

CIVIL AVIATION REGULATIONS

SURINAME

PART 16

**UNITS OF MEASUREMENT TO BE USED IN
AIR AND GROUND OPERATIONS**

VERSION 2.0

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16.1 DEFINITIONS

When the terms are used in the CARS part 16 concerning the units of measurement, there to be used in all aspects of international civil aviation air and ground operations.

The terms are found in CARS part 1.

16.2 APPLICABILITY

This CARS contains specifications for the use of a standardized system of units of measurement in international civil aviation air and ground operations. This standardized system of units of measurement is based on the International System of Units (SI) and certain non-SI units considered necessary to meet the specialized requirements of international civil aviation. See CASAS Advisory Pamphlet A, The development of the SI for details concerning the development of the SI.

16.2.1 These Regulations shall be applicable to all aspects of international civil aviation air and ground operations.

16.3 STANDARD APPLICATION OF UNITS OF MEASUREMENT

16.3.1 SI Units

16.3.1.1 The International System of Units (SI) developed and maintained by the General Conference of Weights and Measures (CGPM) shall, subject to the provisions of 16.3.2 and 16.3.3, be used as the standard system of units of measurement for all aspects of national and international civil aviation air and ground operations.

16.3.1.2 Prefixes

The prefixes and symbols listed in Table 3-1 shall be used to form names and symbols of the decimal multiples and sub-multiples of SI units.

Note 1.— As used herein the term SI unit is meant to include base units and derived units as well as their multiples and sub-multiples.

Note 2.— See CASAS Advisory Pamphlet B GUIDANCE ON THE APPLICATION OF THE SI for guidance on the general application of prefixes

Table 3-1. SI unit prefixes

<i>Multiplication factor</i>	<i>Prefix</i>	<i>Symbol</i>
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	deca	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

16.3.2 Non-SI Units

16.3.2.1 Non-SI units for permanent use with the SI

The non-SI units listed in Table 3-2 shall be used either in lieu of, or in addition to, SI units as primary units of measurement but only as specified in Table 3-4.

Table 3-2. Non-SI units for use with the SI

Specific quantities in Table 3-4 related to	Unit	Symbol	Definition (in terms of SI units)
mass	tonne	t	1 t = 10 ³ kg
plane angle	degree	°	1° = (π/180) rad
	minute	'	1' = (1/60)° = (π/10 800) rad
	second	"	1" = (1/60)' = (π/648 000) rad
temperature	degree Celsius	°C	1 unit °C = 1 unit K _a)
time	minute	min	1 min = 60 s
	hour	h	1 h = 60 min = 3 600 s
	day	d	1 d = 24 h = 86 400 s
	week, month, year	-	
volume	litre	L	1 L = 1 dm ³ = 10 ⁻³ m ³

a) See CASAS Advisory Pamphlet C CONVERSION FACTORS , Table C-2 for conversion

- 16.3.2.2 Non-SI alternative permitted for temporary use with SI
The non-SI units listed in Table 3-3 shall be permitted for temporary use as alternate units of measurement but only for those specific quantities listed in Table 3-4.

Note.— It is intended that the use of the non-SI alternative units listed in Table 3-3 and applied as indicated in Table 3-4 will eventually be discontinued in accordance with individual unit termination dates established by the Council. Termination dates, when established, will be given in Chapter 16.4.

16.3.3 Application of specific units

- 16.3.3.1 The application of units of measurement for certain quantities used in international civil aviation air and ground operations shall be in accordance with Table 3-4.

Note.— Table 3-4 is intended to provide standardization of units (including prefixes) for those quantities commonly used in air and ground operations. Basic Annex provisions apply for units to be used for quantities not listed

- 16.3.3.2 Means and provisions for design, procedures and training shall be established for operations in environments involving the use of standard and non-SI alternatives of specific units of measurement, or the transition between environments using different units, with due consideration to human performance.

Note.— Guidance material on human performance can be found in the Human Factors Training Manual (Doc 9683).

Table 3-3. Non-SI alternative units permitted for temporary use with the SI

Specific quantities in Table 3-4 related to	Unit	Symbol	Definition (in terms of SI units)
distance (long)	nautical mile	NM	1 NM = 1 852 m
distance (vertical)*	foot	ft	1 ft = 0.304 8 m
speed	knot	kt	1 kt = 0.514 444 m/s

* altitude, elevation, height, vertical speed

Table 3-4. Standard application of specific units of measurement

<i>Ref. No.</i>	<i>Quantity</i>	<i>Primary unit (symbol)</i>	<i>Non-SI alternative unit (symbol)</i>
1. Direction/Space/Time			
1.1	altitude	m	ft
1.2	area	m ²	
1.3	distance (long) ^{a)}	km	NM
1.4	distance (short)	m	
1.5	elevation	m	ft
1.6	endurance	h and min	
1.7	height	m	ft
1.8	latitude	° ' "	
1.9	length	m	
1.10	longitude	° ' "	
1.11	plane angle (when required, decimal subdivisions of the degree shall be used)	°	
1.12	runway length	m	
1.13	runway visual range	m	
1.14	tank capacities (aircraft) ^{b)}	L	
1.15	time	s min h d week month year	
1.16	visibility ^{c)}	km	
1.17	volume	m ³	
1.18	wind direction (wind directions other than for a landing and take-off shall be expressed in degrees true; for landing and take-off wind directions shall be expressed in degrees magnetic)	°	
2. Mass-related			
2.1	air density	kg/m ³	
2.2	area density	kg/m ²	
2.3	cargo capacity	kg	
2.4	cargo density	kg/m ³	
2.5	density (mass density)	kg/m ³	
2.6	fuel capacity (gravimetric)	kg	
2.7	gas density	kg/m ³	
2.8	gross mass or payload	kg t	
2.9	hoisting provisions	kg	
2.10	linear density	kg/m	
2.11	liquid density	kg/m ³	
2.12	mass	kg	
2.13	moment of inertia	kg · m ²	
2.14	moment of momentum	kg · m ² /s	
2.15	momentum	kg · m/s	

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<i>Ref. No.</i>	<i>Quantity</i>	<i>Primary unit (symbol)</i>	<i>Non-SI alternative unit (symbol)</i>
3. Force-related			
3.1	air pressure (general)	kPa	
3.2	altimeter setting	hPa	
3.3	atmospheric pressure	hPa	
3.4	bending moment	kN · m	
3.5	force	N	
3.6	fuel supply pressure	kPa	
3.7	hydraulic pressure	kPa	
3.8	modulus of elasticity	MPa	
3.9	pressure	kPa	
3.10	stress	MPa	
3.11	surface tension	mN/m	
3.12	thrust	kN	
3.13	torque	N · m	
3.14	vacuum	Pa	
4. Mechanics			
4.1	airspeed ^{d)}	km/h	kt
4.2	angular acceleration	rad/s ²	
4.3	angular velocity	rad/s	
4.4	energy or work	J	
4.5	equivalent shaft power	kW	
4.6	frequency	Hz	
4.7	ground speed	km/h	kt
4.8	impact	J/m ²	
4.9	kinetic energy absorbed by brakes	MJ	
4.10	linear acceleration	m/s ²	
4.11	power	kW	
4.12	rate of trim	°/s	
4.13	shaft power	kW	
4.14	velocity	m/s	
4.15	vertical speed	m/s	ft/min
4.16	wind speed ^{e)}	m/s	kt
5. Flow			
5.1	engine airflow	kg/s	
5.2	engine waterflow	kg/h	
5.3	fuel consumption (specific)		
	piston engines	kg/(kW · h)	
	turbo-shaft engines	kg/(kW · h)	
	jet engines	kg/(kN · h)	
5.4	fuel flow	kg/h	
5.5	fuel tank filling rate (gravimetric)	kg/min	
5.6	gas flow	kg/s	
5.7	liquid flow (gravimetric)	g/s	
5.8	liquid flow (volumetric)	L/s	
5.9	mass flow	kg/s	
5.10	oil consumption		
	gas turbine	kg/h	
	piston engines (specific)	g/(kW · h)	
5.11	oil flow	g/s	
5.12	pump capacity	L/min	
5.13	ventilation airflow	m ³ /min	
5.14	viscosity (dynamic)	Pa · s	
5.15	viscosity (kinematic)	m ² /s	

<i>Ref. No.</i>	<i>Quantity</i>	<i>Primary unit (symbol)</i>	<i>Non-SI alternative unit (symbol)</i>
6. Thermodynamics			
6.1	coefficient of heat transfer	$W/(m^2 \cdot K)$	
6.2	heat flow per unit area	J/m^2	
6.3	heat flow rate	W	
6.4	humidity (absolute)	g/kg	
6.5	coefficient of linear expansion	$^{\circ}C^{-1}$	
6.6	quantity of heat	J	
6.7	temperature	$^{\circ}C$	
7. Electricity and magnetism			
7.1	capacitance	F	
7.2	conductance	S	
7.3	conductivity	S/m	
7.4	current density	A/m^2	
7.5	electric current	A	
7.6	electric field strength	C/m^2	
7.7	electric potential	V	
7.8	electromotive force	V	
7.9	magnetic field strength	A/m	
7.10	magnetic flux	Wb	
7.11	magnetic flux density	T	
7.12	power	W	
7.13	quantity of electricity	C	
7.14	resistance	Ω	
8. Light and related electromagnetic radiations			
8.1	illuminance	lx	
8.2	luminance	cd/m^2	
8.3	luminous exitance	lm/m^2	
8.4	luminous flux	lm	
8.5	luminous intensity	cd	
8.6	quantity of light	$lm \cdot s$	
8.7	radiant energy	J	
8.8	wavelength	m	
9. Acoustics			
9.1	frequency	Hz	
9.2	mass density	kg/m^3	
9.3	noise level	$dB^{(8)}$	
9.4	period, periodic time	s	
9.5	sound intensity	W/m^2	
9.6	sound power	W	
9.7	sound pressure	Pa	
9.8	sound level	$dB^{(9)}$	
9.9	static pressure (instantaneous)	Pa	
9.10	velocity of sound	m/s	
9.11	volume velocity (instantaneous)	m^3/s	
9.12	wavelength	m	

<i>Ref. No.</i>	<i>Quantity</i>	<i>Primary unit (symbol)</i>	<i>Non-SI alternative unit (symbol)</i>
10. Nuclear physics and ionizing radiation			
10.1	absorbed dose	Gy	
10.2	absorbed dose rate	Gy/s	
10.3	activity of radionuclides	Bq	
10.4	dose equivalent	Sv	
10.5	radiation exposure	C/kg	
10.6	exposure rate	C/kg · s	

- a) As used in navigation, generally in excess of 4 000 m.
- b) Such as aircraft fuel, hydraulic fluids, water, oil and high pressure oxygen vessels.
- c) Visibility of less than 5 km may be given in m.
- d) Airspeed is sometimes reported in flight operations in terms of the ratio MACH number.
- e) The decibel (dB) is a ratio which may be used as a unit for expressing sound pressure level and sound power level. When used, the reference level must be specified.

16.4 TERMINATION OF USE OF NON-SI ALTERNATE UNITS

The non-SI units listed in Table 3-3 have been retained temporarily for use as alternative units because of their widespread use and to avoid potential safety problems which could result from the lack of international coordination concerning the termination of their use. As termination dates are established by the Council, they will be reflected as Standards contained in this Chapter. It is expected that the establishment of such dates will be well in advance of actual termination. Any special procedures associated with specific unit termination will be circulated to all States separately from this CARS Part16.

16.4.1 The use in international civil aviation operations of the alternative non-SI units listed in Table 3-3 shall be terminated on the dates listed in Table 4-1.

Table 4-1. Termination dates for non-SI alternative units

<i>Non-SI alternative unit</i>	<i>Termination date</i>
Knot Nautical mile } Foot	not established
	not established
