Designation: G147 – 09

Standard Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests[1]

This standard is issued under the fixed designation G147; 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 covers specimen preparation, identification, packing, shipping, handling, and conditioning before, during, and after natural and artificial weathering testing.

1.2 This practice includes details on the conditioning of specimens after exposure and before examination. This practice also covers long-term storage of file specimens.

1.3 Conditioning in this practice does not refer to the specific act of exposing the specimens to the weathering factors.

1.4 *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.*

NOTE 1—There is no equivalent ISO standard describing procedures for identification, shipping, conditioning, and handling of specimens intended for natural or artificial weathering tests. ISO 139 and ISO 291 describe procedures used for conditioning specimens prior to and during physical property testing.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D618 Practice for Conditioning Plastics for Testing
D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials
D1776 Practice for Conditioning and Testing Textiles
D3924 Specification for Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials
E41 Terminology Relating To Conditioning
G7 Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials
G24 Practice for Conducting Exposures to Daylight Filtered Through Glass
G90 Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight
G113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials
G151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources
G152 Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
G153 Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
G154 Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
G155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

2.2 *Other Documents:*

ISO 139 Textiles—Standard Atmosphere for Conditioning and Testing[3]
ISO 291 Plastics—Standard Atmospheres for Conditioning and Testing[3]

3. Terminology

3.1 The definitions given in Terminologies E41 and G113 are applicable to this practice.

3.2 Unless otherwise stated, use of the term "specimens" in this practice refers to specimens of the test material and of any applicable reference or control materials included as part of the exposure experiment.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *handling, n*—the management of a specimen between exposure periods, or prior to, or after an exposure test.

4. Significance and Use

4.1 Weathering is an inherently variable science due to the fact that weather itself is variable. In addition, there can be variability in results in artificial accelerated testing even when

[1] This practice is under the jurisdiction of ASTM Committee G03 on Weathering and Durability and is the direct responsibility of Subcommittee G03.01 on Joint Weathering Projects.

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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

all devices are running identical exposure cycles. Therefore, it is essential to control all factors as much as possible in order to reduce the overall source of error.

4.2 Proper handling of specimens is extremely important for maintaining the integrity of the material being evaluated. Damage to specimens caused by improper handling and labeling can adversely affect the validity of the testing program, causing loss of money and time. Improper handling can introduce nonstandard procedures into the protocol which may be a significant source of variability, adversely affecting the overall precision of results obtained. Improper handling may also introduce a bias in the results obtained.

4.3 Changes to materials can occur even under a seemingly benign conditioning environment, especially if the specimen has already been exposed. Therefore it is necessary to minimize the number and length of non-testing periods in order that the exposure is the only cause of further changes.

5. General Handling Procedures

5.1 Handle all test specimens with care and attention. Physical damage resulting from improper handling can distort the results from the exposure. Wear clean soft cotton gloves if the specimen will be touched on the exposed surface in order to avoid exposing surfaces to skin oils.

5.1.1 In climates where it is necessary to wear sunscreen, insect repellent, or other skin treatments, take extra precautions that these are not transferred to the test specimen.

5.2 The front surface (that is, the side to be oriented towards the light source) is the primary surface of a test specimen. However, some three dimensional specimens may have more than one primary surface. The primary surface(s) must remain free of marks or damage not caused by the weathering elements. Handle test specimens by the edges whenever possible.

5.3 It is recommended that the test specimens be separated during shipment or storage. This ensures that the specimen surface will not be damaged by abrasion or by interaction with other specimens. For flat specimens, this can be accomplished using slotted containers or racks. If specimens are to be stacked, use of a smooth liner film or paper between adjacent specimens is recommended. Non-textured paper, coated papers such as release liners, or unstabilized polyethylene or polyester films are suitable protective layers. Any material placed against the face of the test specimens shall not contaminate or have other interaction with the specimen that affects durability or appearance. For some materials, specimens can be stacked face-to-face. However, this is not recommended because of the damage which can be caused by abrasion or interaction between the surfaces of adjacent specimens.

NOTE 2—Textured paper may leave surface impressions, and additives such as antioxidants, UV absorbers, or plasticizers can migrate from a film onto the test specimen. Suppliers of polymer films can be found in the Thomas Register.

5.4 Never rest the test specimen on its primary surface without protection. Care should be taken not to mar the surface when specimens are placed on measurement equipment, on test frames used for outdoor exposures, or in specimen holders used in laboratory-accelerated exposure devices.

5.5 In the event that it is necessary to handle wet specimens, take extra care to ensure that nothing contacts the primary surface until it has dried completely.

6. Specimen Identification

6.1 Each specimen shall be uniquely coded, and the test laboratory shall maintain records which allow the following information to be determined:

6.1.1 Laboratory I.D. code number.
6.1.2 Exposure location.
6.1.3 Exposure type:
6.1.3.1 Exposure angle (when applicable),
6.1.3.2 Orientation,
6.1.3.3 Backing type,
6.1.3.4 Device type (when applicable), and
6.1.3.5 Exposure cycle (when applicable).
6.1.4 Intended duration of exposure.
6.1.5 Individual specimen identification:
6.1.5.1 Series,
6.1.5.2 Formula code, or
6.1.5.3 Consecutive numbering.
6.1.6 Replicate Number.

6.2 The identifying mark for a specimen shall be made in such a manner that it does not affect the test results for the specimen during the exposure.

6.3 Typically, most marking is made on the back or nonexposed side of the test specimen. Do not label the top of the exposed surface with any marking system (inks) that may degrade, run down, and contaminate the specimen.

6.3.1 When using an ink or any other liquid as a marker, make sure that it has fully dried before stacking specimens.

6.4 Typical methods for marking specimens are:

6.4.1 Scribing,
6.4.2 Permanent ink marker pen,
6.4.3 Paint pen,
6.4.4 Grease crayon
6.4.5 Tag attached to the specimen, and
6.4.6 Bar code labels.

NOTE 3—The following items have been found to be useful for marking specimens: permanent marker pen, (broad tip, black only), paint pen, and grease crayon. If the durability of the marking made by a marker pen, grease crayon, or paint pen is not known, experiments to evaluate durability should be conducted prior to use for identifying specimens.

6.5 Do not scribe on the exposed side of the specimen when oxidation of the specimen or substrate will cause unwanted specimen damage or when the information will become obscured.

6.6 When test specimens must be marked on the front side, place the marking away from the center portion of the specimen, preferably in a corner. The marking on the front surface will be affected by the same weathering factors as the specimen, and therefore, extra attention must be given to the durability of the marking.

6.7 The frame to which specimens are attached may also be marked provided that the frame and specimens remain together throughout the exposure.

7. Shipping Specimens

7.1 Incorrect shipping methods can have a deleterious effect on test materials and is an often overlooked source of error in exposure tests. Specimens damaged during shipment can result in postponement or cancellation of exposures or may result in only partial completion of critical experiments. Shipping is an inherently rigorous process, but damage can be minimized with care.

NOTE 4—Care should be taken to minimize exposure of specimens to extremely high or low temperatures or to conditions that might result in thermal shock during shipping.

7.2 When transporting or shipping specimens from one location to another, care should be taken to use sturdy shipping containers for all specimens.

7.3 It is recommended that specimens be isolated from one another during shipping.

7.3.1 For flat specimens such as metal panels with a coating, a slotted box is the best form of shipping container. The panels are placed in a wooden box with slots at opposite sides to hold the top and bottom of the panel. There should be adequate spacing between each slot to prevent contact between neighboring panels.

7.3.2 As an alternative to using a container with precut slots, the specimens may be maintained separately by placing a spacer at each end. Use a wood dowel or extruded polystyrene foam block wrapped in a smooth film or paper, and ensure that the box is completely filled. Use bulk packing material to fill in any excess space in the box.

7.4 If specimens are to be stacked and bundled during shipment, use the following procedure:

7.4.1 Place a smooth film or paper meeting the requirements of 5.3 between adjacent specimens.

7.4.2 Bundle specimens using paper or other wrapping material and pressure-sensitive adhesive tape. The paper or other wrapping material used shall not contaminate or interact with the specimens in any way that will affect the results from exposure tests or property measurements.

7.4.3 Place bundled specimens in a box or container and use bulk packaging material to isolate the bundles. It is recommended that the volume of the container be at least 50 % greater than the total volume of bundles placed in the container. Expanded polystyrene foam chips, poly bubble liner, and shredded paper (except newsprint) have been found acceptable as bulk packing material. Pack the container as tightly as possible to avoid damage caused by movement during shipping.

7.5 For irregularly shaped specimens, it is recommended that each be wrapped in a smooth film or paper. Use bulk packing material to separate specimens during shipment. Pack specimens as tightly as possible to avoid damage during shipping. The smooth film or paper and bulk packing material shall not interact with, cause abrasion, or otherwise adversely affect the specimens. The volume of the container used for shipping should be 50 % greater than the total volume of the specimens it will hold.

7.6 Large specimens that require crating should be securely fastened to the crating base. Frame the sides and top of the crate with solid material.

7.7 Place any special handling instructions for the panels being shipped in a clearly marked envelope or packet on the outside of the container. Place “fragile” labels on all shipments that are easily damaged.

7.8 Keep a complete record of all shipments to facilitate tracing in the event that they are lost. These records include the shipping method employed, shipment date, and any tracing or tracking numbers provided by the shipper.

8. Initial Receipt of Specimens

8.1 Upon initial receipt of specimens to be exposed, read any special handling instructions attached to the packaging before the package is opened. Inspect the packaging material for signs of damage. If any signs of damage are found, they shall be noted and reported to the originator.

NOTE 5—Signs of package damage could indicate adverse effects on the specimens enclosed.

8.2 Open the specimen package as soon as possible after arrival in the laboratory. Process the specimens in the fastest possible manner so that a minimum amount of time passes before exposure begins.

NOTE 6—In some cases, preconditioning of the specimen may be required before exposure.

8.2.1 Make sure each specimen has an identifying mark which can be used to distinguish it from other similar specimens. See Section 6 for further details.

8.3 Review the instructions for testing that are included with the specimens for accuracy and to ensure that the testing laboratory has all of the necessary facilities to conduct the test. Use a log sheet or computerized data base, or both, to keep track of the following information:

8.3.1 Test identification number,

8.3.2 Name and address of originator,

8.3.3 Description of specimens, and

8.3.4 Test specification.

8.4 Check the arriving specimens for defects which are present prior to exposure, and note any that are found on the exposure log so that these defects will not be counted as weathering failures. Damage to specimens caused during shipping shall be noted, reported to the originator, and described in the report of test results.

NOTE 7—Whenever possible, provide photographic documentation of any noticeable defects.

8.4.1 Conduct any initial instrumental property measurements at this time. Follow the conditioning procedures required in the relevant standard describing the procedure for measuring the property or properties of interest.

8.5 During the period between initial measurements and the start of the exposure, maintain the specimens in a condition