
International Union of Pure and Applied Chemistry -
International Union of Pure and Applied Physics
and its Sub-Committee SUN
Organisation Internationale de Métrologie Légale

On 31 March 1959, the Draft ISO Recommendation (No. 276) was distributed to all the ISO Member Bodies and was approved by the following Member Bodies:

Australia	Hungary	Poland
Austria	India	Portugal
Belgium	Ireland	Sweden
Burma	Israel	Switzerland
Czechoslovakia	Japan	United Kingdom
Denmark	Netherlands	U. S. A.
France	New Zealand	U. S. S. R.
Germany	Norway	
Greece	Pakistan	

Two Member Bodies opposed the approval of the Draft:

Italy, Romania

The Draft ISO Recommendation was submitted by correspondence to the ISO Council, which decided, in December 1960, to accept it as an ISO RECOMMENDATION.

Introduction

This document, containing a table of *Quantities and Units of Mechanics*, is part of a more comprehensive publication dealing with quantities and units in various fields of science and technology.

Parts of this more comprehensive publication are the ISO Recommendation R 31/Part I (2nd edition):

*The International System of Units
and Quantities and Units of Space and Time¹⁾,*

the ISO Recommendation R 31/Part II:

Quantities and Units of Periodic and Related Phenomena

and the ISO Recommendation R 31/Part IV:

Quantities and Units of Heat.

General information regarding the arrangement of the tables and the symbols and abbreviations used is to be found in the introduction to ISO/R 31/Part I, where the full definitions of basic units are given as an appendix.

The statements in the definition column for quantities are given merely for identification; they are not intended to be complete definitions.

¹⁾ The title of the first edition of this document was: "Fundamental Quantities and Units of the MKSA System and Quantities and Units of Space and Time".

Quantities
3-1.1

3. Mechanics

Item No.	Quantity	Symbol	Definition	Remarks
3-1.1	mass	<i>m</i>		

3. Mechanics

Units

3-1.a...3-1.h

Item No.	Name of unit and in certain cases abbreviation for this name	International symbolic abbreviation for unit	Definition	Conversion factors	Remarks
3-1.a	kilogramme	kg	The kilogramme is the unit of mass defined under that name by the Conférence Générale des Poids et Mesures.		For details, see ISO/R 31/Part I.
3-1.b	gramme	g	$1 \text{ g} = 10^{-3} \text{ kg}$		
3-1.c	tonne	t	$1 \text{ t} = 1000 \text{ kg}$		
3-1.d	metric carat		1 metric carat = 200 mg		Adopted by the 4th Conférence Générale des Poids et Mesures (1907) for commercial transactions in diamonds, fine pearls and precious stones.
3-1.e	metric technical unit of mass		1 metric technical unit of mass is the mass that acquires an acceleration of 1 m/s^2 under the influence of a force equal to 1 kilogramme-force. (See 3-8d).	1 metric technical unit of mass = 9.80656 kg (exactly)	
3-1.f	pound (UK) (avoirdupois), lb (UK)		1 lb (UK) is the fundamental unit of mass in the British Imperial System as defined in law (Weights and Measures Acts).	1 lb (UK) = 0.453 592 338 kg (determined experimentally in 1933).	For details, see ISO/R 31/Part I. See also remark 3-1.h
3-1.g	pound (US) (avoirdupois), lb avdp (US)		The avoirdupois pound (US) is derived from the international kilogramme as authorised in the Mendenhall Order of 5th April, 1893. The relation used is 1 avoirdupois pound = 0.453 592 427 7 kg	1 lb avdp (US) = 0.453 592 427 7 kg (exactly)	The relation given in the definition was officially adopted on or before March 21, 1894. The factor therein is the result of an experimental determination in 1883 of the mass at that time of the United Kingdom Standards. See also remark 3-1.h
3-1.h	pound (avoirdupois)	lb		1 lb = 0.453 592 37 kg	Consideration has been given to the possibility of redefining the U.K. and U.S. pounds (avoirdupois) on a common legal basis by reference to the kilogramme, and the following values have been proposed: $1 \text{ pound} = 0.453 592 3 \text{ kg}$ or $0.453 592 37 \text{ kg}$ Both these values are such that the ratio of the grain (1/7000 lb) to the kilogramme would be exactly expressible as a terminating decimal. No decision, however, has so far been reached. Throughout these tables the term pound, with its symbolic abbreviation lb, not followed by the affix (UK) or (US), relates to a unit of mass which is treated here as if it were exactly equivalent to 0.453 592 37 kg, but the adoption of this relationship should not be regarded as giving it any special status; nor does it prejudice the choice of a common definitive value for the pound in the future. The same common relationship applies to multiples and sub-multiples of the pound whenever they are not followed by an affix having some other significance. The value of the pound given under 3-1.h coincides with that adopted in 1959 for precise measurement for science and technology by the following 6 national laboratories: (continued)

Quantities
3-2.1...3-7.1

3. Mechanics (continued)

Item No.	Quantity	Symbol	Definition ¹⁾	Remarks
3-2.1	density (mass density)	ϱ, ρ	Mass divided by volume.	
3-3.1	relative density	d	Ratio of the density of a substance to the density of a reference substance under conditions that should be specified for both substances.	This quantity is dimensionless. When the reference substance is water, the name specific gravity is often used in English.
3-4.1	specific volume	v	Volume divided by mass.	
3-5.1	momentum	p	Product of mass and velocity.	
3-6.1	moment of momentum, angular momentum	b, p_θ, p_ϕ	The moment of momentum of a particle about a point is equal to the vector product of the radius vector from this point to the particle and the momentum of the particle.	
3-7.1	moment of inertia (dynamic moment of inertia)	I, J	The (dynamic) moment of inertia of a body about an axis is the sum (integral) of the products of its mass-elements and the squares of their distances from the axis.	To be distinguished from 3-16.1 and 3-16.2

¹⁾ The statements in this column are given merely for identification and they are not intended to be complete definitions.