



Standard Tables for Reference Solar Ultraviolet Spectral Distributions: Hemispherical on 37° Tilted Surface¹

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¹ NOTE—The title to Table 2 was corrected editorially in August 2008.

INTRODUCTION

These tables of solar ultraviolet (UV) spectral irradiance values have been developed to meet the need for a standard ultraviolet reference spectral energy distribution to be used as a reference for the upper limit of ultraviolet radiation in the outdoor weathering of materials and related indoor exposure studies. A wide variety of solar spectral energy distributions occur in the natural environment and are simulated by artificial sources during product, material, or component testing. To compare the relative optical performance of spectrally sensitive products, or to compare the performance of products before and after being subjected to weathering or other exposure conditions, a reference standard solar spectral distribution is required. These tables were prepared using version 2.9.2 of the Simple Model of the Atmospheric Radiative Transfer of Sunshine (SMARTS2) atmospheric transmission code (1,2).² SMARTS2 uses empirical parameterizations of version 4.0 of the Air Force Geophysical Laboratory (AFGL) Moderate Resolution Transmission model, MODTRAN (3,4). An extraterrestrial spectrum differing only slightly from the extraterrestrial spectrum in ASTM E490 is used to calculate the resultant spectra. The hemispherical (2π steradian acceptance angle) spectral irradiance on a panel tilted 37° (average latitude of the contiguous United States) to the horizontal is tabulated. The wavelength range for the spectra extends from 280 to 400 nm, with uniform wavelength intervals. The input parameters used in conjunction with SMARTS2 for each set of conditions are tabulated. The SMARTS2 model and documentation are available as an adjunct ADJG173CD³ to this standard.

1. Scope

1.1 The table provides a standard ultraviolet spectral irradiance distribution that maybe employed as a guide against which manufactured ultraviolet light sources may be judged when applied to indoor exposure testing. The table provides a reference for comparison with natural sunlight ultraviolet spectral data. The ultraviolet reference spectral irradiance is provided for the wavelength range from 280 to 400 nm. The wavelength region selected is comprised of the UV-A spectral region from 320 to 400 nm and the UV-B region from 280 to 320 nm.

1.2 The table defines a single ultraviolet solar spectral irradiance distribution:

1.2.1 Total hemispherical ultraviolet solar spectral irradiance (consisting of combined direct and diffuse components) incident on a sun-facing, 37° tilted surface in the wavelength region from 280 to 400 nm for air mass 1.05, at an elevation of 2 km (2000 m) above sea level for the United States Standard Atmosphere profile for 1976 (USSA 1976), excepting for the ozone content which is specified as 0.30 atmosphere-centimeters (atm-cm) equivalent thickness.

1.3 The data contained in these tables were generated using the SMARTS2 Version 2.9.2 atmospheric transmission model developed by Gueymard (1,2).

1.4 The climatic, atmospheric and geometric parameters selected reflect the conditions to provide a realistic maximum ultraviolet exposure under representative clear sky conditions.

1.5 The availability of the SMARTS2 model (as an adjunct (ADJG173CD³) to this standard) used to generate the standard spectra allows users to evaluate spectral differences relative to the spectra specified here.

¹ These tables are under the jurisdiction of ASTM Committee G03 on Weathering and Durability and is the direct responsibility of Subcommittee G03.09 on Radiometry.

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² The boldface numbers in parentheses refer to the list of references at the end of this standard.

³ Available from ASTM International Headquarters. Order Adjunct No. ADJG173CD. Original adjunct produced in 2005.