Designation: G24 – 05

Standard Practice for Conducting Exposures to Daylight Filtered Through Glass[1]

This standard is issued under the fixed designation G24; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice evaluates the resistance of nonmetallic materials to solar radiation filtered through glass.

1.2 For direct exposures, refer to Practice G7.

1.3 This practice is limited to the method of conducting the exposures. The preparation of test specimens and evaluation of results are covered in various standards for the specific materials.

1.4 Exposure conducted according to this practice can use two types of exposure cabinets.

1.4.1 *Type A*—A cabinet that allows passive ventilation of specimens being exposed behind glass.

1.4.2 *Type B*—Enclosed cabinet with exterior painted black that allows no ventilation of specimens exposed behind glass. Exposures conducted using a Type B cabinet are typically referred to as "black box under glass exposures."

1.5 Type A exposures of this practice are technically similar to Method B of ISO 877.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C1036 Specification for Flat Glass

E824 Test Method for Transfer of Calibration From Reference to Field Radiometers

E903 Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres (Withdrawn 2005)[3]

E1084 Test Method for Solar Transmittance (Terrestrial) of Sheet Materials Using Sunlight

G7 Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials

G113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials

G173 Tables for Reference Solar Spectral Irradiances: Direct Normal and Hemispherical on 37° Tilted Surface

G177 Tables for Reference Solar Ultraviolet Spectral Distributions: Hemispherical on 37° Tilted Surface

2.2 *Other Documents:*

WMO Guide to Meteorological Instruments and Methods of Observation WMO No. 8, Fifth Edition.[4]

ISO 105 B01 Textiles—Tests for Colour Fastness, International Standards Organization, Geneva, Switzerland.[5]

ISO 877 Plastics—Methods of Exposure to Direct Weathering, to Weathering Using Glass-Filtered Daylight, and to Intensified Weathering by Daylight Using Fresnel Mirrors, International Standards Organization, Geneva, Switzerland[5]

AATCC 16C Colorfastness to Light, Daylight[6]

3. Terminology

3.1 *Definitions:*

3.1.1 The definitions contained in Terminology G113 are applicable to this practice.

4. Significance and Use

4.1 Since solar irradiance, air temperature, relative humidity, and the amount and kind of atmospheric contaminants vary continuously, results from exposures based on time may differ. The variations in the results may be minimized by timing the exposures in terms of one or more environmental

[1] This practice is under the jurisdiction of ASTM Committee G03 on Weathering and Durabilityand is the direct responsibility of Subcommittee G03.02 on Natural and Environmental Exposure Tests.

Current edition approved Jan. 1, 2005. Published February 2005. Originally approved in 1973. Last previous edition approved in 1997 as G24 – 97. DOI: 10.1520/G0024-05.

[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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from World Meteorological Organization, Geneva, Switzerland.

[5] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

[6] Available from American Association of Textile Chemists and Colorists (AATCC), One Davis Dr., P.O. Box 12215, Research Triangle Park, NC 27709-2215.

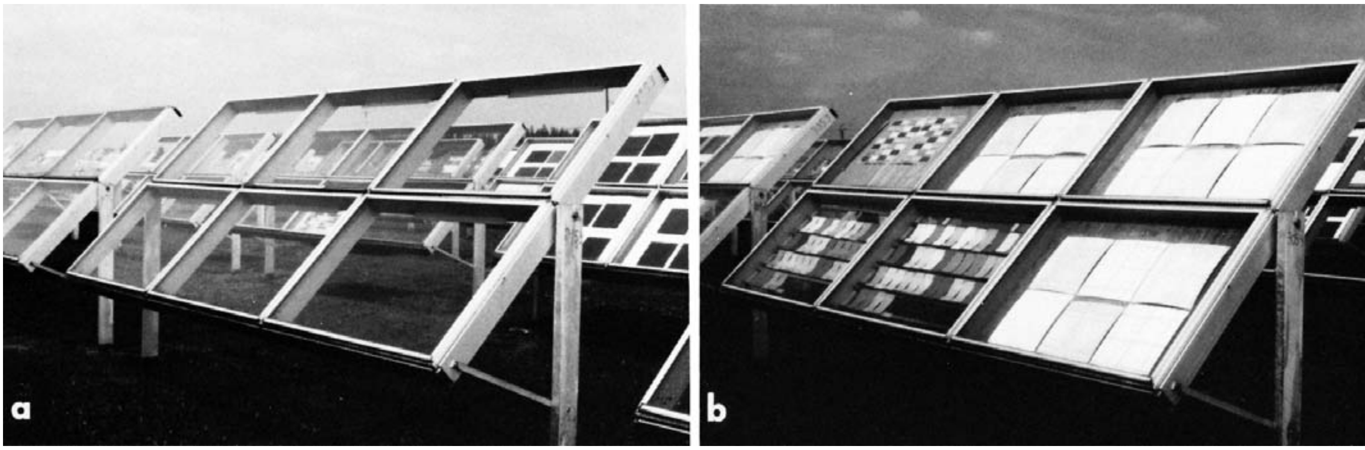

FIG. 1 a and 1b Typical Well-Ventilated Under Glass Exposure Cabinet, Type A

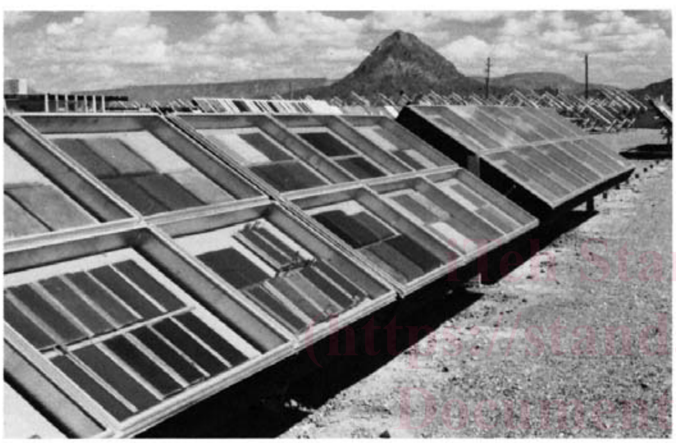

FIG. 2 Typical Enclosed Under Glass Exposure Cabinet, Type B (Black Box Under Glass)

parameters such as solar radiant exposure, or in terms of a predetermined property change of a reference specimen with known performance.

4.2 Variations in temperature, moisture and atmospheric contaminants can have a significant effect on the degradation caused by solar radiation. In addition, exposures conducted at different times of the year can cause large differences in rate of degradation. Different materials may have different sensitivities to heat, moisture, and atmospheric contaminants. This may explain differences in rankings of specimens exposed to equivalent solar radiant exposure when other environmental conditions vary.

4.3 Since the method of mounting may influence the temperature and other parameters of the specimen during exposure, there should be a mutual understanding as to the method of mounting the specimen for the particular exposure test under consideration.

4.4 There can be large differences among various single strength window glasses in their transmission in the 300 to 350 nm region. For example, at 320 nm, the percent transmission for seven different lots of single strength window glass ranged from 8.4 to 26.8 %. For this range of transmission, the rate of degradation for materials sensitive to short wavelength UV from 300 to 320 nm could vary by as much as 300 %.[7]

4.5 Differences in UV transmission between different lots of glass persist after solarization. The largest differences among window glasses in UV transmission are in the spectral range of 300 to 320 nm. Use of radiant exposure based on total solar radiation or total solar UV radiation to determine exposure periods is not sensitive to these differences. For materials very sensitive to differences in short wavelength UV radiation, monitoring UVB radiation behind glass may be the best approach for use when radiant energy is used to determine the length of exposures. However, for materials sensitive to long wavelength UV or visible radiation, monitoring UVB radiation or using reference materials that are very sensitive to short wavelength solar ultraviolet radiation to determine exposure periods may produce erroneous results.

4.6 This practice is best used to compare the relative performance of materials tested at the same time behind the same lot of glass. Because of variability between lots of glass and between exposures conducted at different times of the year, comparing the amount of degradation in materials exposed for the same duration or radiant exposure at separate times, or in separate fixtures using different lots of glass is not recommended.

4.7 It is strongly recommended that at least one control material be exposed with each test. The control material should be of similar composition and construction. and be chosen so that its failure modes are the same as that of the material being tested. It is preferable to use two control materials, one with relatively good durability, and one with relatively poor durability. If control materials are included as part of the test, they shall be used for the purpose of comparing the performance of the test materials relative to the controls.

4.8 There are other standards which describe exposures to glass filtered daylight. Three cited standards are ISO 105-B01, ISO 877, and AATCC 16C.

[7] Ketola, W. D., and Robbins, J.S., III, "UV Transmission of Single Strength Window Glass," *Accelerated and Outdoor Durability Testing of Organic Materials, ASTM STP 1202*, Warren D. Ketola and Douglas Grossman, Eds., American Society for Testing and Materials, Philadelphia, 1994.