GIBRALTAR

DIRECTOR OF CIVIL AVIATION

DIRECTION – 01

made under Section 17 (1) of the Civil Aviation Act 2009

Units of Measurement

DCA Direction 01 - Units of Measurement

Contents

Amendment Record

	Item	Date
1	Initial Issue	29 May 2009

DCA Direction 01 - Units of Measurement

Rationale:

Annex 5 to the Chicago Convention 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.

The units of measurement to be used in Gibraltar when exercising the privileges of any licence, approval or certificate issued or validated by the Gibraltar DCA, or when conducting any operation which is subject to the Gibraltar Civil Aviation Act 2009, are defined and detailed in this Direction.

Direction:

As Director of Civil Aviation, in the exercise of my powers under section 17(1) of the Civil Aviation Act 2009, I direct that all persons:

- exercising the privileges of any licence, approval or certificate issued or validated by the Gibraltar DCA;
- conducting any air or ground operation that is subject to the Gibraltar Civil Aviation Act 2009;

are to use the Units of Measurement defined in Table 1 and identified in Table 2.

In addition, Table 3 specifies the Unit prefixes which may be used, while Table 4 contains the conversion formulae to be used to convert certain non-SI distance and speed Units to their SI equivalents. Table 5 specifies the date/time formats to be used.

C C PURKISS
Director of Civil Aviation

29 May 2009

Table 1. Definitions

Unit	Symbol	Definition
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 metre apart in vacuum, would produce between these conductors a force equal to 2 x 10 -7 Newton per metre of length
Bar	b	The pressure or stress of 100,000 Newton per square metre
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 metre of black body at the temperature of freezing platinum under a pressure of 101,325 Newtons per square metre
Celsius temperature	t_C	The Celsius temperature is equal to the difference $t°C = T – T_0$ between two thermodynamic temperatures T and T_0 where T_0 equals 273.15 Kelvin
Coulomb	C	The quantity of electricity transported in 1 second by a current of 1 ampere
Degree Celsius	°C	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 0.3048 metre exactly
Gray	Gy	The energy imparted by ionizing radiation to a mass of matter corresponding o 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 metre 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
Litre	L	A unit of volume restricted to the measurement of liquids and gases which is equal to 1 cubic decimetre
Lumen	lm	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 illuminance produced by a luminous flux of 1 lumen uniformly distributed over a surface of 1 square metre
Metre	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 metres exactly
Newton	N	The force which when applied to a body having a mass of 1 kilogram gives it an acceleration of 1 metre 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 metre
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
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 metre
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

Table 2. Units of Measurement

	Ref. No.	Quantity	Unit to be used (symbol)
1. Direction/Space/Time			
	1 .1	altitude	ft
	1.2	area	m^2
	1.3	distance (long) (when required to one decimal place) - (see Note A)	NM
	1.4	distance (short)	m
	1.5	elevation	ft
	1.6	endurance	h and min
	1.7	height	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) - (see Note B)	L
	1.15	time	s
			min
			h
			d
			week
			month
			year
	1.16	Visibility - (see Note C)	km
	1.17	volume	m^3
			L
	1.18	Wind direction (wind directions other than for a landing and take-off expressed in degrees true; for landing and take-off wind directions 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	$kg \cdot m^2$
	2.14	moment of momentum	$kg \cdot m^2/s$
	2.15	momentum	kg · m/s
	2.16	weight	kg
			t
3. Force-related			
	3.1	air pressure (general)	kPa
	3.2	altimeter setting	mb
	3.3	atmospheric pressure	mb
	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 - (see Note D)	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	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	$^{\circ}/s$
	4.13	shaft power	kW
	4.14	velocity	m/s
	4.15	vertical speed	ft/min
	4.16	wind speed	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 air flow	m^3/min

	5.14	viscosity (dynamic)	Pa • s
	5.15	viscosity (kinematic)	m^2/s
6. Thermodynamics			
	6.1	coefficient of heat transfer	$W/(m^2.K)$
	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	$°C^{-1}$
	6.6	quantity of heat	J
	6.7	temperature	°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.s
	8.7	radiant energy	J

	8.8	wavelength	m
9. Acoustics			
	9.1	frequency	Hz
	9.2	mass density	kg/m³
	9.3	noise level	dB (see Note 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
	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
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

Notes

	A)	There is no sharp dividing line between the usage of nautical miles or metres. Generally distances having a navigational or position reporting aspect are given in nautical miles. Distances on the aerodrome are given in metres. Distances from obstacles in the vicinity of aerodromes are given in nautical miles and tenths.
	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.

Table 3. Unit Prefixes

Multiplication factor	Prefix	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}	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

Table 4. Distance/ speed conversion formulae
(altitude, elevation, height, vertical speed)

To convert from	To	Use formulae
Nautical Mile (NM)	Metre (m)	1 NM = 1852 m
Foot (ft)	Metre (m)	1 ft = 0.3048 m
Knot (kt)	Metre/second (m/s)	1 kt = 0.514 444 m/s

Table 5. Date/ time format

Date	In alphanumeric	day month year
	In numeric form	Year (4 digits) month (2 digits) day (2 digits)
Time		hh:mm:ss

Co-ordinated Universal Time used with the day commencing at midnight
Decimal seconds where required