PART 5

Units of Measurements

This Part of Jordanian Civil Aviation Regulations is hereby adopted under the authority and provisions of the Civil Aviation Law No. (41) of 2007

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Revision Control Sheet

Amendment No.	Effective Date	Subpart	Paragraph
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Section No.	Contents

Subpart A
General

5.1 Applicability.

(a) This Part prescribes general rules and specifies the measurement units within the territorial limits of The Hashemite Kingdome Of Jordan for the standardization of the Units of Measurement to be used in Air and Ground Operations in international civil aviation.

(b) The standardized system of units of measurement set up by this part, 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 in the Hashemite Kingdom of Jordan.

(c) The measurement units, standards and recommended practices contained in this Part are, based on those stipulated in Annex 5, to the Convention on International Civil Aviation "Units of Measurement to be used in Air and Ground Operations.

(d) This part shall be applicable to all aspects of international civil aviation air and ground operations in Jordan.

(e) As per JCAR Part 11, "General Rule Making" Section 11.9 Where there is an inconsistency between a standard prescribed in ICAO Annex 5 to the Chicago convention and the standards of this Part, the provision of this part regulations and standards shall prevail to the extent of the inconsistency.

(f) All operators and service providers involved in international civil aviation operations in Jordan shall comply with all standards set out in this Part at all times and should endeavor to comply with all recommended practices.

(g) In addition to this part of Standards, the following may also be issued as and when required safety directive. The Safety Directives will be incorporated into subsequent amendment of this part.

5.3 Definitions:

When the following terms are used in the standards and recommended practices concerning the units of measurement to be used in all aspects of international civil aviation air and ground operations, they have the following meanings:

Ampere (A). The ampere is that constant electric current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to 2 x 10-7 Newton per meter of length.

Becquerel (Bq). The activity of a radionuclide having one spontaneous nuclear transition per second.

Candela (cd): The luminous intensity, in the perpendicular direction, of a surface of 1/600 000 square meter of black body at the temperature of freezing platinum under a pressure of 101 325 Newton per square meter.

Celsius temperature (to C): The Celsius temperature is equal to the difference toc = T - To between two thermodynamic temperatures T and To where To equals 273.15 Kelvin.

Coulomb (C): The quantity of electricity transported in 1 second by a current of 1 ampere.

Degree Celsius (oC): The special name for the unit Kelvin for use in stating values of Celsius temperature.

Farad (F): The capacitance of a capacitor between the plates of which there appears a difference of potential of 1 volt when it is charged by a quantity of electricity equal to 1 coulomb.

Foot (ft): The length equal to 0.304 8 meter exactly.

Gray (Gy): The energy imparted by ionizing radiation to a mass of matter corresponding to 1 joule per kilogram.

Henry (H): The inductance of a closed circuit in which an electromotive force of 1 volt is produced when the electric current in the circuit varies uniformly at a rate of 1 ampere per second.

Hertz (Hz): The frequency of a periodic phenomenon of which the period is 1 second.

Human performance: Human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations.

Joule (J): The work done when the point of application of a force of 1 Newton is displaced a distance of 1 meter in the direction of the force.

Kelvin (K): A unit of thermodynamic temperature which is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water.

Kilogram (kg): The unit of mass equal to the mass of the international prototype of the kilogram.

Knot (kt): The speed equal to 1 nautical mile per hour.

Liter (L): A unit of volume restricted to the measurement of liquids and gases which is equal to 1 cubic decimeter.

Lumen (Im). The luminous flux emitted in a solid angle of 1 steradian by a point source having a uniform intensity of 1 candela.

Lux (lx): The luminance produced by a luminous flux of 1 lumen uniformly distributed over a surface of 1 square meter.

Meter (m): The distance travelled by light in a vacuum during 1/299 792 458 of a second.

Mole (mol): The amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12.

Note.- When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles or specified groups of such particles.

Nautical mile (NM): The length equal to 1 852 meters exactly.

Newton (N): The force which when applied to a body having a mass of 1 kilogram gives it an acceleration of 1 meter per second squared.

Ohm (Ω): The electric resistance between two points of a conductor when a constant difference of potential of 1 volt, applied between these two points, produces in this conductor a current of 1 ampere, this conductor not being the source of any electromotive force.

Pascal (Pa). The pressure or stress of 1 Newton per square meter.

Radian (rad). The plane angle between two radii of a circle which cut off on the circumference an arc equal in length to the radius.

Safety Directive. Is a mandatory requirement to be complied by all operators and service providers involved in international civil aviation operations in Jordan, for purposes of immediate promulgation of local standards and recommended practices in response to, but not limited to, amendments to ICAO Annexes.

Second (s): The duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium-133 atom.

Siemens (S): The electric conductance of a conductor in which a current of 1 ampere is produced by an electric potential difference of 1 volt.

Sievert (Sv): The unit of radiation dose equivalent corresponding to 1 joule per kilogram.

Steradian (sr): The solid angle which, having its vertex in the centre of a sphere, cuts off an area of the surface of the sphere equal to that of a square with sides of length equal to the radius of the sphere.

Tesla (T): The magnetic flux density given by a magnetic flux of 1 Weber per square meter.

Tonne (t): The mass equal to 1 000 kilograms.

Volt (V): The unit of electric potential difference and electromotive force which is the difference of electric potential between two points of a conductor carrying a constant current of 1 ampere, when the power dissipated between these points is equal to 1 watt.

Watt (W): The power which gives rise to the production of energy at the rate of 1 joule per second.

Weber (Wb): The magnetic flux which, linking a circuit of one turn, produces in it an electromotive force of 1 volt as it is reduced to zero at a uniform rate in 1 second.

5.5-5.9 Reserved

Subpart B

Standard Application of Units of Measurement

5.11 SI Units

(a)The International System of Units is a complete, coherent system which includes three classes of units:

(1) base units;

(2) supplementary units; and

(3) derived units.

(b) The International System of Units developed and maintained by the General Conference of Weights and Measures (CGPM) is based on the following base units.

SI Base units

Quantity	Unit	Symbol
Amount of substance	Mole	mol
Electric current	Ampere	A
Length	Meter	m
L:uminous intensity	Candela	cd
Mass	Kilogram	kg
Temperature	Second	K
Time		s

(c) The supplementary units of the SI are listed in Table B-2 and may be regarded either as base units or as derived units and based on the following table

SI supplementary units

Quantity	Unit	Symbol
plane angle	radian	Rad
solid angle	steradian	sr

(d) Derived units of the SI are formed by combining base units, supplementary units and other derived units according to the algebraic relations linking the corresponding quantities. The symbols for derived units are obtained by means of the mathematical signs for multiplication,

division and the use of exponents. Those derived SI units which have special names and symbols are listed in following table.

SI **supplementary units**

Quantity	Unit	Symbol	*Derivation*
absorbed dose (radiation)	gray	Gy	J/kg
activity of radionuclides	Becquerel	Bq	l/s
Capacitance	farad	F	C/V
Capacitance			
conductance	Siemens	S	A/V
dose equivalent (radiation)	sievert	Sv	J/kg
electric potential, potential difference, electromotive force	volt	V	W/A
electric resistance	ohm	Ω	V/A
energy, work, quantity of heat	joule	J	N · m
force	Newton	N	kg · m/s2
frequency (of a periodic phenomenon)	hertz	Hz	l/s
illuminance	lux	lx	lm/m2
inductance	Henry	H	Wb/A
luminous flux	lumen	lm	cd · sr
magnetic flux	Weber	Wb	V · s
magnetic flux density	tesla	T	Wb/m2
power, radiant flux	watt	W	J/s
pressure, stress	Pascal	Pa	N/m2
quantity of electricity, electric charge	coulomb	C	A · s

(e) The International System of Units shall, subject to the provisions of Sections 5.13 and 5,15 be used as the standard system of units of measurement for all aspects of international civil aviation air and ground operations .

(f) The prefixes and symbols listed in Table (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.

No.	Multiplication factor	Prefix	Symbol
1	1000 000 000 000 000 000 = 10^{18}	exa	E
2	1 000 000 000 000 000 = 10^{15}	peta	P

3	1 000 000 000 000 = 10^{12}	tera	T
4	1 000 000 000 = 10^{9} giga G	Giga	G
5	1 000 000 = 10^{6} mega M	mega	M
6	1 000 = 10^{3} kilo k	Kilo	k
7	100 = 10^{2} hecto h	Hector	h
8	10 = 10^{1} deca da	Deca	da
9	0.1 = 10^{-1} deci d	decii	d
10	0.01 = 10^{-2} centi c	centi	c
11	0.001 = 10^{-3} milli m	Milli	m
12	0.000 001 = 10^{-6} micro μ	Micro	
13	0.000 000 001 = 10^{-9} nano n	Nano	n
14	0.000 000 000 001 = 10^{-12} pico p	Pico	p
15	0.000 000 000 000 001 = 10^{-15} femto f	Femto	f
16	0.000 000 000 000 000 001 = 10^{-18} atto a	Atto	a

Table (1) SI unit prefixes Multiplication factor Prefix Symbol

5.13 Non-SI units

(a) Non-SI units for permanent use with the SI.

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

Table (2). Non-SI units for use with the SI

No	Specific quantities in Table 3-4 related to	Unit	Symbol	Definition (in terms of SI units)
1	mass	tonne	t	1 t = 103 kg
2	plane angle	degree minute second	° ' "	1° = (π/180) rad 1' = (1/60)° = (π/10 800) rad 1" = (1/60)' = (π/648 000) rad
3	Temperature	degree Celsius	°c	1 unit °C = 1 unit Ka)
4	time	minute hour day week, month, year	min h d ----	1 min = 60 s 1 h = 60 min = 3 600 s 1 d = 24 h = 86 400 s
5	volume	liter	L	1 L = 1 dm3 = 10–3m3

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

Note. It is intended that the use of the non-SI units listed in Table (3) and applied as indicated in Table (4) will eventually be discontinued in accordance with individual unit termination dates established by the ICAO Council.

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

No	Specific quantities in Table 3-4 related to	Unit	Symbol	Definition (in terms of SI units)
1	distance (long)	nautical miles	NM	1 NM = 1 852 m
2	Distance (vertical) altitude, elevation, and height (when associated with the operation of aircraft)	feet	ft	1 ft = 0.304 8 m
3	Speed	knots	kt	1 kt = 0.514 444 m/s

5.15 Application of specific units

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

Note. Table (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.

(b) Means and provisions for design, procedures and training should 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.

Table (4) Standard application of specific units of measurement

1(Direction/Space/ Time)

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
1.1	altitude	m	ft
1.2	area	m2	
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	o ' "	
1.9	length	m	ft
1.10	longitude	o ' "	
1.11	plane angle (when required, decimal subdivisions of the degree shall be used)	o	
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	m3	
1.18	wind direction (wind directions other than for a landing and take-off shall be expressed in degrees true; for landing and takeoff wind directions shall be expressed in degrees magnetic)		

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.

Table (4) Standard application of specific units of measurement
2(**Mass-related)**

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
2.1	air density	kg/m3	
2.2	area density	kg/m2	
2.3	cargo capacity	Kg	
2.4	cargo density	kg/m3	
2.5	density (mass density)	kg/m3	
2.6	fuel capacity (gravimetric)	Kg	
2.7	gas density	kg/m3	
2.8	gross mass or payload	Kg t	
2.9	hoisting provisions	Kg	
2.10	linear density	kg/m	
2.11	liquid density	kg/m3	
2.12	Mass	Kg	
2.13	moment of inertia	kg · m2	
2.14	moment of momentum	kg · m2/s	
2.15	momentum	kg · m/s	

Table (4): Standard application of specific units of measurement
3(**Force-related)**

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
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	

Table (4) Standard application of specific units of measurement 4(**Mechanics)**

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
4.1	Airspeed (d)	km/h	Kt
4.2	angular acceleration	rad/s2	
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/m2	
4.9	kinetic energy absorbed by brakes	MJ	
4.10	linear acceleration	m/s2	
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

d) Airspeed is sometimes reported in flight operations in terms of the ratio MACH number.

e) A conversion of 1 kt = 0.5 m/s is used in ICAO Annexes for the representation of wind speed.

Table (4) Standard application of specific units of measurement 5(**Flow)**

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
5.1	engine airflow	kg/s	
5.2	engine water flow	kg/h	
5.3	fuel consumption (specific) piston engines turbo-shaft engines jet engines	kg/(kW . h) kg/(kW . h) 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 piston engines (specific)	 kg/h g/(kW . h)	
5.11	oil flow	g/s	
5.12	pump capacity	L/min	
5.13	ventilation airflow	m3/min	
5.14	viscosity (dynamic)	Pa . s	
5.15	viscosity (kinematic)	m2/s	

Table (4) Standard application of specific units of measurement
6(**Thermodynamics)**

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
6.1	coefficient of heat transfer	W/(m2 . K)	
6.2	heat flow per unit area	J/m2	
6.3	heat flow rate	W	
6.4	humidity (absolute)	g/kg	
6.5	coefficient of linear expansion	°C–1	
6.6	quantity of heat	J	
6.7	temperature	°C	

Table (4) Standard application of specific units of measurement
7(**Electricity and magnetism)**

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
7.1	capacitance	F	
7.2	conductance	S	
7.3	conductivity	S/m	
7.4	current density	A/m2	
7.5	electric current	A	
7.6	electric field strength	C/m2	
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	

Table (4) Standard application of specific units of measurement
8(**Light and related electromagnetic radiations)**

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
8.1	luminance	Lx	
8.2	luminance	cd/m2	
8.3	luminous exitance	lm/m2	
8.4	luminous flux	Lm	
8.5	luminous intensity	cd	
8.6	quantity of light	lm · s	
8.7	radiant energy	J	
8.8	wavelength	M	

Table (4) Standard application of specific units of measurement
9(**Acoustics)**

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
9.1	frequency	Hz	
9.2	mass density	kg/m3	
9.3	noise level	dB (e)	
9.4	period, periodic time	S	
9.5	sound intensity	W/m2	
9.6	sound power	W	
9.7	sound pressure	Pa	
9.8	sound level	dB (f)	
9.9	static pressure (instantaneous)	Pa	
9.10	velocity of sound	m/s	
9.11	volume velocity (instantaneous)	m3/s	
9.12	wavelength	M	

f) 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.

Table (4) Standard application of specific units of measurement
10(**Nuclear physics and ionizing radiation)**

Ref. No.	Quantity	Primary unit (symbol)	Non-SI alternative unit (symbol)
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	

5.17-5.19 Reserved

5.21 Termination of use of non-SI alternative units

4.1 The use in international civil aviation operations of the alternative non-SI units listed in Table (3) shall be terminated on the dates listed in the following Table.

Termination dates for non-SI alternative units

No	Non-SI	alternative unit Termination date
1	Knot	not established
2	Nautical mile	not established
3	Foot	not established

5.23-5.29 Reserved

Subpart C

Presentation Of Date And Time In All-Numeric Form

5.31 Introduction

Based on the International Organization for Standardization (ISO) Standards 2014 and 3307 procedures for writing the date and time in all-numeric form and in compliance with ICAO adoption of these procedures the following presentation will be used in all our regulations and aviation documents where appropriate in the future.

5.33 Presentation of date

(a) Where dates are presented in all-numeric form, ISO 2014 specifies that the sequence year-month-day should be used. The elements of the date should be:

(1) four digits to represent the year, except that the century digits may be omitted where no possible confusion could arise from such an omission. There is value in using the century digits during the period of familiarization with the new format to make it clear that the new order of elements is being used;

(2) two digits to represent the month; and

(3)two digits to represent the day.

(b)Where it is desired to separate the elements for easier visual understanding, only a space or a hyphen should be used as a separator. As an example, 25 August 1983 may be written as:

	19830825	or	830825
or	1983-08-25	or	83-08-25
or	1983 08 25	or	83 08 25.

(c)It should be emphasized that the ISO sequence should only be used where it is intended to use an all-numeric presentation.

(d)Presentations using a combination of figures and words may still be used if required (e.g. 25 August 1983).

5.35. Presentation of time

(a) Where the time of day is to be written in all-numeric form, ISO 3307 specifies that the sequence hours-minutes seconds should be used.

(b) Hours should be represented by two digits from 00 to 23 in the 24-hour timekeeping system and may be followed either by decimal fractions of an hour or by minutes and seconds. Where decimal fractions of an hour are used, the normal decimal separator should be used followed by the number of digits necessary to provide the required accuracy.

(c) Minutes should likewise be represented by two digits from 00 to 59 followed by either decimal fractions of a minute or by seconds.

(d) Seconds should also be represented by two digits from 00 to 59 and followed by decimal fractions of a second if required.

(e) Where it is necessary to facilitate visual understanding a colon should be used to separate hours and minutes and minutes and seconds. For example, 20 minutes and 18 seconds past 3 o'clock in the afternoon may be written as:

152018 or 15:20:18 in hours, minutes and seconds

or 1520.3 or 15:20.3 in hours, minutes and decimal fractions of a minute

or 15.338 in hours and decimal fractions of an hour.

5.37. Combination date and time groups

This presentation lends itself to a uniform method of writing date and time together where necessary. In such cases, the sequence of elements year-month-day-hour-minute-second should be used. It may be noted that not all the elements need be used in every case — in a typical application, for example, only the elements day-hour-minute might be used.

5.39 Reserved

Subpart D
Conversion Formulae And Factors

5.41 Conversions.

(a)Attachment C of ICAO Annex 5, list of conversion factors provided to express the definitions of miscellaneous units of measure as numerical multiples of SI units shall be adopted.

(b) Bellow is a useful conversion table

Conversion table

No	Unit	Arithmetic operations		To obtain
	Knots	Multiplication per	1.69	feet/second (ft/s)
	Feet/second	Multiplication per	0.5925	knots (kts)
	Miles per hour	Multiplication per	1.47	feet/second (ft/s)
	Feet/second	Multiplication per	0.6818	miles per hour (mph)
	Nautical mile	Multiplication per	6076	feet (ft)
	Nautical mile	Multiplication per	1852	meters (m)
	Nautical mile	Multiplication per	1.15	statute mile (stmi)
	Statute mile	Multiplication per	0.869	nautical mile (nmi)
	Knots	Multiplication per	101.3	feet /minute (ft/m)
	Ib/ltr	Multiplication per	3.7854	Liters
	Us gallon	Multiplication per	4.5460	Liters
	Imperial gallon	Multiplication per	1.2009	Us gallon
	Inch	Multiplication per	2.54	Centimeter
	Kilogram	Multiplication per	2.21	Pound
	Yard	Multiplication per	0.9144	meter
	Tone	Multiplication per	1000	kilogram