Designation: G7/G7M – 13

Standard Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials[1]

This standard is issued under the fixed designation G7/G7M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This practice covers procedures to be followed for direct exposure of nonmetallic materials to the environment. When originators of a weathering test have the actual exposure conducted by a separate agency, the specific conditions for the exposure of test and control specimens must be clearly defined and mutually agreed upon between all parties.

1.2 For exposures behind glass, refer to Practice G24.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 This practice is technically equivalent to the parts of ISO 877 that describe direct exposures of specimens to the environment.

1.5 *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]

E41 Terminology Relating To Conditioning

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

E913 Method for Calibration of Reference Pyranometers With Axis Vertical by the Shading Method (Withdrawn 2005)[3]

E941 Test Method for Calibration of Reference Pyranometers With Axis Tilted by the Shading Method (Withdrawn 2005)[3]

G24 Practice for Conducting Exposures to Daylight Filtered Through Glass

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

G130 Test Method for Calibration of Narrow- and Broad-Band Ultraviolet Radiometers Using a Spectroradiometer

2.2 *ISO Standards:*

ISO 877 Plastics—Methods of Exposure to Direct Weathering; to Weathering Using Glass-Filtered Daylight, and to Intensified Weathering by Daylight Using Fresnel Mirrors[4]

ISO 9370 Plastics—Instrumental Determination of Radiant Exposure in Weathering Tests—General Guidance and Basic Test Method[4]

2.3 *ASTM Adjuncts:*

A Test Rack[5]

3. Terminology

3.1 *Definitions*—The definitions given in Terminology E41 and Terminology G113 are applicable to this practice.

4. Significance and Use

4.1 The relative durability of materials in natural exposures can be very different depending on the location of the exposure because of differences in ultraviolet (UV) radiation, time of wetness, temperature, pollutants, and other factors. Therefore, it cannot be assumed that results from one exposure in a single location will be useful for determining relative durability in a different location. Exposures in several locations with different

[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.

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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.

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

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[5] Detailed drawings for an acceptable test rack may be obtained from ASTM International. Request ADJG0007.

climates which represent a broad range of anticipated service conditions are recommended.

4.2 Because of year-to-year climatological variations, results from a single exposure test cannot be used to predict the absolute rate at which a material degrades. Several years of repeat exposures are needed to get an "average" test result for a given location.

4.3 Solar ultraviolet radiation varies considerably as a function of time of year. This can cause large differences in the apparent rate of degradation in many polymers. Comparing results for materials exposed for short periods (less than one year) is not recommended unless materials are exposed at the same time in the same location.

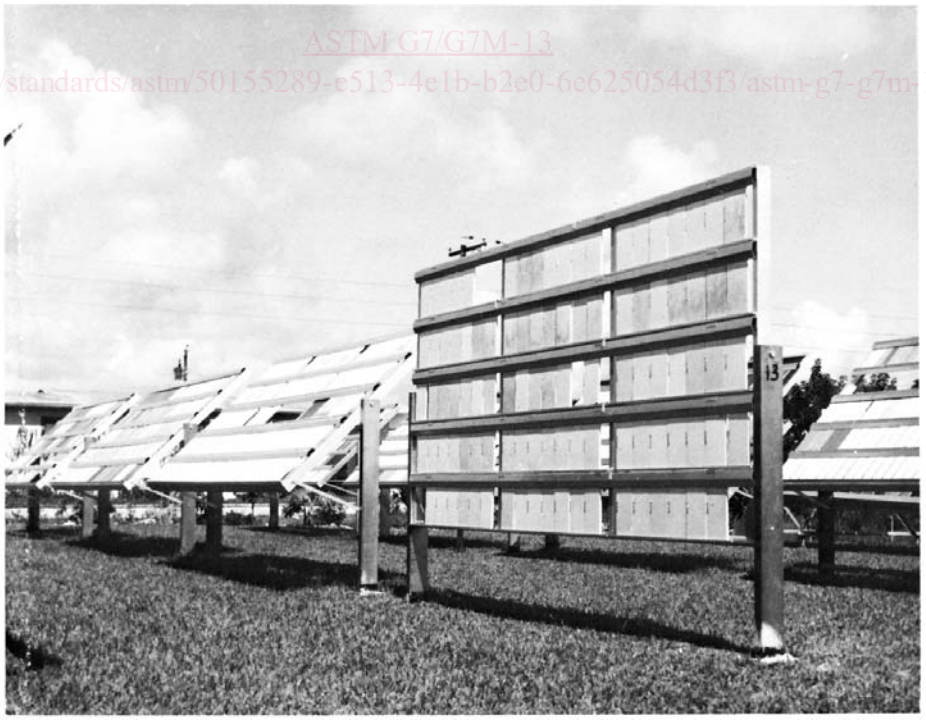
4.4 Defining exposure periods in terms of total solar or solar-ultraviolet radiant energy can reduce variability in results from separate exposures. Solar ultraviolet measurements are typically made using instruments which record broadband UV (for example, 295 to 385 nm) or narrow band UV, as described in 7.2.4 and 7.2.5. An inherent limitation in solar-radiation measurements is that they do not reflect the effects of temperature and moisture, which may also influence the rate or type of degradation.

4.5 The design of the exposure rack, the location of the specimen on the exposure rack, and the type or color of adjacent specimens can affect specimen temperature and time of wetness. In order to minimize variability caused by these factors, it is recommended that test specimens, control specimens, and any applicable weathering reference material be placed on a single test panel or on test panels placed adjacent to each other during exposure.

4.6 It is strongly recommended that at least one control material be part of any exposure evaluation. When used, the control material shall meet the requirements of Terminology G113, and be of similar composition and construction compared to test specimens. It is preferable to use two control materials, one with relatively good durability and one with relatively poor durability. Unless otherwise specified, use at least two replicate specimens of each test and control material being exposed. Control materials included as part of a test shall be used for the purpose of comparing the performance of test materials relative to the controls.

5. Test Sites, Location of Test Fixtures, and Exposure Orientation

5.1 *Test Sites*—Exposures can be conducted in any type of climate. However, in order to get more rapid indications of outdoor durability, exposures are often conducted in locations that receive high levels of solar radiation, temperature, and moisture. Typically, these conditions are found in hot desert and subtropical or tropical climates. Known attributes of the use environment should be represented by the locations selected for outdoor durability evaluation. For example, if the use environment for the product being evaluated will include freeze/thaw cycling, specimen exposure in a northern temperature climate is recommended. In addition, exposures are often conducted in areas where specimens are subjected to salt air (seashore) or industrial pollutants.



NOTE 1—Detailed drawings of this test rack are available from ASTM International, 100 Barr Harbor Dr., W. Conshohocken, PA 19428. Request Adjunct ADJG0007.

FIG. 1 Typical Exposure Rack