National Measurement Guidelines 1999

as amended

made under section 7B of the

National Measurement Act 1960

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taking into account amendments up to National Measurement Amendment Guidelines 2004 (No. 1)

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Reader’s guide

Aim of the guide
The aim of this guide is to help you to understand the National Measurement Guidelines 1999 (the guidelines). However, the guide is not part of the guidelines and has no legal force.

The guidelines are made under the National Measurements Act 1960 (the Act).

Introduction
The Act and the National Measurement Regulations 1999 (the regulations) prescribe the SI base, supplementary and certain derived, Australian legal units of measurement for specified physical quantities. They also prescribe certain additional, non-SI, legal units of measurement that may be used for particular purposes. The purpose of the guidelines is to supplement those provisions. As additional physical quantities need to be covered, Guideline 5 will be amended as required.

Australian legal units of measurement
The guidelines set out how to form Australian legal units of measurement for physical quantities from the Australian legal units of measurement prescribed by the regulations.

Subsection 3 (1) of the Act defines Australian legal units of measurement as:
(a) a unit of measurement prescribed for the purposes of subsection 7A (1); or
(b) a unit of measurement derived by the application of guidelines issued by the Chief Metrologist under subsection 7B (1), or 2 or more successive applications of those guidelines.

Sections 7 and 7A of the Act provide that the Australian legal units of measurement of a physical quantity are the sole legal units of measurement of that physical quantity and may be prescribed by the regulations.

The regulations contain the following schedules:
• Schedule 1, Part 1 — SI base units of measurement
• Schedule 1, Part 2 — SI derived units of measurement with special names
• Schedule 1, Part 3 — non-SI units of measurement used with SI units of measurement
• Schedule 1, Part 4 — additional derived units of measurement
• Schedule 2, Part 1 — additional Australian legal units of measurement
• Schedule 2, Part 2 — purposes for which additional legal units of measurement may be used
• Schedule 3 — SI prefixes that may be combined with Australian legal units of measurement for specifying numerical values.
1 **Name of guidelines** [see Note 1]

These guidelines are the *National Measurement Guidelines 1999*.

2 **Commencement** [see Note 1]

These guidelines commence on the date of commencement of Schedule 1 to the *National Measurement Amendment (Utility Meters) Act 1999*.

3 **Objects**

These guidelines govern the way in which Australian legal units of measurement may be combined:

(a) to produce an Australian legal unit of measurement; and

(b) with prefixes to produce Australian legal units of measurement.

*Note* These guidelines are a disallowable instrument: see Act, subs 7B (2).

4 **Definitions**

In these guidelines:

- **product symbol** means a symbol used to indicate the product of 2 or more Australian legal units of measurement.

- **regulations** means the *National Measurement Regulations 1999*.

- **SI prefix** means a prefix mentioned in Schedule 3 of the regulations.

5 **Physical quantities**

Australian legal units of measurement may be formed only for the following physical quantities:

- absorbed dose, absorbed dose index, kerm and specific energy imparted
  (ionising radiation)

- absorbed dose rate
  (ionising radiation)

- acceleration

- activity of radioactive nuclides

- amount of substance

- apparent energy

- apparent power

- area

- catalytic activity

- concentration of protein
  in grains
  (weight/weight)

- current density

- density

- dose equivalent and
dose equivalent index
  (ionising radiation)

- electric capacitance

- electric charge

- electric conductance

- electric current

- electric field strength

- electric inductance
• electric resistance
• energy
• exposure to ionising radiation
• exposure rate
• flow rate
• force
• frequency
• illuminance
• kinematic viscosity
• length
• luminance
• luminous flux
• luminous intensity
• magnetic field strength
• magnetic flux
• magnetic flux density
• magnetic permeability
• mass
• permittivity
• plane angle
• position
• potential difference (and electromotive force)
• power
• power density
• pressure
• reactive energy
• reactive power
• sound intensity level
• sound power level
• sound pressure level
• specific energy absorption
• specific energy absorption rate
• temperature
• time
• velocity and speed
• viscosity
• volume
• work.

Note Position is defined in terms of a group of 3 coordinates. The Australian Fiducial Network has been determined under subsection 8A (1) of the Act as a recognised-value standard of position by the Commission at the request of the Inter-Government Committee on Surveying Measurements.

6 Combining Australian legal units of measurement

(1) An Australian legal unit of measurement for a physical quantity may be formed by combining Australian legal units of measurement according to the mathematical relations linking the corresponding physical quantities.

(2) The resulting Australian legal unit of measurement may be represented by using a name or symbol that is itself formed from derived units.

Example pascal (pressure in newtons per square metre): Pa = N/m².

7 Combining Australian legal unit of measurement and prescribed SI prefix

(1) A decimal multiple or submultiple of an Australian legal unit of measurement must be formed by using a single SI prefix.

Example Nanometre: 1nm or 1 x 10⁻⁹m, but not 1µm.

(2) However, subsection (1) does not apply to kilogram.

Example kJ/kg.

Note Kilogram is an SI base unit of measurement: see regulations, Sch 1, item 1.1.
Section 8

(3) An additional derived unit of measurement, mentioned in Part 4 of Schedule 1 to the regulations, may be combined with another Australian legal unit of measurement to form an Australian legal unit of measurement.

Note An exponent associated with a symbol for an Australian legal unit of measurement indicates that the multiple or submultiple of the unit is raised to the power expressed by the exponent.

(4) The combination of the unit and a prefix may be combined with other Australian legal unit of measurement symbols to form the symbol for a compound unit that is an Australian legal unit of measurement.

Example Velocity in kilometres per hour: km/h.

8 Australian legal units of measurement that must not be combined with prefixes

(1) The following Australian legal units of measurement must not be combined with SI prefixes:

- kilogram
- minute
- hour
- day
- decibel
- inch
- foot
- hectare

- ounce
- foot/minute
- degree
- minute
- second of arc
- radian
- steradian
- degree Celsius.

(2) A decimal multiple or sub-multiple of kilogram must be formed by attaching a prefix to gram.

Note For historical reasons, kilogram already contains a prefix.

9 Australian legal units of measurement that may only be combined with prefixes that form multiples of the unit

Tonnie may be combined only with an SI prefix that gives a decimal multiple of tonne.

Example kilotonne, but not millitonne.

10 Combination of a prescribed SI prefix with a combination of Australian legal units of measurement

An Australian legal unit of measurement may be formed from a combination of Australian legal units of measurement under section 6 and the use of an SI prefix.

Example velocity (km/h):

Metre and hour are Australian legal units of measurement: see Act, subs 3 (1), definition of Australian legal unit of measurement, para (a) and Sch 1 of the regulations.

Metre and hour may be combined to form the Australian legal unit of measurement metre per hour (m/h): see Act, subs 3 (1), definition of Australian legal unit of measurement, para (b).
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Expression of Australian legal units of measurement

(1) Names and symbols of Australian legal units of measurement must not be used together in the same expression.

Example km/h, but not kilometre/h.

(2) An adjective or sign must not be added to the name or symbol of an Australian legal unit of measurement.

Example W cannot be used as the unit of acoustic power.

(3) The symbol for an SI prefix must be placed immediately before the symbol of the Australian legal unit of measurement to which it refers, without an intermediate space.

Examples
1 milliwatt: mW
2 kilometre: km
3 gigatonne: Gt
4 megajoule: MJ.

(4) For a decimal multiple or submultiple of an Australian unit of measurement that is expressed as a fraction, an SI prefix:

(a) may precede the Australian legal unit of measurement in the numerator or the denominator, or both if there is no other way to form an unambiguous expression; and

(b) should precede the Australian legal unit of measurement in the numerator.

Examples
1 km/s, but not mm/µs or m/ms
2 mm/s, but not m/ks.

(5) Only a single SI prefix may be used to form a multiple of a derived Australian legal unit of measurement.

(6) The product symbol is:

(a) a space or a dot (·); or

(b) if the resulting expression is unambiguous — a full stop (.).

(7) The product symbol must be used only with symbols that represent Australian legal units of measurement.

Example N·m or N m, but not Newton·meter.

(8) If the symbol for an Australian legal unit of measurement is the same as an SI prefix, the product symbol should be used.

Example Thermal resistivity (metre kelvin per watt): m·K/W, not m K/W which may be confused with millikelvin per watt (mK/W).
(9) An Australian legal unit of measurement derived from the division of 2 other Australian legal units of measurement may be expressed using an oblique stroke (/), a horizontal line or a negative exponent to produce an unambiguous expression.

Example $\text{m/s}$, $\frac{\text{m}}{\text{s}}$, $\text{m} \cdot \text{s}^{-1}$ or $\text{m s}^{-1}$.

(10) The oblique stroke must not be repeated on a line unless ambiguity is avoided by the use of parentheses. In a complex expression, negative exponents or parentheses must be used.

Examples
1. $\text{m/s}^2$, $\frac{\text{m}}{\text{s}^2}$, $\text{m} \cdot \text{s}^{-2}$ or $\text{m s}^{-2}$, but not $\text{m/s/s}$
2. $\text{m} \cdot \text{kg}/(\text{s}^3 \cdot \text{A})$ or $\text{m} \cdot \text{kg} \cdot \text{s}^{-3} \cdot \text{A}^{-1}$, but not $\text{m} \cdot \text{kg}/\text{s}^3/\text{A}$.

(11) A space must be left after the numerical value of an Australian legal unit of measurement and before the name or symbol of the unit of measurement.

Examples
1. 22 m, but not 22m.
2. 27 volts, but not 27volts.
3. 15 °C, but not 15°C.

*Note 1* When expressing temperature in degrees Celsius, a space must not be left between the symbol for degrees and the symbol for Celsius. See example 3.

*Note 2* When expressing a percentage in relation to an Australian legal unit of measurement, a space must not be left between the number and the symbol for percentage: eg 25%, but not 25 %.
Notes to the *National Measurement Guidelines 1999*

**Note 1**

The National Measurement Guidelines 1999 (in force under section 7B of the *National Measurement Act 1960*) as shown in this compilation is amended as indicated in the Tables below.

Under the *Legislative Instruments Act 2003*, which came into force on 1 January 2005, it is a requirement for all non-exempt legislative instruments to be registered on the Federal Register of Legislative Instruments.

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