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Standard Guide for Expression of Temperature[1]

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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.

2. Referenced Documents

2.1 *ASTM Standards:*

E 344 Terminology Relating to Thermometry and Hydrometry[2]

IEEE/ASTM SI-10 Standard for Use of the International System of Units (SI): The Modern Metric System[3]

3. Terminology

3.1 *General*—Standard terms used in this guide are defined in Terminology E 344 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). In expressions of dimensions the symbol θ is sometimes used to indicate the dimension temperature.

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 unit depend upon the scale.

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

4.4 A temperature difference, interval, or increment is also described by 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 1—The symbol for the kelvin is the capital letter K only; the degree sign (°) 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 °C. The degree Celsius is a derived SI unit.

NOTE 2—The symbol for the degree Celsius consists of the degree sign (°) followed by the capital letter C. Neither the degree sign nor the letter C alone represents the degree Celsius.

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

$$t = n_c \text{ °C} \quad (2)$$

where:

n_c = a numerical value designating the magnitude,
°C = the symbol for the unit degree Celsius.

The magnitude may also be represented by the notation t/°C.

5.1.7 By definition, at any temperature, a temperature increment of one degree Celsius is equal to a temperature increment of one kelvin.

5.1.8 By definition, the Celsius temperature $t = 0$ °C is the same as the thermodynamic temperature $T = 273.15$ K. The relation between numerical values associated with both expressions of a temperature is therefore given by:

$$n_c = n_k - 273.15 \quad (3)$$

[1] This guide is under the jurisdiction of ASTM Committee E-20 on Temperature Measurement and is the direct responsibility of Subcommittee E20.91 on Editorial and Terminology.

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[2] *Annual Book of ASTM Standards*, Vol 14.03.

[3] *Annual Book of ASTM Standards*, Vol 14.02.