



Designation: G7/G7M – 21

Standard Practice for Natural Weathering of Materials¹

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 materials to the environment. Typically, this testing is performed on exposure racks tilted at a commonly-facing tilt angle from the horizontal (such as 5 or 45 degrees) and facing the equator. Other exposure orientations can be used.

1.2 This practice is not intended for the corrosion testing of bare metals, or for testing behind glass.

1.2.1 For corrosion testing, refer to Practice [G50](#)

1.2.2 For exposures behind glass, refer to Practice [G24](#)

1.3 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.4 This practice is technically equivalent to the parts of ISO 877-1 and -2 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[D3614](#) Guide for Laboratories Engaged in Sampling and Analysis of Atmospheres and Emissions

[E772](#) Terminology of Solar Energy Conversion

[E824](#) Test Method for Transfer of Calibration From Reference to Field Radiometers

[G24](#) Practice for Conducting Exposures to Daylight Filtered Through Glass

[G50](#) Practice for Conducting Atmospheric Corrosion Tests on Metals

[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

[G167](#) Test Method for Calibration of a Pyranometer Using a Pyrheliometer

2.2 ISO Standards:³

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

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

[ISO 9060:2018](#) Solar Energy – Specification and Classification of Instruments for Measuring Hemispherical Solar and Direct Solar Radiation

2.3 Other Standards:

WMO – No. 8, “Guide to Meteorological Instruments and Methods of Observation,” seventh edition, World Meteorological Organization, Geneva, Switzerland, 2008

¹ This practice is under the jurisdiction of ASTM Committee [G03](#) on Weathering and Durability and 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 Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

*A Summary of Changes section appears at the end of this standard

3. Terminology

3.1 *Definitions*—The definitions given in Terminologies G113 and E772 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, relative humidity, time of wetness, temperature, wet-dry cycling, freeze-thaw cycling, 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 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 exposures, repeated over several years are needed to get a representative test result for a given location.

4.3 Solar UV radiation varies considerably as a function of time of year. This can cause large differences in the apparent rate of degradation in many materials. 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 The duration of natural weathering tests is often based on time (24 months for example). The variability between different exposures can be reduced by using a duration based on total solar or solar UV radiant exposure. Solar UV measurements are typically made using instruments which record broadband UV (for example, 295 to 385 nm), as described in 7.2.4. An inherent limitation in timing a weathering test based solely on solar-radiation measurements is that temperature and moisture 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, color, and emissivity of adjacent specimens can affect specimen temperature and time of wetness. In order to minimize variability caused by these factors, control and weathering reference material specimens should be placed adjacent to test specimens during exposure.

4.6 It is recommended that at least one control specimen be part of any exposure evaluation. When used, the control specimen shall meet the requirements of Terminology G113, and be of similar composition and construction compared to



FIG. 1 Typical Exposure Rack