Democratic Socialist Republic of Sri Lanka

Civil Aviation Authority of Sri Lanka

Implementing Standards

(Issued under Sec. 120, Civil Aviation Act No. 14 of 2010)

Title: Conformance to Annex-5- Units of Measurements to be used in Air and Ground Operations

Reference No.: IS-05-All **S.N**.: SLCAIS 003 **Date**: 26th May 2020

Pursuant to Sec. 120 of the Civil Aviation Act No.14 of 2010, which is hereinafter referred to as the CA Act, Director General of Civil Aviation shall have the power to issue, whenever he considers it necessary or appropriate to do so, such Implementing Standards for the purpose of giving effect to any of the provisions of the CA Act, regulations or rules made thereunder including the Articles of the Convention on International Civil Aviation which are specified in the Schedule to the CA Act.

Accordingly, I, the undersigned being the Director General of Civil Aviation do hereby issue the Implementing Standards on Units of Measurements to be used in Air and Ground Operations as mentioned in the Attachment hereto (Ref: Attachment No. IS-05- Att), elaborating the requirements to be satisfied by the aeronautical service providers providing air traffic services to aircraft ensuring effective implementation of the International Standards and Recommended Practices on "Units of Measurements to be used in Air and Ground Operations" contained in Annex 5 to the Convention and the Air Navigation Regulations of 1955.

This Implementing Standard shall be applicable to Statutory Service Provider and shall come in to force with immediate effect and remain in force unless revoked.

Attention is also drawn to sec. 103 of the Act, which states inter alia that failure to comply with Implementing Standard is an offence.

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Enclosure: Attachment No. IS-05-Att

Implementing Standards

SLCAIS - 003 : Conformance to Annex-5- Units of Measurements to be used in Air and Ground Operations

GENERAL

Introduction

A. Requirements contained in this document are based on the amendment 17 of ICAO Annex 5 – "Units of Measurements to be used in Air and Ground Operations".

B. Airport & Aviation Services (SL) Ltd. being the statutory service provider responsible for provision of air navigation services to aircraft, shall strictly comply with the requirements published in this Document.

C. This Implementing Standard supersedes the SLCAIS-003 issued by the Director General of Civil Aviation on 28th April 2011.

D. Applicability

This Implementing Standard SLCAIS 003 is applicable to Airport & Aviation Services (SL)Ltd. who is responsible for the provision of Units of Measurements to be used in Air and Ground Operations

1. Notice to the Recipient

1.1. The requirements in this Implementing Standard are based on the Standards and Recommended Practices (SARPs) adopted by the International Civil Aviation Organization (ICAO) and incorporated in the Amendment No.17 to Annex 5 – "Units of Measurements to be used in Air and Ground Operations"

1.2. In pursuance of the obligation cast under Article 38 of the Convention which requires the Contracting States to notify the ICAO of any differences between the national regulations of the States and practices and the International Standards contained in the respective Annex and any amendments thereto, the CAASL will be taking steps to notify ICAO of such differences relating to either a Standard or a Recommended Practice, if any. The CAASL will also keep the ICAO currently informed of any differences which may subsequently occur, or of the withdrawal of any differences previously notified. Furthermore, the CAASL will take steps for the publication of differences between the national regulations and practices and the related ICAO Standards and Recommended Practices through the Aeronautical Information Service, which is published in accordance with the provisions in the Annex-15 to the Convention.

1.3. Taking into account of the ICAO council resolution dated 13 April 1948 which invited the attention of Contracting States of the desirability of using in the State's national regulations, as far as is practicable, the precise language of those ICAO Standards that are of a regulatory character, to the greatest extent possible the CAASL has attempted to retain the ICAO texts in the Annex in drafting this Implementing Standard.

1.4. Status of ICAO Annex components in the Implementing Standard
Some of the components in an ICAO Annex are as follows and they have the status as indicated:

1.4.1. **Standard:** Any specification for physical characteristics, configuration, materiel, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38. The Standards are reflected in the Implementing Standards in the normal fonts and recipients are required to conform to such requirements invariably and the DGCA **will take appropriate enforcement action** when those requirements are not complied with.

1.4.2. **Recommended Practice:** Any specification for physical characteristics, configuration, materiel, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity, efficiency or environmentally responsiveness of international air navigation, and to which Contracting States will endeavor to conform in accordance with the Convention. The Recommended Practices are reflected in the Implementing Standards in italic fonts and the Recipients are encouraged to implement them to the greatest extent possible. However, DGCA **will not take enforcement action** when a Recommended Practice is not satisfied by the recipient.

1.4.3. **Appendices:** Comprising material grouped separately for convenience but forming part of the Standards and Recommended Practices adopted by the Council. Enforcement action on such matters will be as in the case of Standards or Recommended Practices.

1.4.4. **Definitions:** A definition does not have independent status but is an essential part of each Standard and Recommended Practice in which the term is used, since a change in the meaning of the term would affect the specification.

1.4.5. **Tables and Figures:** add to or illustrate a Standard or Recommended Practice, and which are referred to therein, form part of the associated Standard or Recommended Practice and have the same status.

Implementing Standards: IS-05-All

Title: Units of Measurements to be used in Air and Ground Operations

Definitions

When the following terms are used, they have the following meanings for the purpose of this document:

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 2×10^{-7} newton per metre 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 metre of black body at the temperature of freezing platinum under a pressure of 101 325 newtons per square metre.

Celsius temperature (t^oc). 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 (^0C). 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 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 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.

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.

STANDARD APPLICATION OF SPECIFIC UNITS OF MEASUREMENT

The application of units of measurement for certain quantities used in international civil aviation air and ground operations shall be as specified in the Table-1 below

Reference No	Quantity	Units to be used (symbol)
1. Direction/Space/Time		
1.1.	altitude	ft
1.2.	area	m^2
1.3.	distance (long)[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) [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	$kg \cdot m^2$
2.14	moment of momentum	$kg \cdot m^2/s$
2.15	momentum	$kg \cdot m/s$
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]	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	°/s
4.13	shaft power	kW
4.14	velocity	m/s
4.15	vertical speed	ft/min
4.16	wind speed [e]	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/m^3
9.3	noise level	dB [e]
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[f]
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 radio nuclides	Bq
10.4	dose equivalent	Sv
10.5	radiation exposure	C/kg
10.6	exposure rate	C/kg . s

Table 1 - Units of Measurements

a) As used in navigation, generally in excess of 4000m.

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.

SI UNIT
PREFIXES

The prefixes and symbols listed in Table-2 below shall be used to form names and symbols of the decimal multiples and sub-multiples of SI units.

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 2 - Unit Prefixes

NON SI UNITS

The non-SI units listed in Table-3 below are permitted for temporary use as alternative units of measurement but only for those specific quantities listed in Table-1 above.

Specific quantities in Table 1 related to Unit	Unit	Symbol	Definition
mass	tonne	t	1 t = 10^{3} kg
plane angle	degree minute second	° ’ ”	1^{0} =(π/180) rad $1^{'}$ = (1/60)° = (π/10,800)rad $1^{''}$ = (1/60)' = (π/648,000) rad
temperature	degree Celsius	°C	1 unit ^{0}C = 1 unit K[a]
time	min 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
volume	litre	L	1 L = 1 dm^{3} = 10^{-3} m^{3}

Table 3 - Non SI Units

TEMPERATURE CONVERSION FORMULAE

The figures in the Table-4 below shall be used for conversion of temperature from Kelvin to Celsius and vice versa

To convert	to	Use formula
Celsius temperature (t°C)	Kelvin temperature (t K)	t K = t °C + 273.15
Fahrenheit temperature	Celsius temperature (t°C)	t °C = (t°F – 32)/1.8
Fahrenheit temperature	Kelvin temperature (t K)	t K = (t°F + 459.67)/1.8
Kelvin temperature (t K)	Celsius temperature (t°C)	t °C = t K – 273.15
Rankine temperature (t°R)	Kelvin temperature (t K)	t K = t°R /1.8

Table 4 - Temperature Conversion Formulae

DISTANCE/ SPEED CONVERSION FORMULAE

(altitude, elevation, height, vertical speed)

The figures in the Table-5 below shall be used for conversion of units relating to distance and speed

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

Table 5 - Distance/ speed conversion formulae

- END -