

**International Standards
and Recommended Practices**



**Annex 5
to the Convention on
International Civil Aviation**

Units of Measurement to be Used in Air and Ground Operations

This edition incorporates all amendments adopted by the Council prior to 23 February 2010 and supersedes, on 18 November 2010, all previous editions of Annex 5.

For information regarding the applicability of the Standards and Recommended Practices, see Foreword.

**Fifth Edition
July 2010**

International Civil Aviation Organization

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TRANSMITTAL NOTE

NEW EDITIONS OF ANNEXES TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

It has come to our attention that when a new edition of an Annex is published, users have been discarding, along with the previous edition of the Annex, the **Supplement** to the previous edition. Please note that the Supplement to the previous edition should be retained until a new Supplement is issued.



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AMENDMENTS

Amendments are announced in the supplements to the *Catalogue of ICAO Publications*; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

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FOREWORD

Historical background

International Standards and Recommended Practices for Dimensional Units to be used in Air-Ground Communications were first adopted by the Council on 16 April 1948 pursuant to Article 37 of the Convention on International Civil Aviation (Chicago, 1944) and were designated as Annex 5 to the Convention. They became effective on 15 September 1948 and became applicable on 1 January 1949.

Table A shows the origin of subsequent amendments together with a list of the principal subjects involved and the dates on which the Annex and the amendments were adopted by the Council, when they became effective and when they became applicable.

Action by Contracting States

Notification of differences. The attention of Contracting States is drawn to the obligation imposed by Article 38 of the Convention by which Contracting States are required to notify the Organization of any differences between their national regulations and practices and the International Standards contained in this Annex and any amendments thereto. Contracting States are invited to extend such notification to any differences from the Recommended Practices contained in this Annex and any amendments thereto, when the notification of such differences is important for the safety of air navigation. Further, Contracting States are invited to keep the Organization currently informed of any differences which may subsequently occur, or of the withdrawal of any differences previously notified. A specific request for notification of differences will be sent to Contracting States immediately after the adoption of each amendment to this Annex.

The attention of States is also drawn to the provisions of Annex 15 related to the publication of differences between their national regulations and practices and the related ICAO Standards and Recommended Practices through the Aeronautical Information Service, in addition to the obligation of States under Article 38 of the Convention.

Promulgation of information. The establishment and withdrawal of and changes to facilities, services and procedures affecting aircraft operations provided in accordance with the Standards and Recommended Practices specified in this Annex should be notified and take effect in accordance with the provisions of Annex 15.

Status of Annex components

An Annex is made up of the following component parts, not all of which, however, are necessarily found in every Annex; they have the status indicated:

1.— *Material comprising the Annex proper:*

- a) *Standards and Recommended Practices* adopted by the Council under the provisions of the Convention. They are defined as follows:

Standard: Any specification for physical characteristics, configuration, matériel, 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.

Recommended Practice: Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of international air navigation, and to which Contracting States will endeavour to conform in accordance with the Convention.

- b) *Appendices* comprising material grouped separately for convenience but forming part of the Standards and Recommended Practices adopted by the Council.
- c) *Definitions* of terms used in the Standards and Recommended Practices which are not self-explanatory in that they do not have accepted dictionary meanings. 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.
- d) *Tables* and *Figures* which 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.

2.— *Material approved by the Council for publication in association with the Standards and Recommended Practices:*

- a) *Forewords* comprising historical and explanatory material based on the action of the Council and including an explanation of the obligations of States with regard to the application of the Standards and Recommended Practices ensuing from the Convention and the Resolution of Adoption.
- b) *Introductions* comprising explanatory material introduced at the beginning of parts, chapters or sections of the Annex to assist in the understanding of the application of the text.
- c) *Notes* included in the text, where appropriate, to give factual information or references bearing on the Standards or Recommended Practices in question, but not constituting part of the Standards or Recommended Practices.
- d) *Attachments* comprising material supplementary to the Standards and Recommended Practices, or included as a guide to their application.

Selection of language

This Annex has been adopted in six languages — English, Arabic, Chinese, French, Russian and Spanish. Each Contracting State is requested to select one of those texts for the purpose of national implementation and for other effects provided for in the Convention, either through direct use or through translation into its own national language, and to notify the Organization accordingly.

Editorial practices

The following practice has been adhered to in order to indicate at a glance the status of each statement: *Standards* have been printed in light face roman; *Recommended Practices* have been printed in light face italics, the status being indicated by the prefix **Recommendation**; *Notes* have been printed in light face italics, the status being indicated by the prefix *Note*.

Any reference to a portion of this document, which is identified by a number and/or title, includes all subdivisions of that portion.

Table A. Amendments to Annex 5

<i>Amendment</i>	<i>Source(s)</i>	<i>Subject(s)</i>	<i>Adopted Effective Applicable</i>
1st Edition	Council action in pursuance of Assembly Resolution A1-35		16 April 1948 15 September 1948 1 January 1949
1 to 11 (2nd Edition)	Air Navigation Commission	Reduction of the number of unit tables from five tables to two tables.	11 December 1951 1 May 1952 1 September 1952
12 (3rd Edition)	Air Navigation Commission	Provision for identical units in the ICAO Table and the Blue Table except in respect of those units for measurement of altitudes, elevations, heights and vertical speed.	8 December 1961 1 April 1962 1 July 1964
13 (4th Edition)	Council action in pursuance of Assembly Resolution A22-18, Appendix F	Change in the title of the Annex and increase in the scope to cover all aspects of air and ground operations; provision of standardized system of units based on the SI; identification of non-SI units permitted for use in international civil aviation; provision for termination of the use of certain non-SI units.	23 March 1979 23 July 1979 26 November 1981
14	Air Navigation Commission study	Establishment of a firm date for the termination of the unit bar and introduction of guidance material relating to Coordinated Universal Time (UTC) and the method of referencing date and time.	27 February 1984 30 July 1984 22 November 1984
15	Air Navigation Commission	New definition of the metre; introduction of the special name “sievert”; deletion of references to temporary non-SI units no longer to be used.	24 November 1986 19 April 1987 19 November 1987
16	Amendment 162 to Annex 1	New provisions concerning Human Factors.	21 February 2000 17 July 2000 2 November 2000
17 (5th Edition)	Aeronautical Meteorological Observation and Forecast Study Group (AMOFSG)	Replacement of km/h by m/s for the SI unit to report wind speed.	22 February 2010 12 July 2010 18 November 2010

INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

CHAPTER 1. 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 metre apart in a 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 ($t^{\circ}\text{C}$). 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 ($^{\circ}\text{C}$). 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 0.304 8 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.

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.

CHAPTER 2. APPLICABILITY

Introductory Note.— This Annex 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 Attachment A for details concerning the development of the SI.

2.1 Applicability

The Standards and Recommended Practices contained in this Annex shall be applicable to all aspects of international civil aviation air and ground operations.
