



Public Authority for Civil Aviation

CAR-178

Civil Aviation Regulation

Units of Measurement

Effective 31st Jan 2019

Approved by: HE Dr. Mohamed bin Nasser Al-Zaabi (CEO)

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FOREWORD

- (a) This Civil Aviation Regulation (CAR) has been issued by the Public Authority for Civil Aviation of Oman (hereinafter referred to as PACA or “the AUTHORITY”) under the provisions of the Civil Aviation Law of the Sultanate of Oman.
- (b) This CAR has been modelled upon similar regulations implemented by other member States and includes the subject matter endorsed within ICAO Annex 5, *Units of Measurement to be Used in Air and Ground Operations*. This CAR 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.
- (c) CAR 178 prescribes the requirements:
 - (1) for all civil aircraft operating in the Muscat Flight Information Region (FIR), and all aircraft bearing the nationality and registration marks of the Sultanate of Oman, wherever they may be, to the extent that they do not conflict with the rules published by the State having jurisdiction over the territory over-flown.
 - (2) relating to the flight and maneuver of aircraft over the high seas within the meaning of Article 12 of the ICAO Convention on International Civil Aviation which are applicable without exception.
- (d) Amendments to the text in CAR 178 in revised editions are issued as a complete amendment of pages contained within.
- (e) The editing practices used in this document are as follows:
 - (1) ‘Shall’ and ‘Must’ are used to indicate a mandatory requirement and may appear in this CAR.
 - (2) ‘Should’ is used to indicate a recommendation.
 - (3) ‘May’ is used to indicate discretion by the AUTHORITY, or the industry as appropriate.
 - (4) ‘Will’ indicates a mandatory requirement and is used to advise of action incumbent on the AUTHORITY.

****Note: The use of the male gender implies the female gender and vice versa.***

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Glossary of Terms and Abbreviations

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 a vacuum, would produce between these conductors a force equal to 2×10^{-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 newtons per square meter.

Celsius temperature (t°C). The Celsius temperature is equal to the difference $t^{\circ}\text{C} = T - T_0$ 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 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.

International System of Units (SI). The International System of Units developed and maintained by the General Conference of Weights and Measures (CGPM).

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 (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 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.

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 center 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.

SUBPART A – GENERAL

CAR 178.001 Applicability

Civil Aviation Regulation 180, *Units of Measurement*, shall be applicable to all aspects of air and ground operations for international civil aircraft operating in the Muscat Flight Information Region (FIR), and all aircraft bearing the nationality and registration marks of the Sultanate of Oman, wherever they may be, to the extent that they do not conflict with the rules published by the State having jurisdiction over the territory overflown.

CAR 178.003 Definitions

Definitions in this CAR, CAR 171, CAR 172 and CAR 1 shall form part of this regulation, supplemented by the definitions contained in ICAO documentation. Where there are differences between the CAR and ICAO definitions, the CAR definitions shall apply.

CAR 178.005 SI Units

The prefixes and symbols listed in ICAO Annex 5, Table 3-1 shall be used to form names and symbols of the decimal multiples and submultiples of SI units.

CAR 178.007 Non-SI Units

- (a) The non-SI units listed below shall be used either in lieu of, or in addition to, SI units as primary units of measurement but only as specified in ICAO Annex 5, Table 3-4.

<i>Specific quantities in ICAO Annex 5, Table 3-4 related to</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition (in terms of SI units)</i>
(1) mass	tonne	t	1 t = 10 ³ kg
(2) plane angle	degree	°	1° = (π/180) rad
	minute	'	1' = (1/60)° = (π/10 800) rad
	second	"	1" = (1/60)' = (π/648 000) rad
(3) temperature	degree Celsius	°C	1 unit °C = 1 unit K ¹
(4) 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
(5) volume	liter	L	1 L = 1 dm ³ = 10 ⁻³ m ³

Note 1: See ICAO Annex 5, Attachment C, Table C-2 for conversion.

- (b) The non-SI units listed below shall be permitted for temporary use as alternative units of measurement but only for those specific quantities listed in ICAO Annex 5, Table 3-4.

<i>Specific quantities in ICAO Annex 5, Table 3-4 related to</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition (in terms of SI units)</i>
(1) distance (long)	nautical mile	NM	1 NM = 1,852 m
(2) distance (vertical) ¹	foot	ft	1 ft = 0.304 8 m
(3) speed	knot	kt	1 kt = 0.514 444 m/s

Note 1: altitude, elevation, height, vertical speed.

CAR 178.009 Application of Specific Units

The application of units of measurement for certain quantities used in international civil aviation air and ground operations shall be in accordance with ICAO Annex 5, Table 3-4.

CAR 178.011 Termination of Use of Non-SI Alternative Units

The use in international civil aviation operations of the alternative non-SI units listed in CAR 178.007 (b) shall be terminated on the dates listed below:

<i>Non-SI alternative unit</i>	<i>Termination date</i>
Knot	not established ¹
Nautical mile	not established ¹
Foot	not established ²

Note 1: No termination date has yet been established for use of nautical mile and knot.

Note 2: No termination date has yet been established for use of the foot.

SUBPART B - ATTACHMENTS**CAR 178.051 Attachments**

The following attachments from ICAO Annex 5 shall form part of this CAR:

ATTACHMENT A. Development of the International System of Units (SI);

ATTACHMENT B. Guidance on the application of the SI;

ATTACHMENT C. Conversion Factors;

ATTACHMENT D. Coordinated Universal Time; and

ATTACHMENT E. Presentation of date and time in all-numeric form.

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