

# International System of Units (SI) Check-List 2-page Version

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Metrology is the science of measurement.<sup>1</sup> The International System of Units, also called SI, consists of standards which result from meticulous negotiations among international metrologists. The purpose of the International System of Units is to communicate quantitative information clearly across languages and cultures.

This check-list summarizes the most important elements of those standards. For more detail, you may wish to download the PDF document NIST Special Publication 330, 2008 Edition, by Barry N. Taylor and Ambler Thompson: *The International System of Units (SI)*.<sup>2</sup> A relevant Wikipedia article<sup>3</sup> is also useful. The Bureau International des Poids et Mesures (BIPM) also publishes useful information<sup>4</sup> in French and English. Here is a simple check-list to help you to use SI correctly:

- A. Except for **degrees Celsius**, SI units like **microfarads** and **millivolts** are **always** written in lower case and are almost always pluralized. (See D below for exceptions to the usual pluralizing standard.) Because of their phonetics, some SI units like **megahertz** and **siemens** are written the same in singular and plural.
- B. SI symbols like **kHz** and **μV** are written in lower case or UPPER CASE Latin or Greek characters or in combinations. SI symbols are the most universal parts of SI. Those symbols which are paired with SI values are **never pluralized** and they are **never rendered in italics**. Be careful with UPPER and lower case: UPPER CASE **M** is the SI symbol for the **mega-** prefix; lower case **m** is the symbol for **meters** or **metres** as well as the **milli-** prefix; lower case Greek **μ** is the symbol for the **micro-** prefix. With the advent of computer word processors, using **u** as a substitute for **μ** is an obsolete practice. Lower-case italic **m** represents **mass**. UPPER CASE **K** is the SI symbol for thermodynamic temperature in **kelvins** and lower case **k** is the SI symbol for the **kilo-** prefix. One should not be used in place of the other.
- C. With three exceptions, SI values and SI symbols are **always separated with spaces** and **never with anything else**. Those exceptions are the symbols for angular degrees, angular minutes and angular seconds. **The 100 m dash** and **a 10 A fuse** are correct expressions. It is also correct to write: **The summit of 6190 m Denali in Alaska is located at 63°04'08.7"N 151°00'25.5"W**.
- D. When used in an adjectival sense in English, SI values and spelled-out SI units are separated with hyphens and are not pluralized: **the 100-meter dash** and **a 10-ampere fuse** are correct expressions. When accompanying values of exactly 1 or -1, SI units are not pluralized.
- E. **Abbreviations do not exist in SI**. Instead of abbreviations like **amps** and **secs**, use SI symbols like **A** and **s** or fully spelled-out SI units like **amperes** and **seconds**. Note that the symbol for the SI *time* unit **minutes** is **min**, which is not an abbreviation, and therefore it is not pluralized and it is not followed by a period.
- F. Except at the end of a sentence, an SI symbol is never followed by a dot or period. To avoid confusion, try not to end sentences with SI symbols if possible.
- G. Fractional SI values are decimalized and preceded with a zero or other integers:

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<sup>1</sup> <https://en.wikipedia.org/wiki/Metrology>

<sup>2</sup> <https://www.nist.gov/sites/default/files/documents/2016/12/07/sp330.pdf>

<sup>3</sup> [https://en.wikipedia.org/wiki/International\\_System\\_of\\_Units](https://en.wikipedia.org/wiki/International_System_of_Units)

<sup>4</sup> <http://www.bipm.org/en/publications/si-brochure/>

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**0.529  $\mu\text{m}$  or 0.529 micrometers.**

- H. Since either a dot or a comma may be used in SI as a decimal marker, **the comma should never be employed as a separator for long integers or long fractions.** Segment values with five digits or more utilizing spaces or half spaces. Except in some tables, 4-digit integers or 4-digit fractions should not be segmented. Using a word-processor, create a half space by changing the font size of a regular space to about half the value of the rest of the text. The *speed of light in space*, whose symbol is italic *c*,<sup>5</sup> is **299 792 458 m/s** or **299 792.458 km/s** or **299.792 458 Mm/s** when written in SI. The *speed of light in space* may also be written as **299 792,458 km/s** or **299,792 458 Mm/s** without any change in meaning.
- I. SI symbols should never include suffixes. Instead of **115 VAC**, write **AC 115 V** or **115 volts alternating current** in correct SI.
- J. **Avoid orphaned values.** Instead of **9-15 volts** or **9-15 V**, write **9 volts to 15 volts** or **9 V to 15 V** in SI.
- K. SI dates are rendered with numerals in descending order: year-month-date. The origin of what became the International System of Units began in Paris on **1875-05-20** with an international treaty. SI *time* is reckoned in the 24-hour system, often with the time zone specified: **1445 UTC** or **0657 EST**. A date-time stamp could be written **2019-03-28-1405 UTC** or for resolution to the nearest second **2019-03-28T14:05:06Z**.<sup>6</sup>
- L. SI standards have changed over time. Avoid obsolete expressions. The old **degrees kelvin** should be **kelvins (symbol K)**. The obsolete **mhos** should be **siemens (symbol S)**, which ends with an **s** in both singular and plural unit forms. The old **cc** symbol is still commonly used in medicine, but **cm<sup>3</sup>** or **mL** should be used instead. The obsolete **microns** unit is now **micrometers** or **micrometres (symbol  $\mu\text{m}$ )**. Multiple prefixes like  **$\mu\mu$**  or **micromicro-** are no longer allowed in SI. Use the **pico-** unit prefix or the **p-** symbol prefix instead. An acceptable SI substitute for the obsolete **parts per million (ppm)** and **parts per billion (ppb)** has not yet been developed. If international metrologists eventually agree on an SI unit and symbol for nominal-scale entities, then fractional prefixes combined with that unit or symbol will do a good job of carrying out that proportional function. The use of the tiny non-SI length unit **ångström (symbol Å)** is discouraged by international metrologists.

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<sup>5</sup> Quantities to be measured and their symbols are written in italics: *current* and *inductance* are examples. Think of  $e=mc^2$  and  $I=E/R$ . SI symbols or units which are coupled with SI values are never italicized.

<sup>6</sup> See [https://en.wikipedia.org/wiki/ISO\\_8601](https://en.wikipedia.org/wiki/ISO_8601).