



National Measurement Guidelines 2016

National Measurement Act 1960

I, PETER FISK, Chief Metrologist, make these Guidelines under subsection 7B (1) of the *National Measurement Act 1960*.

Dated 31 March 2016

PETER FISK

Peter Fisk
Chief Metrologist

Contents

Reader's guide	3
1 - Name of Guidelines	4
2 - Authority	4
3 - Commencement	4
4 - Revocation	4
5 - Objects	4
6 - Definitions	4
7 - Physical quantities	4
8 - Combining Australian legal units of measurement	4
9 - Combining Australian legal unit of measurement and prescribed SI prefix	5
10 - Australian legal units of measurement that must not be combined with prefixes	5
11 - Australian legal units of measurement that may only be combined with prefixes that form multiples of the unit	6
12 - Combination of a prescribed SI prefix with a combination of Australian legal units of measurement	6
13 - Expression of Australian legal units of measurement	6

Reader's guide

Aim of the guide

The aim of this guide is to assist your understanding of the *National Measurement Guidelines 2016* (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 International System of Units (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.

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 pertaining to the Guidelines:

- 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

Guidelines

1 Name of Guidelines

These Guidelines are the National Measurement Guidelines 2016

2 Authority

These Guidelines are made under subsection 7B (1) of the *National Measurement Act 1960*.

3 Commencement

These Guidelines commence on 1 April 2016.

4 Revocation

These Guidelines revoke the *National Measurement Guidelines 1999* (the former Guidelines) on 1 April 2016.

5 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: subsection 7B (2) of the Act.

6 Definitions

In these Guidelines:

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

Regulations mean the *National Measurement Regulations 1999*.

SI Prefix means a prefix mentioned in Schedule 3 of the Regulations.

Note Several other words and expressions used in these Guidelines have the meaning given by section 3 of the Act.

7 Physical quantities

Australian legal units of measurement may be formed only for the physical quantities as prescribed under the Regulations.

8 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): $Pa = N/m^2$.

9 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: 1 nm or 1×10^{-9} m, but not 1 m μ m.

- (2) Subsection 9(1) of these Guidelines does not apply to *kilogram*.

Example kJ/kg

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

- (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 Speed in kilometres per hour: km/h.

10 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.

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

Tonne may be combined only with an SI Prefix that gives a decimal multiple of *tonne*.

Example kilotonne, but not millitonne.

12 **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 8 of these Guidelines and the use of an SI Prefix.

Example speed (km/h):

Metre and hour are Australian legal units of measurement: see subsection 3 (1) of the Act, 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 subsection 3 (1) of the Act, definition of *Australian legal unit of measurement*, para (b).

Metre per hour may be further combined with the SI Prefix kilo (k) to form the Australian legal unit of measurement kilometre per hour (km/h): see subs 3 (1) of the Act, definition of *Australian legal unit of measurement*, paragraph (b).

13 **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_a 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/ μ s 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 dot (\cdot);
 - (b) if the resulting expression is unambiguous — a full stop ($.$); or
 - (c) if the symbol for an Australian legal unit of measurement is not the same as an SI prefix — a space.

Example Thermal resistivity (metre kelvin per watt): m \cdot K/W, not m K/W which may be confused with millikelvin per watt (mK/W).

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

Example N \cdot m or N m, but not Newton \cdot meter

- (8) 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 m/s, $\frac{m}{s}$ or m \cdot s⁻¹

- (9) 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 m/s², $\frac{m}{s^2}$ or m \cdot s⁻², but not m/s/s
- 2 m \cdot kg/(s³ \cdot A) or m \cdot kg \cdot s⁻³ \cdot A⁻¹, but not m \cdot kg/s³/A

-
- (10) 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 %.

- (11) However, subsection 13(10) of these Guidelines do not apply to geographic coordinates. When expressing geographic coordinates no space must be left between the numerical values and the symbols for degrees, minutes and seconds.

Example 33°43'03.0"S 151°09'37.1"E