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Standard Guide for Expression of Temperature¹

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1. Scope

1.1 This guide covers uniform methods for expressing temperature, temperature values, and temperature differences.

1.2 This guide is intended as a supplement to [IEEE/ASTM SI-10](#).

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[E344 Terminology Relating to Thermometry and Hydrometry](#)

[IEEE/ASTM SI-10 Standard for Use of the International System of Units \(SI\): The Modern Metric System](#)

3. Terminology

3.1 *General*—Standard terms used in this guide are defined in Terminology [E344](#) and in [IEEE/ASTM SI-10](#).

4. Basic Concepts

4.1 Temperature is a fundamental measurable quantity designated by the symbol T or the symbol t (see [5.1](#)).

4.2 A temperature value is expressed in terms of a temperature scale. The complete description consists of a numerical value designating the magnitude, a unit, and, where appropriate, a tolerance or uncertainty. Both the numerical value and the unit depend upon the scale.

4.3 A unit of temperature is understood to mean an interval on a temperature scale.

¹ This guide is under the jurisdiction of ASTM Committee [E20](#) on Temperature Measurement and is the direct responsibility of Subcommittee [E20.91](#) on Editorial and Terminology.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4.4 A temperature difference, interval, or increment is also described by a sign, a numerical value designating the magnitude, a unit, and, where appropriate, a tolerance or uncertainty.

5. Temperature Scales

5.1 Thermodynamic Temperature Scales:

5.1.1 By international agreement, the theoretical temperature scale to which all temperature values should be ultimately referable is the Kelvin Thermodynamic Temperature Scale (KTTS). A value of temperature expressed on the KTTS is known as a thermodynamic temperature, symbol T .

5.1.2 The unit of thermodynamic temperature is the kelvin, symbol K. The kelvin is a base unit in the International System of Units (SI). Note that the symbol for the kelvin is the capital letter K only; the degree sign ($^{\circ}$) is not used.

5.1.3 The expression of a value of thermodynamic temperature is written:

$$T = n_k \text{ K} \quad (1)$$

where:

n_k = a numerical value designating the magnitude,

K = the symbol for the unit kelvin.

The magnitude may also be represented by the notation T/K .

5.1.4 A thermodynamic temperature may be expressed as a Celsius temperature. The symbol t is to be used to designate a Celsius temperature, but if this symbol leads to a conflict in notation in a given context, it is acceptable to use the symbol T instead to designate a Celsius temperature.

5.1.5 The unit of Celsius temperature is the degree Celsius, symbol $^{\circ}\text{C}$. The degree Celsius is a derived SI unit. Note that the symbol for the degree Celsius consists of the degree sign ($^{\circ}$) followed by the capital letter C. Neither the degree sign nor the letter C alone represents the degree Celsius. The Unicode value for the degree sign is 00B0 in hexadecimal, 0176 in decimal. The symbol may be represented by the two separate Unicode characters, the degree sign ($^{\circ}$) followed by the capital letter C. The Unicode character “ $^{\circ}\text{C}$ ” with the hexadecimal value 2103 (decimal value 8451) may also be used as the degree Celsius symbol.

5.1.6 The expression of a value of Celsius temperature is written:

$$t = n_c \text{ }^{\circ}\text{C} \quad (2)$$