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IEEE Recommended Practice for Preferred Metric Units for Use in Electrical and Electronics Science and Technology

IEEE Standards Coordinating Committee 14

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Quantities, Units, and Letter Symbols

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IEEE Standards Coordinating Committee 14 on Quantities, Units, and Letter Symbols

Approved 8 February 2019

IEEE-SA Standards Board

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Abstract: The preferred metric units for use in Electrical and Electronics Science and Technology is provided by this recommended practice. The application of IEEE/ASTM SI 10 is supported.

Keywords: conversion factors, IEEE 945™, International System, International System of Units, metric practice, metric system, preferred units, SI, SI 10, Système International d'Unités

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Introduction

This introduction is not part of IEEE Std 945-2019, IEEE Recommended Practice for Preferred Metric Units for Use in Electrical and Electronics Science and Technology.

This revision of IEEE Recommended Practice for Preferred Metric Units for Use in Electrical and Electronics Science and Technology incorporates changes since the 1984 edition. The most significant changes include:

— Addition of definitions for various terms.

— Replacement of SI prefixes, symbols, and multiplication factors table with reference to IEEE/ASTM SI 10.

— Item numbering in the tables setup in format "TA-B", T (for table), A = Table Number, and B = item number in table.

— Sorting of the order of units throughout to be from largest to smallest.

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Contents

1. Overview 9
1.1 Scope 9
1.2 Purpose 9

2. Normative references 9

3. Definitions 9

4. Multiples and submultiples of SI units 10

5. Space and time 10

6. Periodic and related phenomena 12

7. Mechanics 12

8. Heat 15

9. Electricity and magnetism 16

10. Light and related electromagnetic radiation 19

11. Acoustics 20

Annex A (informative) Bibliography 22

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IEEE Recommended Practice for Preferred Metric Units for Use in Electrical and Electronics Science and Technology

1. Overview

1.1 Scope

This recommended practice provides the preferred metric units for use in Electrical and Electronics Science and Technology and supports the application of IEEE/ASTM SI 10.

1.2 Purpose

The purpose of this recommended practice is to aid in the selection of appropriate metric units for quantities ~~so as to promote uniformity in the use of metric units and to limit the number of different metric units~~ that are of interest to ~~will be used in~~ electrical and electronic engineers. ~~electronics science and technology. ANSI/IEEE Std 268-1982, American National Standard Metric Practice, prescribes how metric units are to be used and gives guidance concerning correct metric practice.~~

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document 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.

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IEEE/ASTM SI 10™, American National Standard for Metric Practice.[1, 2]

3. Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.[3]

area density: The quantity of mass per area.

coefficient of heat transfer: The density of heat flow rate divided by the temperature difference.

density: The quantity of mass per volume.

linear density: The quantity of mass per length.

mass concentration: The quantity of mass of a constituent per volume of the mixture.

thermal insulance: The temperature difference divided by density of heat flow rate.

thermal resistance: The temperature difference divided by heat flow rate.

NOTE—Coefficient of heat transfer and thermal insulance are reciprocals of each other.[4]

4. Multiples and submultiples of SI units

For SI prefixes, symbols, and multiplication factors, see IEEE/ASTM SI 10.

A common practice is to use multiples and submultiples that are a powers of 10^3, also known as the rule of 1000.

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~~Table 1-Multiples and Submultiples of SI Units~~

Multiplying Factor	Prefix	Letter Symbol
1 000 000 000 000 000 000 = 10^{18}	exa	E
1 000 000 000 000 000 = 10^{15}	peta	P
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto*	h
10 = 10^{1}	deka*	da
0.1 = 10^{-1}	deci*	d
0.01 = 10^{-2}	centi*	c
0.001 = 10^{-3}	milli	m
0.000 001 = 10^{-6}	micro	μ
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

~~(Deleted)~~

~~*To be avoided where practical. See ANSI/IEEE Std 268-1982 .~~

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5. Space and time

Table 1 provides preferred space and time SI units.

Table 1—Space and time SI units

Item	Quantity	SI symbol (unit)	Preferred multiples of SI units	Other units permitted for use with SI	Typical and recommended applications and explanatory notes
T1-1	plane angle	rad (radian)		° (degree)	Engineering and scientific calculations Measurement of angles in surveys, plans, electrical calculations (Use of decimal division of degrees instead of minutes and seconds is encouraged.)
T1-2	solid angle	sr (steradian)			Engineering and scientific calculations
T1-3	length (width, height, thickness, radius, diameter, depth)	m (meter)	km (kilometer) m (meter) cm (centimeter) mm (millimeter) µm (micrometer) nm (nanometer)		The kilometer replaces mile, meter replaces yard and foot, centimeter replaces inch, and smaller submultiples replace the fractions of an inch. The hectometer, dekameter, and decimeter are used only rarely and are not recommended for general use. In many engineering applications the centimeter is avoided for fear of confusion or of proliferation of different unit multiples. Thus, all dimensions on mechanical engineering drawings are expressed in millimeters; dimensions for construction projects are expressed in meters or millimeters, but not in centimeters.

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