



Designation: D750 – 12 (Reapproved 2021)

Standard Practice for Rubber Deterioration Using Artificial Weathering Apparatus¹

This standard is issued under the fixed designation D750; 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 specific variations in the test conditions and procedures that shall be applicable when Practice **G151** plus either Practice **G152**, **G153**, **G154**, or **G155** are employed for exposure of vulcanized rubber compounds. It also covers the preparation of test specimens and the evaluation of results.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

1.3 *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.*

1.4 *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

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

D3183 Practice for Rubber—Preparation of Pieces for Test Purposes from Products

D4483 Practice for Evaluating Precision for Test Method

Standards in the Rubber and Carbon Black Manufacturing Industries

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 Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

G155 Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

3. Significance and Use

3.1 This practice describes procedures to use in determining the effects of an open-flame carbon-arc light source, an enclosed carbon-arc light source, a xenon-arc light source, or a fluorescent UV source along with heat and moisture on rubber specimens held in a jig or holder with or without a specified strain. The purpose is to attempt to accelerate the effects produced by light, heat, and moisture in the natural environment. Exposures are not intended to simulate the deterioration caused by localized weather phenomena, such as atmospheric pollution, biological attack, and saltwater exposure. The Significance and Use section in Practice **G151** and the standard for the appropriate apparatus, that is, Practices **G152**, **G153**, **G154**, or **G155** should be consulted for additional information on significance and use of the exposure tests.

3.2 The primary criterion used in estimating resistance to weathering is the percentage decrease in tensile strength and in elongation at break. A supplementary criterion for estimating resistance to weathering is the observed extent of surface crazing and cracking.

3.3 Results obtained by use of these test procedures should not be represented as equivalent to those of any natural exposure test until the degree of quantitative correlation has been established for the material in question.

3.4 Because of differences in the spectral power distributions of the exposure sources as well as the other conditions in the different types of laboratory weathering tests, the different procedures may not result in the same performance rankings or

¹ This practice is under the jurisdiction of ASTM Committee **D11** on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee **D11.15** on Degradation 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.

types of failure modes of the materials. Comparisons shall not be made of relative stabilities of materials exposed in different types of apparatus.

3.5 When conducting exposures in devices that use laboratory light sources, it is important to consider how well the artificial weathering conditions will reproduce property changes and failure modes caused by end-use environments on the materials being tested.

3.6 Practices **G151**, **G152**, **G153**, **G154**, and **G155** recommend that a similar material of known performance (a control) be exposed simultaneously with the test specimen to provide a standard for comparative purposes. Preferably, a control material known to have poor durability as well as one that has good durability should be used. The reason for using a control is that reproducibility in ranking stabilities is usually better than reproducibility of absolute changes. Therefore, the use of controls is particularly important when test materials are not being compared with one another.

4. Apparatus

4.1 Historically, this standard utilized carbon arc exposure apparatus in a test method for rubber deterioration. The options of using either xenon arc or fluorescent UV exposure apparatus have been added in order to update the tests with the use of light sources that give a better representation of the effects of solar radiation than carbon arcs. The xenon arc source with daylight filters, which conforms to Practice **G155**, gives the closest simulation of the full spectrum of terrestrial solar radiation, and the fluorescent UV/condensation test apparatus with the UVA-340 fluorescent UV lamp, which conforms to Practice **G154**, closely simulates the UV of terrestrial solar radiation in the 300 to 360 nm region.

4.2 The type of carbon-arc exposure apparatus preferred is the filtered open flame carbon arc, which conforms with Practice **G152**, but the enclosed carbon arc apparatus conforming with Practice **G153** may be used by mutual consent of the concerned parties.

5. Test Specimens

5.1 Unless otherwise mutually agreed upon, test specimens prepared especially for this test or cut from the material to be evaluated shall be three tension test replicates prepared in accordance with Practices **D3182** and **D3183**. An additional three tension test replicates shall be prepared and stored for testing in accordance with **7.1.3**. Unless otherwise mutually agreed upon, the specimens should have a maximum thickness of 0.75 mm (0.030 in.) and a minimum thickness 0.60 mm (0.025 in.).

5.2 If evaluation is limited only to visual observation, then specimens of any thickness may be used and the thickness shall be included in the report. Dimensions of the specimens are not critical but previous practice called for specimens 75 mm (3 in.) wide by 150 mm (6 in.) in length.

5.3 Exposing at least duplicate sets, preferably triplicate sets, of test specimens whenever possible is recommended.

5.4 Specimens cut from rubber products may be buffed.

6. Procedure

6.1 Firmly fasten the test specimens in a jig or holder that permits exposure either with or without elongation. While exposures are usually made without elongation of the test specimen, when mutually agreed upon, any specified amount of elongation may be employed but this must be reported in the results of the test.

6.2 The four exposure procedures use different types of exposure sources and test conditions. Therefore, they may produce different test results. They shall not be used interchangeably without supporting data that demonstrates equivalency of the procedures for the materials tested. Choice of the type of apparatus and duration of exposure shall be by mutual agreement among the interested parties.

6.3 For the allowed operational fluctuations of the specified set points for irradiance, temperature, and relative humidity, refer to Table A3.1 in Practice **G151**. If the actual operating conditions do not comply with the maximum allowable fluctuations in Table A3.1 after the equipment has stabilized, discontinue the test and correct the cause of the problem before continuing.

6.4 Specimens should be confined to an exposure area in which the irradiance is at least 90 % of the irradiance at the center of the exposure area. Unless it is known that irradiance uniformity meets this requirement, use one of the procedures described in Practice **G151**, Appendix X2 to ensure equal radiant exposure on all specimens or to compensate for differences within the exposure chamber. If the specimens do not completely fill the racks, fill the empty spaces with blank metal panels to maintain the test conditions within the chamber.

6.5 The apparatus shall be operated continuously. However, if the test needs to be interrupted to perform routine maintenance or inspection, it should be during a dry period.

6.6 *Procedure for Exposure in Open Flame Carbon Arc Apparatus (Practice **G152**) or Enclosed Carbon Arc Apparatus (Practice **G153**)*—Unless otherwise specified, use the following operating conditions:

6.6.1 The open flame carbon arc apparatus and the enclosed carbon arc apparatus shall be used with daylight type filters and conform with the spectral power distribution specifications in Practices **G152** and **G153**, respectively.

6.6.2 Unless otherwise mutually agreed upon or specified, operate with a cycle cam of 102 min light followed by 18 min of light plus water spray on the front surface of the sample (see **Note 1**). The water spray temperature is typically $21 \pm 5^\circ\text{C}$, but may be lower if ambient water temperature is low and a holding tank is not used to store purified water.

NOTE 1—This cycle is recommended only because it has long historical usage, not because it has been established for technical reasons as superior.

6.6.3 Set the uninsulated black panel temperature (BPT) at 63°C during the dry period of exposure to light.

6.6.4 Set the relative humidity at 60 % during the dry period of exposure to light.