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Metric Practice Guide for the Welding Industry

American Welding Society

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Metric Practice Guide for the Welding Industry

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Approved by
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Abstract

This metric practice guide is based on the International System of Units (SI) as defined in the *U.S. Federal Register* notice of July 28, 1998, "Metric System of Measurement: Interpretation of the International System of Units for the United States." It includes the base units, derived units, and rules for their use. Also covered are conversion factors and rules for their use in converting inch-pound units to SI units.

Recommendations are presented for style and usage in such areas as prefixes, punctuation, number grouping, etc. There are also suggestions to industry for managing the transition.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

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1. Scope

This metric practice guide is based on the International System of Units (SI) as defined in the *U.S. Federal Register* notice of July 28, 1998, "Metric System of Measurement: Interpretation of the International System of Units for the United States." (Other source documents and style guides are referenced in Annex D.) This guide contains specifications of the SI base units, derived units, prefixes, and rules for their use in AWS documents and by the welding industry. It also contains factors and rules for converting from inch-pound units (often referred to as U.S. Customary Units) to SI Units and recommendations to industry for managing the transition.

2. The International System of Units (SI)

A system of units is any collection of related units. SI is the only system that has the properties outlined in 2.1–2.3.

2.1 Completeness. Completeness requires that a unit of measurement be defined for every quantity of interest in the physical sciences and technologies.

2.2 Coherence. Coherence requires that all derived units in the system be obtained from the base units by the rules of multiplication and division with no numerical factor other than the number one (1) ever occurring in the expressions for derived units in terms of the base units. The system of units must also be coherent with its corresponding system of quantities and equations. A system of units is coherent with respect to a system of quantities and equations if the system of units is chosen in such a way that the equations between numerical values have exactly the same form (including numerical factors) as the corresponding equations between quantities.

Quantity	Derived Unit	Unit Equation
Force (mass times acceleration) $F = m \cdot a$	newton	$1\ N = 1\ kg \cdot m/s^2$
Energy (force times distance) $E = F \cdot l$	joule	$1\ J = 1\ N \cdot m$
Power (rate of energy transfer) $P = E/t$	watt	$1\ W = 1\ J/s$
Pressure (force divided by area) $p = F/A$	pascal	$1\ Pa = 1\ N/m^2$

2.3 Uniqueness. Uniqueness requires that there be one, and only one, unit defined for each quantity. For example, the SI Units for force (newton), energy (joule), and power (watt) are the same, respectively, whether the process is mechanical, electrical, or thermal.

2.4 Advantages of the SI. The International System of Units (SI) is the metric system of units in its latest form. SI is the only system of units which fully satisfies all the above three requirements for completeness, coherence, and uniqueness. Within SI, a set of base-ten prefixes is defined to form decimal multiples and submultiples of SI Units. SI Units and their base-ten multiples and submultiples are in harmony with our decimal system of arithmetic, facilitating easy numerical calculations. Awkward manipulations of common fractions such as 1/16, 1/32, and 1/64 are completely unnecessary. All industrial nations, including the United States by the Omnibus Trade and Competitiveness Act of 1988 (Public Law 100-418), have chosen the SI as the preferred system of units for all applications in science, engineering, technology, commerce, and trade.

3. SI Units and Symbols

SI consists of seven base units, derived units, and a set of prefixes for the formation of multiples of the various units.