



ANSI C78.377-2017 (R2022)

*American National Standard for Electric Lamps—
Specifications for the Chromaticity of
Solid-State Lighting Products*

Secretariat:

National Electrical Manufacturers Association

Approved: June 16, 2022

American National Standards Institute, Inc.

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Foreword (This foreword is not a part of ANSI C78.377-2017 [R2022].)

Suggestions for improvement of this standard are welcomed. They should be sent to:

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Introduction

The purposes of this standard are, first, to specify the range of chromaticities recommended for general lighting with solid-state lighting products to ensure high-quality white light and, second, to categorize chromaticities with given tolerances so that the white light chromaticity of the products can be communicated to consumers. For this second purpose, the existing chromaticity standard (ANSI C78.376) for fluorescent lamps (FLRs) uses six nominal CCTs, some of which are given names such as Warm White (3000 K), Cool White (4100 K), and Daylight (6500 K). These names are often printed on product packages to communicate nominal CCT of the products to consumers. 2700 K and 5000 K, however, do not have names. Each of the six FLR lamp nominal CCTs has tolerances given as ellipses in the CIE 1931 (x, y) chromaticity diagram. Four-step MacAdam ellipses are used in ANSI C78.376, and seven-step MacAdam ellipses and seven-step quadrangles are used in the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® specifications for Lamps, V2.0, and Luminaires, V2.0.

This chromaticity specification for LED products was developed to establish an alignment with the existing fluorescent lamp standards, enabling the consistent appearance of various light sources within spaces where multiple technologies are employed. The use of quadrangles to specify the chromaticities comprising the nominal CCTs increases the overall yield complying with this standard while acknowledging that chromaticities previously excluded (i.e. within the quadrangles but outside of the corresponding MacAdam ellipses) are nonetheless very useful in many applications.

This standard provides a basis for specifying chromaticity, explanation of a nominal CCT, target CCT, Duv, and details of SSL chromaticity requirements. In the 2014 revision, the specifications for nominal CCTs of 2200 K and 2500 K were added.

The annexes in this document provide the background information of this standard and tables and graphical representations of the specifications in this standard.

In this revision, extended specifications are added as options for products designed with chromaticity points that may be suitable for some lighting applications. This standard does not render a judgment on the preference, perception of white or natural light. This ANSI standard simply extends the designation of chromaticity regions to include areas that are suitable for some lighting applications. The Extended Specification given in Table 2 is developed as a straightforward mathematical construct to expand the ANSI chromaticity specification. This standard specifies only standardized chromaticity regions and does not relate to color quality metrics such as fidelity, chroma saturation or color discrimination.

1 Scope

The purpose of this standard is to specify the range of chromaticity for general lighting with solid-state lighting (SSL) products, as well as to ensure that the chromaticity of the products can be communicated to consumers. This standard applies to LED lamps, LED light engines and LED luminaires for general indoor lighting applications, and may apply more broadly.

This document does not apply to lighting fixtures sold without a light source. This standard also does not apply to SSL products for some indoor applications that intentionally produce colored light. This document does not include OLED products.

1.1 Patent Disclaimer

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2 Normative References

The following normative documents contain provisions, which through reference in this text constitute provisions of this Standards Publication. By reference herein, these publications are adopted, in whole or in part as indicated, in this Standards Publication. All Standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the Standards indicated below.

CIE 015	<i>Colorimetry</i>
ANSI/IES LS-1	<i>Lighting Science: Nomenclature and Definitions for Illuminating Engineering</i>
ANSI/IES LM-79	<i>Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products</i>

3 Definitions

Terms used in this document such as LED lamp and LED luminaire are defined in ANSI/IES LS-1.

4 Chromaticity

4.1 Basis

The chromaticity coordinates and correlated color temperature (CCT) values used in this standard are based on the CIE colorimetry system. While the chromaticity of light is expressed by chromaticity coordinates such as (x, y) and (u', v') the chromaticity of nominally white light can also be expressed by CCT and the distance from the Planckian locus. CCT is a more intuitive measure of the shade of white light than (x, y) or (u', v') . Since CCT is defined based on the $(u', 2/3v')$ chromaticity diagram, the distance from the Planckian locus should be determined on the same diagram. It should be expressed as a signed value to indicate whether the chromaticity is above or below the Planckian locus. As such a distance parameter with respect to the Planckian locus is not officially defined by the CIE, "Duv" (symbol: D_{uv}) is