# THE REPUBLIC OF SUDAN
# SUDAN CIVIL AVIATION AUTHORITY
# (SCAA)

SUCAR PART 5

UNITS OF MEASUREMENT

to be used in air and ground operations

September 2011

# THE REPUBLIC OF SUDAN
# SUDAN CIVIL AVIATION AUTHORITY
# (SCAA)

# Sudan Civil Aviation Regulation
# SUCAR PART 5
# Units of Measurement

SUCAR Part 5 – *Units of Measurement* has been promulgated pursuant to Article 33 of the Civil Aviation Act, 2010 and issued under my consent as is required by the Act.

The SUCAR fully complies with the requirements of Annex 5 – *Units of Measurement* to the Convention on International Civil Aviation ; and, supported by Directives, Orders and Procedures that may be published, from time-to-time, by the Board of Directors of Civil Aviation and/or the Director General of Civil Aviation, as required by law, constitute the Units of Measurement Standards to be used in the air and ground in the Republic of Sudan.

Dr. Mohamed Elmuktar Hassan
Minister of Cabinet Affairs
Khartoum, 20 October 2011

# AMENDMENTS

| No | Date applicable | Date Entered | Entered by |
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# (SCAA)

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# The Republic of Sudan
# Sudan Civil Aviation Regulations (SUCARs)

## FOREWORD

## 1. Legal Background

Pursuant to Article 33 of the Civil Aviation Act, 2010 regarding the empowerment of the Board of Directors of Civil Aviation to issue and amend Sudan Civil Aviation Regulations (SUCAR) for the approval of the Competent Minister, Sudan Civil Aviation Safety Regulations are issued to ensure compliance with the Convention on International Civil Aviation, signed in Chicago on 7 December 1944 (Chicago Convention) to which the State of Sudan is a Party. The Convention, through its Annexes, provides for the minimum standards to ensure the safety of civil aviation activities and environmental protection throughout the application and implementation of common standards and technical requirements. Sudan Civil Aviation Regulations provide an appropriate and comprehensive framework for the definition and implementation of common technical requirements and administrative procedures in the field of civil aviation. Standards and Recommended Practices (SARPs) contained in ICAO Annexes as well as the technical information in its related publications form a main source in the making of Sudan Civil Aviation Regulations and therefore represent an acceptable guidance in the areas that are not covered by Sudan Civil Aviation Regulations.

a) An aircraft, other than an aircraft registered in the State of Sudan, shall not fly over or land in the territories of the State of Sudan except under an authorization granted by the Civil Aviation Authority (CAA) on behalf of the Government of the State of Sudan.

b) An aircraft other than an aircraft registered in the State of Sudan shall not take on-board or discharge any passengers or cargo at any location within the territories of the State of Sudan, being passengers or cargo carried or to be carried for hire or reward, without the permission of the CAA granted for the aircraft in accordance with any conditions and limitations to which such permission may be subjected.

c) An aircraft shall not fly over or land in the territory of the State of Sudan unless it is registered in:
   i. The State of Sudan; or
   ii. An ICAO Contracting State; or
   iii. Any other State where an agreement/arrangement between the State of Sudan and that State making provisions for over-flight or landing in the territory of the State of Sudan.

d) In accordance with the provisions of **SUCAR Part 7**, an aircraft registered in the State of Sudan shall comply with the Sudan Civil Aviation Regulations.

e) An Aircraft, registered outside the State of Sudan shall comply with the Sudan Civil Aviation Regulations while operating to/from or within the territories of the State of Sudan wherever is applicable.

f) An aircraft registered in the State of Sudan should comply with the regulations of other States that it is overflying wherever is applicable.

g) Sudan CAA accepts the codes of the Type Certification Authority of the State of Manufacturer and/or Design, for the purpose of issuing or Revalidation of Airworthiness Certificates, Airworthiness Directives (ADs), Minimum Equipment List (MEL), and all other related issues in that respect. The Sudan Civil Aviation Authority may impose additional requirements.

h) Any difference that may exist between SUCAR requirements and corresponding ICAO Annex SARPs. Significant differences shall be published in the National AIP. The procedure for amending the SUCARs and filing of differences with ICAO are contained in paragraph 4 below and detailed information is found in the CAA Rule Making Manual.

i) An effort has been made for SUCAR requirements to be fully compliant with corresponding ICAO Annexes; however, where an aviation activity for which a SUCAR regulation has not been promulgated is undertaken in the Sudan, the relevant Annex provisions shall be applicable until it is addressed in an amendment of the SUCAR." Applicability date for SUCARs by users is set at six months after they have been promulgated (30 September 2011).

## 2. Layout of the SUCAR Document

Sudan Civil Aviation Regulations cover all aspects of aviation activities in the State of Sudan and comprise of the following parts;

Part 0 SUCAR Index
Part 1 Personnel Licensing
Part 2 Rules of the Air
Part 3 Meteorological Service for International Air Navigation
Part 4 Aeronautical Charts
Part 5 Units of Measurement
Part 6 Operation of Aircraft
***Note:*** *Designated as Volumes of SUCAR Part 6 in general; Standards contained in ANR Parts VII, Part VIII, Volumes 2, 3, 4, 5, 7 and ANR Part X, as amended, have been directly adopted as Volumes of SUCAR Part 6.*
Part 7 Aircraft Registration or Cancellation
Part 8 Airworthiness of Aircraft and Continuing Airworthiness
***Note:*** *Designated as Volumes of SUCAR Part 8 in general; Standards contained in ANR Parts III, IV, V, VI, and VIII, as amended, have been directly adopted as Volumes of SUCAR Part 8.*
Part 9 RESERVED (Facilitation)
Part 10 Aeronautical Telecommunications
Part 11 Air Traffic Services
Part 12 Search and Rescue
Part 13 Aircraft Accident and Incident Investigation
Part 14 Aerodromes
Part 15 Aeronautical Information Services
Part 16 Environmental Protection
Part 17 Aviation Security
Part 18 The Safe Transportation of Dangerous Goods by Air

Each Part of SUCAR, but not necessarily all, is composed of :

a) An introduction;
b) Text;
c) Definitions;
d) Notes;
e) Tables and figures;

f) Appendices; and
g) Attachments.

## 3 Rules of construction

In the Parts of these Regulations, unless the context requires otherwise:

1. Words importing the singular include the plural
2. Words importing the plural include the singular, and
3. Words importing the masculine gender include the feminine.
4. "Shall" is used in an imperative sense.
5. "May /should" is used in a permissive sense to state authority or permission to do the act prescribed, and the words "no person may…." Or "a person may not ….." means that no person is required, authorized or permitted to do the act prescribed, and
6. The word "Includes" means includes but is not limited to.
7. The word "Show" and its derivatives in these regulations have the exact intent as shown in the dictionary.

## 4 Amendment Rationale and Procedures

The existing Sudan Civil Aviation Regulations will from time to time be amended to reflect the latest updates of ICAO Standards and Recommended Practices (SARPs); it will also be amended to reflect the latest up to date aviation safety related matters detected by the Civil Aviation Authority, the aviation industry service providers or operators, and individuals and authorization holders; amendment may also be generated to ensure safety standardization and to accommodate new initiatives or technologies. The amendment procedure shall be as follows;

1. When the Civil Aviation Authority (**CAA**) receives an amendment to any of the current ICAO Annexes, the same will be routed by the Office of the Director General of Civil Aviation to the Standard and Safety Surveillance Committee (**SSSC**) which in turn will provide a copy to the concerned Directorate for their study and comments within a specified period of time and route the same back to the SSSC for final study and release.
2. When any of the different CAA Directorates requires a change to the applicable SUCAR parts, it will send a letter stating the required change along with its justified reasons for such change where it will then be studied and decided upon by the **SSSC**.
3. Any of the above mentioned change requests would then be prepared in draft form and sent to the concerned Directorate for further study and comments within a specified period of time.
4. All suggested changes will be drafted in the form of notices of proposed amendments and addressed to all concerned including industry representatives for comments prior to final release.
5. Any differences between the new regulations and ICAO standards and recommended practices will be reported and recorded as differences to ICAO and reflected in the Aeronautical Information Publications **(AIP)**.
6. Entry into force time frame for any new regulations will be the responsibility of the **SSSC**. The SSSC will also be responsible for coordinating the identification of differences from corresponding ICAO Annexes in coordination with the concerned Directorates.
7. The Office of the Director General is responsible for filing differences with ICAO as soon as new regulations or amendments thereto have been promulgated.
8. All concerned parties will be given a copy of the new amendment and will be requested to update their copy of the regulations including their list of effective pages.

9. Approved amendments or corrigenda of SUCAR or part(s) thereof will be disseminated to the industry through hardcopies (news release circulars directives and other) and softcopies (online or database, Internet address, CD-ROM and other).
10. It is the responsibility of all concerned parties to keep their copy of the regulations up to date.
11. Where applicable, regulations contained in the Air Navigation Regulations (ANRs) that have not been revoked may be enforced should the need arise.
12. The State may release no regulation prior to the formal approval of the Competent Minister as determined in Civil Aviation Act 2010 or the Director General of Civil Aviation on delegation by the Competent Minister.

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# CHAPTER 1
# DEFINITIONS

When the following terms are used in the Standards andRecommended Practices concerning the units of measurementto be used in all aspects of international civil aviation air andground operations, they have the following meanings:

1. ***Ampere (A).*** The ampere is that constant electric currentwhich, if maintained in two straight parallel conductors ofinfinite length, of negligible circular cross-section, andplaced 1 metre apart in vacuum, would produce betweenthese conductors a force equal to 2 **x** newton per metreof length.
2. ***Becquerel (Bq).*** The activity of a radionuclide having onespontaneous nuclear transition per second.
3. ***Candela (cd).*** The luminous intensity, in the perpendiculardirection, of a surface of 11600 000 square metre of blackbody at the temperature of freezing platinum under apressure of 101 325 newtons per square metre.
4. ***Celsius temperature (toc).*** The Celsius temperature is equal tothe difference toc = T - To between two thermodynamictemperatures T and To where To equals 273.15 kelvin.
5. ***Coulomb (C).*** The quantity of electricity transported in1 second by a current of 1 ampere.
6. ***Degree Celsius ("C).*** The special name for the unit kelvin foruse in stating values of Celsius temperature.
7. ***Farad (F).*** The capacitance of a capacitor between the platesof which there appears a difference of potential of 1 voltwhen it is charged by a quantity of electricity equal to1 coulomb.
8. ***Foot (ft).*** The length equal to 0.304 8 metre exactly.
9. ***Gray (Gy).*** The energy imparted by ionizing radiation to amass of matter corresponding to 1 joule per kilogram.
10. ***Henry (H).*** The inductance of a closed circuit in which anelectromotive force of 1 volt is produced when the electriccurrent in the circuit varies uniformly at a rate of 1 amperepr second.
11. ***Hertz (Hz).*** The frequency of a periodic phenomenon of whichthe period is 1 second.
12. ***Human performance.*** Human capabilities and limitationswhich have an impact on the safety and efficiency ofaeronautical operations.
13. ***Joule (J).*** The work done when the point of application of aforce of 1 newton is displaced a distance of 1 metre in thedirection of the force.
14. ***Kelvin (K). A*** unit of thermodynamic temperature which is thefraction 11273.16 of the thermodynamic temperature of thetriple point of water.
15. ***Kilogram (kg).*** The unit of mass equal to the mass of theinternational prototype of the kilogram.
16. ***Knot*** (kt). The speed equal to 1 nautical mile per hour.
17. ***Litre (L). A*** unit of volume restricted to the measurement ofliquids and gases which is equal to 1 cubic decimetre.
18. ***Lumen (Im).*** The luminous flux emitted in a solid angle of1 steradian by a point source having a uniform intensityof 1 candela.
19. ***Lux (Lr).*** The illuminance produced by a luminous flux of1 lumen uniformly distributed over a surface of 1 squaremetre.

20. ***Metre (m).*** The distance travelled by light in a vacuum during11299 792 458 of a second.
21. ***Mole (mol).*** The amount of substance of a system whichcontains as many elementary entities as there are atoms in0.012 kilogram of carbon-12.

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

22. ***Nautical mile (NM)***. The length equal to 1 852 metres exactly.
23. ***Newton (N).*** The force which when applied to a body havinga mass of 1 kilogram gives it an acceleration of 1 metre persecond squared.
24. ***Ohm (G).*** The electric resistance between two points of aconductor when a constant difference of potential of 1 volt,applied between these two points, produces in thisconductor a current of 1 ampere, this conductor not beingthe source of any electromotive force.
25. ***Pascal (Pa).*** The pressure or stress of 1 newton per squaremetre.
26. ***Radian (rad).*** The plane angle between two radii of a circlewhich cut off on the circumference an arc equal in lengthto the radius.
27. ***Second* (s).** The duration of 9 192 **63** 1 770 periods of theradiation corresponding to the transition between thetwo hyperfine levels of the ground state of thecaesium- 133 atom.
28. ***Siemens (S).*** The electric conductance of a conductor in whicha current of 1 ampere is produced by an electric potentialdifference of 1 volt.
29. ***Sievert (Sv).*** The unit of radiation dose equivalentcorresponding to 1 joule per kilogram.
30. ***Steradian (sr).*** The solid angle which, having its vertex in thecentre of a sphere, cuts off **an** area of the surface of thesphere equal to that of a square wirh sides of length equalto the radius of the sphere.
31. ***Tesla (T).*** The magnetic flux density given by a magnetic fluxof 1 weber per square metre.
32. ***Tonne (t).*** The mass equal to 1 000 kilograms.
33. ***Volt (V).*** The unit of electric potential difference andelectromotive force which is the difference of electricpotential between two points of a conductor carrying aconstant current of 1 ampere, when the power dissipatedbetween these points is equal to 1 watt.
34. ***Waft (W).*** The power which gives rise to the production ofenergy at the rate of 1 joule per second.
35. ***Weber (Wb).*** The magnetic flux which, linking a circuit of oneturn, produces in it **an** electromotive force of 1 volt as it isreduced to zero at a uniform rate in 1 second.

# CHAPTER 2
# APPLICABILITY

*Introductory Note.- This Part contains specifications for the use of astandardized system of units of measurement in international civil aviationair and ground operations. This standardized system of units of measurementis based on the International System of Units (SI) and certain nun-SIunits considered necessary to meet the specialized requirements ofinternational civil aviation. See Attachment A for details concerning thedevelopment of the SI.*

## 5.2.1 Applicability

The Standards and Recommended Practices contained in this Part shallbe applicable to all aspects of international civil aviation air and ground operations in the Republic of Sudan.

# CHAPTER 3
# STANDARD APPLICATION OF UNITS OF MEASUREMENT

## 5.3.1 SI Units

5.3.1.1 In the Republic of Sudan, the International System of Units developed and maintained by the General Conference of Weights andMeasures (CGPM) are, subject to the provisions of 5.3.2 and5.3.3 of this SUCAR applicable as the standard system of units of measurement for all aspects of international civil aviation air and groundoperations.

5.3.1.2 Prefixes

The prefixes and symbols listed in Table 3-1 are applicable in the Sudanto form names and symbols of the decimal multiples andsub-multiples of SI units.

**Table 3.1**
**SI 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= | $10\text{-}^{1}$ | 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= | $10\text{-}^{18}$ | atto | a |

***Note I.-*** *As used herein the term SI unit is meant to include base units and derived units as well as their multiplesand sub-multiples. Attachment B contains guidance on the generalapplication of prefixes.*

## 5.3.2 Non-SI Units

5.3.2.1 Non-SI units for permanent use with the SI

The non-SI units listed in Table 3-2 shall be used either inlieu of, or in addition to, SI units as primary units of measurement as specified in Table 3-4.

## 5.3.3 Non-SI Units for temporary use

The non-SI units listed in Table 3-3 shall be permitted for temporaryuse in the Sudan as alternative units of measurement for those specific quantities listed in Table 3-4.

**Table 3.2**
**Non-SI units for use with the SI**

| Specific quantities in Table 3-4 related to | unit | symbol | Definition in terms of SI units |
|---|---|---|---|
| mass | tonne | t | 1t = $10^3$ kg |
| plane angle | degree | ° | 1° = (π/180) rad |
| | minute | ’ | 1’=(1/60)° = (π/l0 800)rad |
| | second | ’’ | 1” = (1/60)’ = (π/648 000) rad |
| temperature | degree Celsius | °C | 1 unit °C = 1 unit K[a)] |
| time | minute | min | 1 min=60s |
| | hour | h | 1 h=60min=3600s |
| | day | d | 1 d=24h=86400s |
| | week, month, year | - | |
| volume | litre | L | 1 L = $1dm^3$ = $10\text{-}^3m3$ |

a) See Attachment C, Table C-2 for conversion

**Table 3.3**
**Non-SI units for use with the SI**

| Specific quantities in Table 3-4 related to | unit | symbol | Definition in terms of SI units |
|---|---|---|---|
| distance long | nautical miles | nm | 1nm = 1852 m |
| distance vertical [a)] | foot | ft | 1 ft= 0.3048m |
| speed | knots | kt | 1 kt = 0.0514 444 m/s |

a) altitude, elevation, height, vertical speed.

**5.3.4 Application of specific units**

5.3.4.1 The application of units of measurement for certain quantities used in international civil aviation air and groundoperations in the Sudan shall be in accordance with Table 3-4.

5.3.4.2 Basic SUCAR provisions shall be applied for units to be used for quantities not listed in Table 3-4.

5.3.4.2 - Means and provisions for design, procedures and training established foroperations in environments involving the use of standard and non-SI alternatives of specific units of measurement, or thetransition between environments using different units, in the Sudan shall be made with dueconsideration to human performance.Guidance material on human performance can be found in theICAO Human Factors Training Manual (Doc 9683) andCircular 238 (Human Factors Digest No. 6 - Ergonomics).

**Table 3-4**
**Standard application ot spedfic units of measurement**

| Ref No. | Quantity | Primary unit (symbol) | Non-SI alternative unit (symbol) |
|---|---|---|---|
| ***1- Direction/Space/Time*** | | | |
| 1.1 | altitude | m | ft |
| 1.2 | area | rn2 | NM |
| 1.3 | distance (1ong)[a)] | km | ft |
| 1.4 | distance (short) | m | ft |
| 1.5 | elevation | h and ruin | |
| 1.6 | endurance | m | |
| 1.7 | height | 0’” | |
| 1.8 | latitude | m | |
| 1.9 | length | 0’” | |
| 1.10 | longitude | 0 | |
| 1.11 | plane angle (when required, decimal subdivisions of the degree shall tie used) | m | |
| 1.12 | runway length | m | |
| 1.13 | ninwayvisuslrange | m | |
| 1.14 | tank capacities (airrraft)[b)] | L | |
| 1.15 | time | S<br>min<br>h<br>d<br>week<br>month | |
| 1.16 | viaibiIity[c)] | year | |
| 1.17 | volume | km | |
| 1.18 | wind direction (wind directions other than for a landing and take-off shall be expressed in degrees mae; for landing and take-off wind directions shall be expressed in degrees magnetic) | $m^3$<br>0 | |
| ***2. Man-related*** | | | |
| 2.1 | air density | $kg/m^3$ | |
| 2.2 | area density | $kg/rn^2$ | |
| 2.3 | cargo capseity | Kg | |
| 2.4 | cargo density | $kg/ rn^3$ | |
| 2.5 | density (mass density) | $kg/ rn^3$ | |
| 2.6 | fuel capacity (gravimetsic) | kg | |
| 2.7 | gas density | $kg/ rn^3$ | |
| 2.8 | gross mass or payload | Kg<br>t | |

| Ref No. | Quantity | Primary unit (symbol) | Non-SI alternative unit (symbol) |
|---|---|---|---|
| 2.9 | hoisting provisions | kg | |
| 2.10 | linear density | kg/m | |
| 2.11 | liquid density | kg/ $rn^3$ | |
| 112 | mass | kg | |
| 2.13 | moment of inertia | $Kg.m^2$ | |
| 2.14 | nsoment of momentum | $Kg.m^2/s$ | |
| 2.15 | Momentum | Kg.m/s | |
| ***3. Forarttated*** | | | |
| 3.1 | air pressure (gencral) | kPa | |
| 3.2 | ahimeter selling | hpa | |
| 3.3 | atmospheric pccsswe | hpa | |
| 3.4 | bending moment | KN.m | |
| 3,5 | lotte | N | |
| 3.6 | fuel supply pressure | kPa | |
| 33 | hydrsolic pressure | Mpa | |
| 3.8 | modulus of elasticity | kPa | |
| 3.9 | pressure | Mpa | |
| 3.10 | stress | Mn/m | |
| 3.11 | surface irsision | mN/m | |
| 3.12 | thrust | KN | |
| 3.13 | torque | N.m | |
| 3.14 | vacuum | Pa | |
| ***4. MechanIcs*** | | | |
| 4.1 | Airspeet[d)] | km/h | Kt |
| 4.2 | angular acceleration | $nd/s^2$ | |
| 4..3 | angular velocity | rad/s | |
| 4.4 | energy work | J | |
| 4..5 | cquivalcni shaft power | kW | |
| 4.6 | lreqtsency | Hz | |
| 4.7 | ground speed | Hm/h | 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 | rateoftrim | $^0/s$ | |
| 4.13 | shalt power | kW | |
| 4.14 | velocity | m/s | |
| 4.15 | vertIcal speed | m/s | Ft/min |
| 4.16 | wind speed | km/h | Kt |
| ***5. Flow*** | | | |
| 5.1 | engine airflow | kg/s | |
| 5.2 | engIne waterfiow | kg/h | |
| 5.3 | fuel coitsuniption (specific) | | |
| | piston engines | kg/(kW.h) | |
| | turbo – shft engines | kg/(kW. h) | |

| Ref No. | Quantity | Primary unit (symbol) | Non-SI alternative unit (symbol) |
|---|---|---|---|
| | jet engines | kg/(kW. h) | |
| 5.4 | fuel flow | kg/h | |
| 5.5 | fuel tank filling rate (gravirnetric) | kg/min | |
| 5.6 | gas flow | kg/s | |
| 53 | liquid flow (gravimetric) | g/s | |
| 5.8 | liquid flow (volumetric) | L/s | |
| 5.9 | mass flow | kg/s | |
| 5.10 | oil cosisuniption | | |
| | gass turbine | Kg/h | |
| | piston engines (specific) | G / (Kw.h) | |
| 5.11 | oil how | g/s | |
| 5.12 | pump caçiaciiy | L/min | |
| 5.13 | ventilation airflow | $m^3$/min | |
| 5.14 | viscosity (dynamic) | Pa ‘ s | |
| 5.15 | viscosity (kioematic) | $m^2$/s | |
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| 6.3 | heat flow rate | | |
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| 7.1 | capacitance | F | |
| 7.2 | conduciance | S | |
| 7.3 | conductivity | S/n | |
| 7.4 | current density | A/$m^2$ | |
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| 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 denslry | T | |
| 7.12 | power | W | |
| 7.13 | quantity of electricity | C | |
| 7.14 | resistance | Ω | |
| ***8- Light and related electromagnatic raiations*** | | | |
| 8.1 | illuminance | Ix | |
| 8.2 | luminance | Cd/$m^2$ | |
| 8.3 | luminance exitance | In/$m^2$ | |
| 8.4 | luminance flux | lm | |
| 8.5 | luminance inaensity | cd | |

| Ref No. | Quantity | Primary unit (symbol) | Non-SI alternative unit (symbol) |
|---|---|---|---|
| 8.6 | Quantity of light | Im.s | |
| 8.7 | radiant energy | J | |
| 8.8 | wavelength | m | |
| *9. Acoustics* | | | |
| 9.1 | frequency | Hz | |
| 9.2 | mass density | $Kg/m^2$ | |
| 9.3 | noise level | dB | |
| 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 | |
| 9.9 | static pressure (instantinous) | Pa | |
| 9.10 | volisity of sound | m/s | |
| 9.11 | viumevebcity(instaiaaneoats) | $M^3/s$ | |
| 9.12 | wavelength | M | |
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| 10.4 | dose equovalent | Sv | |
| 10.5 | radiation exposure | C/kg | |
| 10.6 | exposure rate | C/kg.s | |

a) As used in navigation, generally in axcess of 4.000 m.
b) Such as aircraft fuel. hydrautx; fined, water, oil and high pressure oxygen vessels.
c) Visibility of less than 5 km may be given in m.
d) Airspeed is somtimes reported in flight operations in tearms of the ratio MACH number.
e) The decibel (dB) is a ratio wich may be used a a unit for expressing sound pressure level and sound power level, When used, the reference level must be specified.

# CHAPTER 4
# TERMINATION OF USE OFNON-SI ALTERNATIVE UNITS

*Introductory Note.- The non-SI units listed in Table 3-3 have been retained temporarily for use as alternative units because of their widespreaduse and to avoid potential safety problems which could result fromthe lack of international coordination concerning the termination of their use. As termination dates are established by the Council, they will berefected as Standards contained in this Chaptel: It is expected that theestablishment of such dates will be well in advance of actual termination.Any special procedures associated with specific unit termination will becirculated to all States separately from this Annex.*

5.4.1 The use in international civil aviation operations of the alternative non-SI units listed in Table 3-3 shall be terminated on the dates that may be published by ICAO and are listed inTable 4- 1 below.

**Table 4-1. Termination dates for non-SI alternative units**

| non-SI alternative units | Termination date |
|---|---|
| Knot } | not established |
| Nautical mile | |
| Foot | not established |

a) No termination date has yet been established for use of nautical mile and knot.
b) No termination date has yet been established for use of the foot.

# ATTACHMENT A
# DEVELOPMENT OF THE INTERNATIONAL SYSTEM OF UNITS (SI)

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**Information on Development of the International System of Units (SI)
can be found in Annex 5, Attachment A
to the
Convention on International Civil Aviation**

# ATTACHMENT B
# GUIDANCE ON THE APPLICATION OF THE SI

## 1. Introduction

1.1 The International System of Units is a complete, coherent system which includes three classes of units:
a) base units;
b) supplementary units; and
c) derived units.

1.2 The SI is based on seven units, which are dimensionally independent and are listed in Table B-I.

**Table B-1. SI base units**

| Quantity | Unit | Symbol |
|---|---|---|
| amount of a substance | mole | mol |
| electric current | ampere | A |
| length | metre | m |
| luminous intensity | candela | cd |
| mass | kilogram | kg |
| thermodynamic temperature | kelvin | K |
| time | second | s |

1.3 The supplementary units of the SI are listed in Table B-2 and may be regarded either as base units or as derived units.

**Table B-2. SI supplementary units**

| Quantity | Unit | Symbol |
|---|---|---|
| Plane range | radian | rad |
| Solid angle | steradian | sr |

1.4 Derived units of the SI are formed by combining base units, supplementary units and other derived units accordingl 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 Table B-3.

***Note.-** The specific application of the derived units listed in Table 8-3 and other units common to international civil aviation operations is given in Table 3-4.*

**Table B-3. SI supplementary units with special names**

| Quantity | Unit | Symbol | Dervation |
|---|---|---|---|
| absorbed dose (radiation) | gray | Gy | J/kg |
| activity of radionuclides | becquerel | Bq | I/s |
| capacitance | farad | F | C/v |
| conductance | siemens | S | A/V |

| | | | |
|---|---|---|---|
| dose cquivalent (radiation) | sievcrt | 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 | $Kg.m/s^2$ |
| frequency (of a periodic phenomenon) | hertz | Hz | l/s |
| illuminance | lux | lx | $lm/m^2$ |
| inductance | henry | H | Wb/A |
| luminous flux | Lumen | Im | cd.sr |
| magnetic flux | weber | Wb | V.s |
| magnetic flux density | teals | T | $Wb/m^2$ |
| power, radiant flux | watt | W | J/s |
| pressure, stress | pascal | Pa | $N/m^2$ |
| quantity of electricity, electric charge | coulomb | C | A.s |

1.5 The SI is a rationalized selection of units from themetric system which individually are not new. The greatadvantage of SI is that there is only one unit for each physicalquantity - the metre for length, kilogram (instead of gram)for mass, second for time, etc. From these elemental or baseunits, units for all other mechanical quantities are derived.These derived units are defined by simple relationships such asvelocity equals rate of change of distance, acceleration equalsrate of change of velocity, force is the product of mass andacceleration, work or energy is the product of force anddistance, power is work done per unit time, etc. Some of theseunits have only generic names such asmetre per second forvelocity; others have special names such as newton (N) forforce, joule (J) for work or energy, watt (W) for power. TheSI units for force, energy and power are the same regardlessof whether the process is mechanical, electrical, chemical ornuclear. Aforce of 1 newton applied for a distance of **1** metrecan produce 1 joule of heat, which is identical with what**1** watt of electric power can produce in 1 second.

1.6 Corresponding to the advantages of SI, which resultfrom the use of a unique unit for each physical quantity, arethe advantages which result from the use of a unique and welldefinedset of symbols and abbreviations. Such symbols andabbreviations eliminate the confusion that can arise fromcurrent practices in different disciplines such as the use of "b"for both the bar (a unit of pressure) and barn (a unit of area).

1.7 Another advantage of SI is its retention of thedecimal relation between multiples and sub-multiples of thebase units for each physical quantity. Prefixes are establishedfor designating multiple and sub-multiple units from "exa"($10^{18}$) down to "atto" ($10^{-18}$)for convenience in writing andspeaking.

I .8 Another major advantage of SI is its coherence. Unitsmight be chosen arbitrarily, but making an independent choiceof a unit for each category of mutually comparable quantitieswould lead in general to the appearance of several additionalnumerical factors in the equations between the numericalvalues. It is possible, however, and in practice more convenient,to choose a system of units in such a way that theequations between numerical values, including the numerical factors, have exactly the same fvrm as the correspondingequations between the quantities.Aunit system defined in thisway is called coherent with respect to the system of quantitiesand equations in question. Equations between units of acoherent unit system contain as numerical factors only thenumber 1. In a coherent system the product or quotient of aand equations in question. Equations between units of acoherent unit system contain as numerical factors only thenumber 1.In a coherent system the product or quotient of any two unit quantities is the unit of the resulting quantity. For example, in any coherent system, unit area results when unit length is multiplied by unit length, unit velocity when unit length is divided by unit time, and unit force when unit mass is multiplied by unit acceleration.

***Note.-*** *Figure B-I illustrates the relationship* of *the units* energy: of *the SI.*

**2. Mass, force and weight**

2.1 The principal departure of SI from the gravimetric system of metric engineering units is the use of explicitlydistinct units from mass and force. In SI, the name kilogram is restricted to the unit of mass, and the kilogram-force (from which the suffix force was in practice often erroneously dropped) is not to be used. In its place the SI unit of force, the newton is used. Likewise, the newton rather than the kilogram-force is used to form derived units which include force, for example, pressure or stress (N/m2 = Pa), energy (N . m = J), and power (N . m/s = W).

2.2 Considerable confusion exists in the use of the term weight as a quantity to mean either force or mass. In common use, the term weight nearly always means mass; thus, when one speaks of a person's weight, the quantity referred to is mass. in science and technology, the term weight of a body has usually meant the force that, if applied to the body, would give it anacceleration equal to the local acceleration of free fall. The adjective "local" in the phrase "local acceleration of free fall" has usually meant a location on the surface of the earth; in this context the "local acceleration of free fall" has the symbol g (sometimes referred to as "acceleration of gravity") with observed values of g differing by over 0.5 per cent at various points on the earth's surface and decreasing as distance from the earth is increased. Thus, because weight is a force = mass x acceleration due to gravity, a person's weight is conditional on his location, but mass is not. Aperson with a mass of 70 kg might experience a force (weight) on earth of 686 newtons (≈155lbf) and a force (weight) of only 113 newtons (≈22lbf) on the moon. Because of the dual use of the term weight as a quantity, the term weight should be avoided in technical practice except under circumstances in which its meaning is completely clear. When the term is used, it is important to know whether mass or force is intended and to use S1 units properly by using kilograms for mass or newtons for force.

2.3 Gravity is involved in determining mass with abalance or scale. When a standard mass is used to balance themeasured mass, the direct effect of gravity on the two massesis cancelled, but the indirect effect through the buoyancy ofair or other fluid is generally not cancelled. In using a springscale, mass is measured indirectly, since the instrumentresponds to the force of gravity. Such scales may be calibratedin mass units if the variation in acceleration of gravity andbuoyancy corrections are not significant in their use.

**3. Energy and torque**

3.1 The vector product of force and moment arm isexample, in any coherent system, unit area results when unit widely designated by the unit newton metre. This unit forlength is multiplied by unit length, unit velocity when unit bending moment or torque results in confusion with the unitlength is divided by unit time, and unit force when unit mass for energy, which is als newton metre. If torque is expressedis multiplied by unit acceleratioN as newton metre per radian, the relationship to energy isclarified, since the product of torque and angular rotation is

(N . m/rad) . rad = N .m

.2 If vectors were shown, the distinction between energy and torque would be obvious, since the orientation of force and length is different in the two cases. It is important to recognize this difference in using torque and energy, and the joule should never be used for torque.

## 4. SI prefixes

4.1 Selection of prefixes

4.1.1 In general the SI prefixes should be used to indicate orders of magnitude, thus eliminating non-significant digits and leading zeros in decimal fractions, and providing a convenient alternative to the powers-of-ten notation preferred in computation. For example:

12 300 mm becomes 12.3 m
12.3 x $l0^3$m becomes 12.3 km
0.00123 μ A becomes 1.23 nA

4.1.2 When expressing a quantity by a numerical value and a unit, prefixes should preferably be chosen so that the numerical value lies between 0.1 and 1 000. To minimize variety, it is recommended that prefixes representing powers of 1 000 be used. However, in the following cases, deviation from the above may be indicated:

a) in expressing area and volume, the prefixes hecto, deca, deci and centi may be required: for example, square hectometre, cubic centimetre;
b) in tables of values of the same quantity, or in a discussion of such values within a given context, it is generally preferable to use the same unit multiplethroughout; and
c) for certain quantities in particular applications, one particular multiple is customarily used. For example, the hectopascal is used for altimeter settings and the millimetre is used for linear dimensions in mechanical engineering drawings even when the values lie outside the range 0.1 to 1 000.

4.2 Prefixes in compound units'

It is recommended that only one prefix be used in forming a multiple of a compound unit. Normally the prefix should be attached to a unit in the numerator. One exception to this occurs when the kilogram is one of the units. For example:
V/m, ***not*** mV/mm; MJ/kg, ***not*** kJ/g

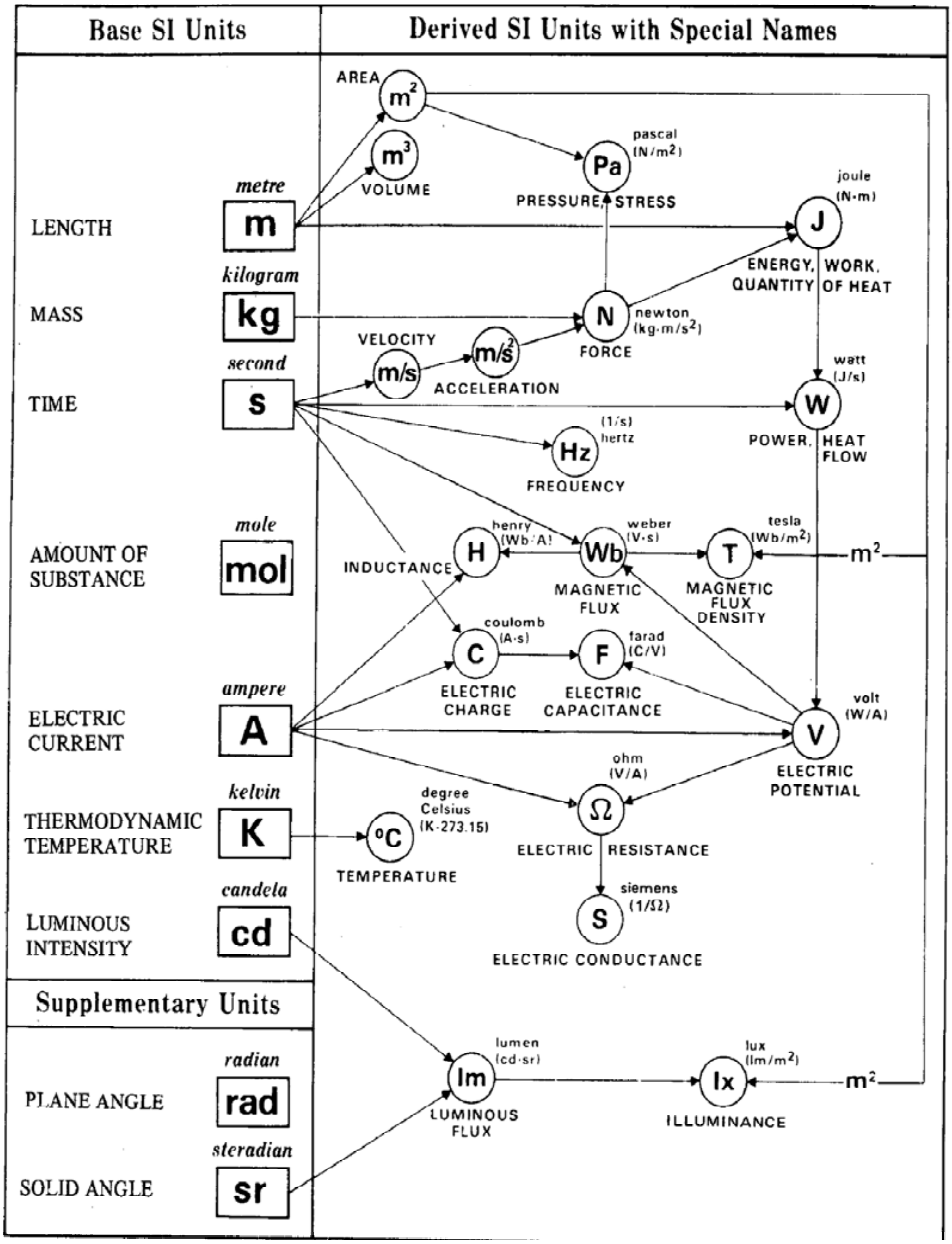
4.3 Compound prefixes

Compound prefixes, formed by the juxtaposition of two or more SI prefixes, are not to be used. For example:

1 nm *not*1mμm; 1 pF *not*1μμF

If values are required outside the range covered by the prefixes, they should be expressed using powers of ten applied to the base unit.

**Figure B-1**




4.4 Powers of units

An exponent attached to a symbol containing a prefix indicates that the multiple or sub-multiple of the unit (the unit with its prefix) is raised to the power expressed by the exponent. For example:

$1cm^3=(10^{-2}m)^3 = 10^{-6}\ m^3$

$1ns^{-1} = (10^{-9}s)^{-1} = 10^9 s^{-1}$

$1mm^2/s = (10^{-3}m)^2/s = 10^{-6}\ m^2\ /s$

**5. Style and usage**

5.1 Rules for writing unit symbols

5.1.1 Unit symbols should be printed in Roman (upright) type regardless of the type style used in the surrounding text.

5.1.2 Unit symbols are unaltered in the plural.

5.1.3 Unit symbols are not followed by a period except when used at the end of a sentence.

5.1.4 Letter unit symbols are written in lower case (cd) unless the unit name has been derived from a proper name, in which case the first letter of the symbol is capitalized (W, Pa). Prefix and unit symbols retain their prescribed form regardless of the surrounding typography.

5.1.5 in the complete expression for a quantity, a space should be left between the numerical value and the unit symbol. For example, write 35 mm not 35mm, and 2.37 lm, not 2.371m. When the quantity is used in an adjectival sense, a hyphen is often used, for example, 35-mm film.

***Exception:*** No space is left between the numerical value and the symbols for degree, minute and second of plane angle, and degree Celsius.

5.1.6 No space is used between.the prefix and unit symbols.

5.1.7 Symbols, not abbreviations, should be used for units. For example, use "A", not "amp", for ampere.

5.2 Rules for writing unit names

5.2.1 Spelled-out unit names are treated as common nouns in English. Thus, the first letter of a unit name is not capitalized except at the beginning of a sentence or in capi- talized material such as a title, even though the unit name may be derived from a proper name and therefore be represented as a symbol by a capital letter (see 5.1.4). For example, normally write "newton" not "Newton" even though the symbol is N.

5.2.2 Plurals are used when required by the rules of grammar and are normally formed regularly, for example, henries for the plural of henry. The following irregular plurals are recommended:

***SingularPlural***
Luxlux
Hertz hertz
Siemens siemens

[1]. *A compound unit is a derived unit expressed in terms of two or more units,that is. not expressed with a single special name.*

5.2.3 No space or hyphen is used between the prefix and the unit name.

5.3 Units formed by multiplication and division

5.3.1 *With unit names:*

Product, use a space (preferred) or hyphen:

newton metre ***or*** newton-metrein the case of the watt hour the space may be omitted, thus:watthour.

Quotient, use the word per and not a solidus:metre per second *not*metre/second.

Powers, use the modifier squared or cubed placed after theunit name:

metre per second squared

In the case of area or volume, a modifier may be placedbefore the unit name:

square millimetre, cubic metre.

This exception also applies to derived units using area orvolume:watt per square metre.

*Note.- To avoid ambiguity in complicated expressions,symbols are preferred to words.*

5.3.2 *With unit symbols:*

Product may be indicated in either of the following ways:

Nm ***or*** N . m for newton metre.

*Note.- When using for a prefix a symbol which coincideswith the symbol for the unit, special care should be taken toavoid confusion. The unit newton metre for torque should bewritten, for example, Nm or N . m to avoid confusion withmN, the millinewton.*

An exception to this practice is made for computer printouts,automatic typewriter work, etc., where the dot half high is notpossible, and a dot on the line may be used.

Quotient, use one of the following forms:

m/s ***or*** m . $s^{-1}$*or* m/s

In no case should more than one solidus be used in the sameexpression unless parentheses are inserted to avoid ambiguity.

For example, write:

J/(mol . K) ***or*** J . $mol^{-1}$ . $K^{-1}$***or*** (J/mol)/Kbut ***not*** J/mol/K.

5.3.3Symbols and unit names should not be mixed in thesame expression. Write:

joules per kilogram ***or*** J/kg ***or*** J . $kg^{-1}$

but ***not*** joules/kilogram ***or*** joules/kg ***or*** joules . $kg^{-1}$.

**5.4 Numbers**

5.4.1 The preferred decimal marker is a point on the line(period); however, the comma is also acceptable. Whenwriting numbers less than one, a zero should be written beforethe decimal marker.

5.4.2 The comma is not to be used to separate digits.Instead, digits should be separated into groups of three,counting from the decimal point towards the left and the right,and using a small space to separate the groups. For example:

73 655 7 281 2.567 321 0.133 47

The space between groups should be approximately the widthof the letter “5" and the width of the space should be constanteven if, as is often the case in printing, variable-width spacingis used between the words.

5.4.3 The sign for multiplication of numbers is a cross( X )or a dot half high. However, if the dot half high is usedas the multiplication sign, a point on the line must not be usedas a decimal marker in the same expression.

5.4.4 Attachment of letters to a unit symbol as a meansof giving information about the nature of the quantity underconsideration is incorrect. Thus MWe for "megawattselectrical (power)", Vac for "volts ac" and kJt for"kilojoules thermal (energy)" are not acceptable. For thisreason, no attempt should be made to construct SI equivalentsof the abbreviations "psia" and "psig", so often used todistinguish between absolute and gauge pressure. If thecontext leaves any doubt as to which is meant, the vordpressure must be qualified appropriately. For example:

". . . at a gauge pressure of 13 kPa".

*or* " . . . at an absolute pressure of 13 kPa".

# ATTACHMENT C
# CONVERSION FACTORS

## 1. General

1.1 The list of conversion factors which is contained inthis Attachment is provided to express the definitions ofmiscellaneous units of measure as numerical multiples of SIunits.

1.2 The conversion factors are presented for readyadaptation to computer read-out and electronic datatransmission. The factors are written as a number greater than1 and less than 10 with six or less decimal places. This numberis followed by the letter E (for exponent), a plus or minussymbol, and two digits which indicate the power of 10 bywhich the number must be multiplied to obtain the correctvalue. For example:

3.523 907 E - 02 is 3.523 907 × $10^{-2}$ or 0.035 239 07

Similarly,

3.386 389 E + 03 is 3.386 389 × $10^{3}$ or 3 386.389

1.3 An asterisk (*) after the sixth decimal place indicatesthat the conversion factor is exact and that all subsequentdigits are zero. Where less than six decimal places are shown,more precision is not warranted.

1.4 Further examples of use of the tables:

| *To convert from* | *to* | *Multiply by* |
|---|---|---|
| pound-force per square foot | Pa | 4.788 026 E + 01 |
| inch | **m** | 2.540 000*E-02 |

thus:

1 lbf/ft$^2$ = 47.880 26 Pa

1 inch = 0.025 4 m(exactly)

## 2. Factors not listed

2.1 Conversion factors for compound units which are notlisted herein can easily be developed from numbers given inthe list by the substitution of converted units, as follows.

***Example:*** To find conversion factor of lb.ft/s to kg.m/s:

***first convert***

1 lb to 0.453 592 4 kg

1ft to 0.304 8 m

***then substitute:***

(0.453 592 4 kg) x (0.304 8 m)/s

= 0.138 255 kg.m/s

Thus the factor is 1.382 55 E-01.

| *To convert from* | *to* | *Multiply by* |
|---|---|---|

| | | |
|---|---|---|
| abampere | ampere (A) | 1.000 000 * E + 0.1 |
| abcoulomb | coulomb (C) | 1.000 000 * E + 0.1 |
| abfarad | farad (F) | 1.000 000 * E + 0.9 |
| abhenry | henry (H) | 1.000 000 * E – 0.9 |
| abmho | siemens (S) | 1.000 000 * E + 0.9 |
| abohm | ohm(Ω) | 1.000 000 * E – 0.9 |
| abvolt | volt(V) | 1.000 000 * E – 0.8 |
| acre (U.S. survey) | square metre ($m^2$) | 4.046 873 * E+03 |
| ampere hour | coulomb (C) | 3.600 000 * E+03 |
| are | square metre ($m^2$) | 1.000 000 * E + 0.2 |
| atmosphere (standard) | pascal (Pa) | 1.013 250 * E + 0.5 |
| atmospere (technical - 1kgf/$cm^2$) | pascal (Pa) | 9.806 650 * E + 04 |
| bear | pascal (Pa) | 1.000 000 * E + 0.5 |
| barrel (for petroleum, 42 U.S. liquid gal) | cubic metre($m^3$) | 1.559 873 *E -1 |

An asterisk (*) after the sixth decimal place indicates that the conversion facor is exact and and that all subsequent digits are zero. Where less than six decimal places are shown, more precision is not warranted.

| ***To convert from*** | ***to*** | ***Multiply by*** |
|---|---|---|
| British thermal unit (International Table) | joule (J) | 1.055 056 E+0.3 |
| British thermal unit (mean) | joule (J) | 1.055 870 E+0.3 |
| British thermal unit (thermochemical) | joule (J) | 1.054 350 E+0.3 |
| Bntish thermal unit (39°F) | joule (J) | 1.059 67 E+0.3 |
| British thermal unit (59°F) | joule (J) | 1.054 80 E+0.3 |
| British thermal unit (60°F) | joule (J) | 1.054 68 E +0.3 |
| Btu (Irteinational Table) ft/h-$ft^2$- °F (k, thermal conductivity) | watt per metre kelvin (W/m-K) | 1.730 735 E+0.0 |
| Btu (thcrmochemical)- ft/h –$ft^2$- °F (k, thermal conductivity) | watt per metre kelvin (W/m-K) | 1.729 577 E+0.0 |
| Btu (International Table) -in/h- $ft^2$- °F (k, Iherinal conductivity) | watt per metre kelvin (W/m-K) | 1.442 279 E-0.l |
| Btu (thermochemical) in/h - $ft^2$- °F (k, thermal conductivity) | watt per metre kelvin (W/m-K) | 1.441 314 E-0.1 |
| Btu (International Table)- in/s $ft^2$ –°F (k , thermal conductivity) | watt per metre kelvin (W/m-K) | 5.192 204 E+0.2 |
| Btu (thermochemical)-in/s' $ft^2$ °F (k. thermal conductivity) | watt per metre kelvin (W/m-K) | 5.188 732 E+02 |
| Btu (international Table)/h | watt (W) | 2.930711 E-0.1 |
| Btu (thermochemical)/fh | watt (W) | 2.928 751 E-0.l |
| Btu (thermochemical)/min | watt (W) | 1.757 250 E+0.I |
| Btu (thermochemical)/s | watt (W) | 1.054 350 E+0.3 |
| Btu (international Table)/ $ft^2$ | joule per square metre (J/$m^2$) | 1.135653 E+0.4 |
| Btu (thersnochentical)/$ft^2$ | joule per square metre (J/$m^2$) | l.134 893 E+0.4 |
| Btu (thermochemical)/ $ft^2$ . h | watt per square metre (W/$m^2$) | 3,152481 E+0.0 |
| Btu (thermochemical)/ $ft^2$ .mm | watt per square metre (W/$m^2$) | 1.891 489 E+0.2 |
| Btu (thermochemical)/ $ft^2$.s | watt per square metre (W/$m^2$) | 1.134893 E+0.4 |
| Btu (thermochemical)/$in^2$ . s | watt per square metre (W/$m^2$) | 1.634246 E+0.6 |
| Btu (International Table)/h - $ft^2$- °F (C, thermal conductance) | watt per square metre kelvin (W/$m^2$.k) | 5.674 466 E+0.0 |

| To convert from | to | Multiply by |
|---|---|---|
| Btu (thermochemical) )/h - $ft^2$- °F (C, thermal conductance) | watt per square metre kelvin ($W/m^2.k$) | 5.678 263 E+0.0 |
| Btu (International Table)/s- $ft^2$- °F | watt per square metre kelvin ($W/m^2.k$) | 2.044 175 F-i-0.4 |
| Btu (thermochemical)/s- $ft^2$- °F | watt per square metre kelvin ($W/m^2.k$) | 2.042808 F.+0.4 |
| Btu (International Table) Ib | joule per kilogram (J/kg) | 2.316 000*E +0.3 |
| Btu (thermochemical)/Ib | joule per kilogram (J/kg) | 2.324444 E +0.3 |
| Btu (international Tabte) Ib.°F (c, heat capacity) | joule per kilogram kelvin (J/kg.k) | 4.186 800*E-+0.3 |
| Btu (thermochemical)/Ib.°F (c, heat capacity) | joule per kilogram kelvin (J/kg.k) | 4.184 000 E+0.3 |
| calorie (inch) | metre (m) | 2.540 000* E+ 0.2 |
| calorie (International Table) | joule (J) | 4.186 800* E+0.0 |
| calorie (mean) | joule (J) | 4.19002 E+0.0 |
| calorie (thermochemical) | joule (J) | 4.l84 000* E+0.0 |
| calorie (15°C) | joule (J) | 4.18580 E+0.0 |
| calorie (20°C) | joule (J) | 4.18l 90 E+0.0 |
| calorie (kilogram. International Table) | joule (J) | 4.186 800* E+0.3 |
| calorie (kilogram, mean) | joule (J) | 4.190 02 E+ 0.3 |
| calorie (kilogram, thermochemical) | joule (J) | 4.184 000* E+0.3 |
| cal (thernioehemieal)/$cm^2$ | joule per square metre (J/m’) | 4. 184 000* E+ 0..4 |
| cal (International Table)/g | joule per kilogram (J/kg) | 4.186800*E-+0.3 |
| cal (thermochemical)/g | joule per kilogram (J/kg) | 4.184 000*E+0.3 |
| cal (International Table)/g-°C | joule per kilogram (J/kg) | 4.186 800*E 0.3 |
| cal (thermochemical)/ g-°C | joule per kilogram (J/kg) | 4.184 000*E+03 |
| cal (thermochemical)/min | watt (W) | 6.373 333 E-0.2 |
| cal (thermochemical)/s | watt (W) | 4.184 000*E+OO |
| cal (thermochemical)/$cm^2$- mm | watt per square metre ($W/m^2$) | 6.973 333 E +02 |
| cal (thermochemical)/ $cm^2$-s | watt per square metre ($W/m^2$) | 4.184 000*E+04 |
| cal (thermochemical)/ cm-s - °C | watt per metre kelvin (W/m.k) | 4.184 000*E+02 |
| centimetre of mercury (0°C) | Pascal (Pa) | 1.33322 E+ 0.3 |
| centimetre of water (4°C) | Pascal (Pa) | 9.80638 E+ 0.1 |
| centipoise | Pascal second (Pa.s) | 1.000 000*E-0.3 |
| centistokes | metre square per second ($m^2$ /s) | 1.000 000 *E-0.6 |
| Circular mil | square metre ($m^2$) | 5.067 075 E-l.0 |
| Clo | kelvin metre square per watt (k. $m^2$/W) | 2.003 712 E-0.l |
| Cup | qupic metre ($m^3$) | 2.365 882 E-0.4 |
| curie | becquerel (Bq) | 3.700 000* E+1.0 |
| day (mean solar) | second (s) | 8.640 000 E+0.4 |
| day (sidereal) | second (s) | 8.616 409 E+0.4 |
| degree (angle) | Radian (rad) | 1.745 329 E-0.2 |
| $^oF$-h-$ft^2$/Btu (International Table) (R, thermal resistance) | kelvin metre square per watt (k. $m^2$/W) | 1.161 102 E-0.l |
| $^oF$-h-$ft^2$/Btu (thermochemical) ( R, thermal resistance) | kelvin metre square per watt (k. $m^2$/W) | 1.762 280 E-0.l |

| To convert from | to | Multiply by |
|---|---|---|
| dyne | newton (N) | 1.000 000*E-0.5 |
| dyne-cm | newton metre (N-m) | 1.000 000*E-0.7 |
| dyne/cm$^2$ | pascal (Pa) | 1.000 000*E-0.1 |
| electronvolt | joule (J) | 1.602 19 E-1.9 |
| EMU of capacitance | farad (F) | 1000 000*E-0.9 |
| EMU or current | ampere (A) | 1.000 000*E -0.9 |
| EMU of electric potential | volt (v) | 1.000 000*E – 0.5 |
| EMU of inductance | henry (H) | 1.000 000*E- 0.7 |
| EMU of resistance | ohm (Ω) | l.000 000*E – 0.1 |
| erg | joule (J ) | 1000 000*E- 0.7 |
| erg/ cm$^2$-s | watt per square metre (W/m$^2$) | 1.000 000*E -0.3 |
| erg/s | watt (W) | 1000 000*E- 0.7 |
| ESU of capacitance | farad (F) | 1.112 650 E-l.2 |
| ESU of current | ampere (A) | 3.335 6 E-l.0 |
| ESU of electric potential | volt (v) | 2.397 9 E-0.2 |
| ESU of inductance | henry (H) | 8.987 554 E+1.1 |
| ESU of resistance | ohm (Ω) | 8.987 554 E+1.2 |
| faraday (based on carbon-12) | coulomb (C) | 9.648 70 E+0.4 |
| faraday (chemical) | coulomb (C) | 9.349 57 E+0.4 |
| faraday (physical) | coulomb (C) | 9352 19 E+0.4 |
| fathom | metre (m) | 1.828 8 E+0.0 |
| fermi (femtoenetre) | metre (m) | 1.000 000*E- 15 |
| fluid ounce (U.S.) | cubic metre (m$^3$) | 2.957 353 E-0.5 |
| foot | metre (m) | 3348 000*E-0.l |
| foot (U.S survey) | metre (us) | 3.048 006 E-0.1 |
| foot of water (39.2°F) | pascal (Pa) | 2.988 98 E+0.3 |
| ft$^2$ | square metre (m$^2$) | 9.290 304*E-0.2 |
| ft$^2$ /h(thernual diffusivity) | metre squared per second (m$^2$/s) | 2.580 640 *E-0.5 |
| ft$^2$/s | metre squared per second (m$^{2/}$s) | 9.290 304*E -0.2 |
| ft$^2$ (volume; sectsom modulus) | cubic meter (m$^3$) | 2.831 685 E-0.2 |
| ft$^2$/min | cubic metre per second (m$^3$/s) | 4.719 474 E-0.4 |
| ft$^2$/s | cubic metre per second (m$^3$/s) | 2.831 685 E-0.2 |
| ft$^2$ (moment of section) | metre to the founh power (m) | 8.630 975 E -0.3 |
| ft- lbf | joule (J) | 1.355 818 E+0.0 |
| ft- lbf /h | watt (W) | 3.766 161 E-0.6 |
| rt- lbf /min | wait (W) | 2,259 697 E -0.2 |
| ft- lbf /s | watt (W) | 1.355 818 E +0.0 |
| ft-poundal | jmsle(J) | 4.214011 E -0.2 |
| free fall standard (g) | metre per second squared (sn/s$^2$) | 9.806 650*E +0.0 |
| ft/h | metre pee second (m/s) | 8.466 667 E -0.5 |
| ft/min | metre per second (m/s) | 5.080 000*E -0.3 |
| ft/s | metre per second (m/s) | 3.048 000 *E-0.l |
| ft/s$^2$ | metre per second squared (m/s$^2$) | 3.048 000*E -0.1 |
| footcandle | lux (Ix) | 1.076 391 E +0.1 |
| footlambert | candela per square metre (cd/m$^2$) | 3,426 259 E +0.0 |
| gal | metre per second squared (nt/s$^2$) | 1.000 000 *E -0.2 |
| gallon (Canadian liquid) | cubic metre (m$^3$) | 4.546 090 E -0.3 |
| gallon (U.K. liquid) | cubic metre (m$^3$) | 4.546 092 E -0.3 |
| gallon (U.S. dry) | cubic metre (m$^3$) | 4.404 884 E -0.3 |

| To convert from | to | Multiply by |
|---|---|---|
| gallon (U.S. liquid) | cubic metre ($m^3$) | 3.785 412 E -0.3 |
| gal (U.S. Iiquid)/day | cubic metre per second ($m^3/s$) | 4.381 264 E -0.8 |
| gal (U.S. Iiquid)/min | cubic metre per second ($m^3/s$) | 6.309 020 E -0.5 |
| gal (U.S. liquid)/hp-h (SFC. spedtlc fuel consumption) | cubic metre per joule ($m^3/J$) | 1.410 089 E -0.9 |
| gamma | tesla (T) | 1.009 000*E -0.9 |
| gauss | tesla(T) | 1,009 000*E-0.4 |
| gilbert | ampere (A) | 7.957 747 E-O.1 |
| grad | degree (angular) | 9.000 000*E -0.1 |
| grad | radian (rad) | 1.570 796 E-0.2 |
| gram | kilogram (kg) | t.000 000*E -0.3 |
| gm/$cm^3$ | kilogram per cubic metre (kg/ $m^3$) | 1.000 090*E+0.3 |
| gram.force/ $cm^2$ | pascal (Pa) | 9.806 630*E+0.1 |
| hectare | square metre ($m^2$) | 1.000 030*E + 0.4 |
| horsepower (550 II' lbf/s) | watt (W) | 7.456 999 E +0.2 |
| horsepower (electric) | watt (W) | 7,460 000*E + 0.2 |
| hoesepower (metric) | watt (W) | 7.354 99 E+0.2 |
| horsepower (water) | watt (W) | 7.460 43 E+0.2 |
| horsepower (U.K.) | watt (W) | 7.457 0 E+0.2 |
| hour (mean solar) | second (s) | 3.600 000 E +0.3 |
| hour (sidereal) | second (s) | 3.590 170 E+ 0.3 |
| hundredweight (long) | kilogram (kg) | 5.080 235 E+0.1 |
| humtredwright (short) | kilogram (kg) | 4.535 924 E+0.1 |
| inch | metre (m) | 2.540 000 *E-02 |
| inch of mercury (32°F) | pascal (Pa) | 3.386 38 E +03 |
| inch of mercury (60°F) | pascal (Pa) | 3.376 85 E +03 |
| inch of water (39.2°F) | pascal (Pa) | 2.490 2 *E +02 |
| inch of water (60°F) | pascal (Pa) | 2.488 4 E.02 |
| $in^2$ | square metre ($m^2$) | 6.451 600 *E-04 |
| $In^3$ (volume; section modulus) | cubic metre ($m^3$) | 1.638106 E-05 |
| $In^3$ /min | cubic metre per second ($m^3$ /s) | 2.731 177 E-07 |
| $in^4$ (moment of section) | metre to the fourth power ($m^4$) | 4.162 314 E-07 |
| In/s | metre per second (m/s) | 2,540 000 *E-02 |
| In/$s^2$ | metre per second squared (m/$s^2$) | 2.540 000 *E-02 |
| kilocalorie (International Table) | joule (J) | 4.186 800 *E+03 |
| kilocalorie (mean) | joule (J) | 4.190 02 *E+03 |
| kilocalorie (thermochemical) | joule (J) | 4.184 000 E+03 |
| kilocalorie (thermochcmlcal)/min | watt (W) | 6.973 333* E+01 |
| kilocalorie (tlsermochemical)/s | watt (W) | 4.184 000*E+03 |
| kilogram-force (kgf) | newton (N) | 9.806 650*E+00 |
| Kgf/m | newton metre (N.m) | 9.806 650*E + 00 |
| Kgf.$s^2$/m (mass) | kilogram (kg) | 9.806 650*E+00 |
| kgf/$cm^2$ | pascal (Pa) | 9.806 650*E+04 |
| kgf/$m^2$ | pascal (Pa) | 9.106 650*E+00 |
| kgf/$mm^2$ | pascal (Pa) | 9.106 650*E+06 |
| km/h | metre per second (m/s) | 2.777 778 E-01 |
| kilopond | newton (N) | 9.806 650*E+00 |
| kW.h | joule (J) | 3.600 000*E+06 |

| To convert from | to | Multiply by |
|---|---|---|
| kip (1 000 lbf) | newton (N) | 4.448 212 E+03 |
| kip/in$^2$ (ksi) | pascal (Pa) | 6.894 757 E+06 |
| knot (international) | metre per second (m/s) | 5.144 444 E-01 |
| lambert | candela per square metre (ed/m$^2$) | 1/π *E+04 |
| lambert | candela per square metre (cd/m$^2$) | 3.183 099 E+03 |
| langly | joule per square mare (J/m$^2$) | 4.184 000*E+04 |
| lb-ft$^2$ (moment of inertia) | kilogram metre squared (kg- m$^2$) | 4.214 011 E-02 |
| Lb.in$^3$ (moment of inertia) | kilogram metre squared (kg-m$^2$) | 2.926 397 E-04 |
| lb/ft.h | pascal second (Pa-s) | 4.1789 E-04 |
| lb/ft.s | pascal second (Pa-s) | l.488 14 E+DO |
| lb/ft$^2$ | kilogram per square metre (kg/m$^2$) | 4.882 28 E+00 |
| lb/ft$^3$ | kilogram per cubic metre (kg/m$^3$) | 1.601 846 E+01 |
| lb/gal (U.K. lIquid) | kilogram per cubic metre (kg/m$^3$) | 9.977633 E+01 |
| lb/gal (U.S. liquid) | kilogram per cubic metre (kg/m$^3$) | 1.198264 E+02 |
| lb/h | kilogram per second (kg/s) | 1.259979E-04 |
| lb/hp.h (SEC. specific fuel consumption) | kilogram per joule (kg/J) | 1.689659 E-07 |
| lb/in$^3$ | kilogram per cubIc metre (kg/m$^3$) | 2.767990 E+04 |
| lb/min | kilogram per second (kg/s) | 7.559 873 E -03 |
| lb/s | kilogram per second (kg/s) | 4.535924 E -01 |
| lb/yd$^3$ | kilogram per cubic metre (kg/m$^3$) | 5.932 764 E -01 |
| lbf -ft | newton metre (N.m) | 1.355 818 E +00 |
| lbf- ft/in | newton metre per metre (N.m/m) | 5337 866 E +01 |
| Ibf.in | newton metre (N.m) | 1.129 848 E-01 |
| Ibf.in/in | newton metre per metre (N.m/m) | 4.448222 E+00 |
| Ibf.s/ft$^2$ | pascal second (Pa.s) | 4.780 026 E+01 |
| lbf/ft | newton per metre (N/m) | 1.459 390 E+01 |
| lbf/ft$^2$ | pascal (Pa) | 4.780 026 E+01 |
| lbf/in | newton per metre (N/m) | 1.751 260 E+02 |
| lbf/in$^2$ (psi) | pascal (Pa) | 6.894757 E+03 |
| lbf/lb (thrust/weight (mass) ratio) | newton per kilogram (N/kg) | 9.806650 E+00 |
| light year | metre (m) | 9.46055 E+l5 |
| liter | cubic metre (m$^3$) | 1.000 000*E -03 |
| maxwell | weber (Wb) | 1.000 000*E-0.8 |
| mho | siemens (5) | 1.000000*E+00 |
| microinch | metre (m) | 2.540 000*E-08 |
| micron | metre (m) | 1.000 000*E-06 |
| mile | metre (m) | 2.540 000*E-05 |
| mile (international) | metre (m) | 1.609 344*E+03 |
| mile (statute) | metre (m) | 1.409 3 E+03 |
| mile (US. survey) | metre (m) | 1.609 347 E+03 |
| mile (international nautical) | metre (rn) | l.852 000*E+03 |
| mile (U.K. nautical) | metre (m) | 1.853 104*E+03 |

| ***To convert from*** | ***to*** | ***Multiply by*** |
|---|---|---|
| mile (U.S. nautical) | metre (m) | 1.852 000*E + 03 |
| $mi^2$ (international) | square metre ($m^2$) | 2.589 988 E+06 |
| $mi^2$ (U.S. sarsey) | square metre ($m^2$) | 2.589 998 E+06 |
| mi/h (international) | metre per second (m/s) | 4.470 400*E-01 |
| mi/h (international) | kilometre per hour (km/h) | 1.609 344*E+00 |
| mi/min (international) | metre per second (m/s) | 2.682 240*E + 01 |
| mi/s (international) | metre per second (m/s) | 1.609 344*E+03 |
| millibar | pascal (Pa) | 1.000 000*E+ 02 |
| millimetre of mercury ($0^oC$) | pascal (Pa) | 1.333 22 E+02 |
| minute (angle) | radian (rad) | 2.908 882 E-04 |
| minute (mean solar) | second (s) | 6.000 000 E+01 |
| minute (sidereal) | second (s) | 5.983 617 E+01 |
| month (mean calendar) | second(s) | 2.628 000 E+06 |
| oersted | ampere per metre (A/m) | 7.957 747 E+01 |
| ohm centimetre | ohm metre (Ω.m) | 1.000 000*E -02 |
| ohm circular.mil per ft | ohm millimetre squared per metre (Ω.$mm^2$/m) | 1.662 426 E-03 |
| ounce (avoirdupois) | kilogram (kg) | 2.834 952 E-02 |
| ounce (troy or apothecary) | kilogram (kg) | 3.110 348 E-02 |
| ounce (U.K. fluid) | cubic metre ($m^3$) | 2.841 307 E-05 |
| ounce (U.S. fluid) | cubic metre ($m^3$) | 2.957 353 E-05 |
| ounce-force | newton (N) | 2.780 139 E-01 |
| ozf .in | newton metre (N.m) | 7.061552 E -03 |
| oz (avoirdupois)/gal (U.K. liquid) | kitograni per cubic metre (kg/$m^3$) | 6.236 021 E+00 |
| oz (avoirdupois)/gal (U.S. liquid) | kilogram per cubic metre (kg/$m^3$) | 7,409 152 E- 00 |
| oz (avoirdupois)/$in^2$ | kilogram per cubic metre (kg/$m^3$) | 1.729994 E+03 |
| oz (avoirdupois)/$ft^2$ | kilogram per square metre (kg/$m^2$) | 3.051 817 E-01 |
| oz (avoirdupois)/$yd^2$ | kilogram per square metre (kg/$m^2$) | 3.390575 E -02 |
| parsec | metre (m) | 3.085 678 E+16 |
| pennyweight | kilogram (kg) | 1.555 174 E-03 |
| perm(0°c) | kilogram per pascal second metre squared (kg/Pa.s.$m^2$) | 5.721 35 E-11 |
| perm (23°c) | kilogram per pascal second metre squared (kg/Pa.s.$m^2$) | 5.745 25 E-11 |
| perm.in (0°c) | kilogram per pascal second metre squared (kg/Pa.s.m) | 1.453 22 E-12 |
| perm.in (23°c) | kilogram per pascal second metre squared (kg/Pa.s.m) | 1.459 29 E-12 |
| phot | lumen per square metre (lu/$m^2$) | 1.000 000 *E+04 |
| pint (U.S. dry) | cubic metre ($m^3$) | 5.506 105 E-08 |
| pint (U.S. liquid) | cubic metre ($m^3$) | 4.731 765 E-04 |
| poise (absolute viscosity) | pascal second (Pa.s) | 1.000 000*E-Ol |
| pound (lb avoirdupois) | kilogram (kg) | 4.535 924 E-01 |
| pound (troy or apothecary) | kilogram (kg) | 3.732 417 E-03 |

| ***To convert from*** | ***to*** | ***Multiply by*** |
|---|---|---|
| poundal | newton (N) | 1.382 550 E-01 |
| potindal/ft’ | pascal (Pa) | 1.488 164 E.00 |
| Poundal. s/ft | pascal second (Pa.s) | 1.488 164 E.00 |
| pouesd.force (Ibf) | newton (N) | 4.442 222 E+00 |
| quart (U.S. dry) | cubic metre ($m^3$) | 1.101 221 E-03 |
| quart (U.S. liquid) | cubic metre ($m^3$) | 9.463 529 E-04 |
| rad (radiation dose absorbed) | gray (Gy) | 1.000 000*E-02 |
| rem | sievert (Sv) | 1.000 000*E-02 |
| rhe | 1 per pascal second (1/Pa.s) | I.000 000*E.0l |
| roentgen | coulomb per kilogram (C/kg) | 2.58 E-04 |
| second (angle) | radian (rad) | 4.848 137 E-06 |
| second (sidereal) | second (a) | 9.972 696 E-01 |
| slug | kilogram (kg) | 1.459 390 E+01 |
| slug/ft.s | pascal second (Pa.s) | 4.781 1026 E+01 |
| slug/$ft^2$ | kilogram per cubic metre ($kg/m^3$) | 5.153 788 E+02 |
| statampere | ampere (A) | 3.335 640 E-10 |
| suatcoulomb | coulomb (C) | 3.335 640 E-10 |
| statfarad | farad (F) | 1.112 650 E-12 |
| stathenry | henry (H) | 8.987554 E+11 |
| statmho | siemens (5) | 1.312 650 E-12 |
| statohm | ohm (2) | 8.987 554 E+11 |
| statvolt | volt (v) | 2.997925 E+02 |
| stere | cubic metre ($m^3$) | 1.000 000*E÷ 00 |
| stilb | candela per square metre ($cd/m^2$) | 1.000 000*E. 04 |
| stokes (kinematic viscosity) | metre squared per second ($m^2/s$) | 1.000 000*E-04 |
| therm | joule (J) | 1.055056 E+08 |
| ton (assay) | kilogram (kg) | 2.916667 E-02 |
| ton (long. 2 240 Ib) | kilogram (kg) | 1.016047 E.03 |
| ton (metric) | kilogram (kg) | 1.000 000*E.03 |
| ton (nuclear equivalent of TNT) | joule (J) | 4.184 E+09 |
| ton (refrigeration) | watt (W) | 3.516 800 E+03 |
| ton (register) | cubic metre ($m^3$) | 2.831 685 E+ 00 |
| ton (short, 2 000 lb) | kilogram (kg) | 9.071 847 E +02 |
| ton (long)/$yd^3$ | kilogram per cubic metre ($kg/m^3$) | 1.328 939 E+03 |
| ton (short)/h | kilogram per second (kg/s) | 2.519 958 E-0l |
| ton -force (2 000 IbI) | newton (N) | 8.896 444 E+03 |
| tonne | kilogram (kg) | 1.000 000 *E + 03 |
| torr (mm Hg, $0^oC$ | pascal (Pa) | 1.333 22 E+02 |
| unit pole | weber (Wb) | 1.256 637 E-07 |
| W.h | joule (J) | 3.600 000*E + 03 |
| W.s | joule(J) | l.000 000*E+00 |
| $W/cm^2$ | watt per square metre ($W/m^2$) | 1.000 000*E + 04 |
| $W/in^2$ | watt per square metre ($W/m^2$) | 1.550 003 E+03 |
| yard | metre (m) | 9.144 000*E -01 |
| $yd^2$ | square metre ($m^2$) | 8.361 274 E-0l |
| $yd^3$ | cubic nseue ($m^3$) | 7.645 549 E-0l |
| $yd^3$/min | cubic metre per second ($m^3/s$) | 1.274 258 E-02 |

| To convert from | to | Multiply by |
|---|---|---|
| year (calendar) | second (s) | 3.153 600 E+07 |
| year (sidereal) | second (s) | 3.155 815 E+07 |
| year (tropical) | second 0) | 3.155 693 E+07 |

**Table C-2. Temperature conversion formulae**

| To convert from | To | Use formula |
|---|---|---|
| Celsius temperature ($t^o{}_C$) | Kelvin temperature ($t_K$) | $t_K = t_{oC} + 273.15$ |
| Fahrenheit temperature ($t^o{}_F$) | Celsius temperature ($t^o{}_C$) | $t_{oC} =(t^o{}_F-32)/1.8$ |
| Fahrenheit temperature ($t^o{}_F$) | Kelvin temperature ($t_K$) | $t_K = (t^o{}_F+459.67)/1.8$ |
| Kelvin temperature ($t_K$) | Celsius temperature ($t^o{}_C$) | $t^o{}_C = t_K – 273.15$ |
| Rankine temperature ($t^o{}_R$) | Kelvin temperature ($t_K$) | $t_K = t^o{}_R/1.8$ |

## ATTACHMENT D
## CO-ORDINATED UNIVERSAL TIME

The Republic of Sudan has accepted Co-ordinated Universal Time (UTC) as the accepted international time for clock time. It is therefore the time used in the Republic of Sudan for world-wide time signal broadcasts in aviation.

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# ATTACHMENT E
# PRESENTATION OF DATE AND TIME

## 1. Introduction

The International Organization for Standardization (ISO)Standards 2014 and 3307 specify the procedures for writingthe date and time in all-numeric form and ICAO will be usingthese procedures in its documents where appropriate in thefuture.

## 2. Presentation of Date

Where dates are presented in all-numeric form, IS0 2014specifies that the sequence year-month-day should be used.The elements of the date should be:

- four digits to represent the year, except that the centurydigits may be omitted where no possible confusioncould arise from such an omission. There is value inusing the century digits during the period of familiarizationwith the new format to make it clear that the neworder of elements is being used;
- two digits to represent the month;
- two digits to represent the day.

Where it is desired to separate the elements for easier visualunderstanding, only a space or a hyphen should be used as aseparator. 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

It should be emphasized that the IS0 sequence should only beused where it is intended to use an all-numeric presentation.Presentations using a combination of figures and words maystill be used if required (e.g. 25 August 1983).

## 3. Presentation of Time

3.1 Where the time of day is to be written in all-numericform, IS0 3307 specifies that the sequence hours-minutessecondsshould be used.

3.2 Hours should be represented by two digits from 00 to23 in the 24-hour timekeeping system and may be followedeither by decimal fractions of an hour or by minutes andseconds. Where decimal fractions of an hour are used, thenormal decimal separator should be used followed by thenumber of digits necessary to provide the required accuracy.

3.3 Minutes should likewise be represented by two digitsfrom 00 to 59 followed by either decimal fractions of a minuteor by seconds.

3.4 Seconds should also be represented by two digits from00 to 59 and followed by decimal fractions of a second ifrequired.

3.5 Where it is necessary to facilitate visual understandinga colon should be used to separate hours and minutesand minutes and seconds. For example, 20 minutes and18 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 decimalfractions of a minute

*or* 15.338 in hours and decimal fractions of an hour.

**4. Combination Date and Time Groups**

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

**-END-**