



Designation: D6147 – 97 (Reapproved 2020)

Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomer— Determination of Force Decay (Stress Relaxation) in Compression¹

This standard is issued under the fixed designation D6147; 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 standard specifies two methods for determining the decrease in counterforce exerted by a test specimen of vulcanized rubber or thermoplastic elastomer which has been compressed at a constant deformation under specified conditions of time and temperature.

1.2 This document was developed based on testing in air and liquids.

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

[D573 Test Method for Rubber—Deterioration in an Air Oven](#)

[D1349 Practice for Rubber—Standard Conditions for Testing](#)

[D3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets](#)

[D3767 Practice for Rubber—Measurement of Dimensions](#)

¹ This test method is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.10 on Physical Testing.

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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.

[D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries](#)

[E145 Specification for Gravity-Convection and Forced-Ventilation Ovens](#)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *Compressive Stress, n* —the time-dependent force necessary to maintain a constant compressive strain, divided by the original cross-sectional area over which the force is applied.

3.1.2 *Force Decay, n* —the decrease in stress which has occurred after a specified time-interval, during application of a constant deformation, expressed as a percentage of the stress at the commencement of that time-interval. (Stress relaxation is a synonym.)

4. Summary of Test Method

4.1 *Method A*—The test specimen is compressed at the test temperature, and it is maintained at this temperature throughout the test period, all force measurements being made at the test temperature.

4.2 *Method B*—The test specimen compression and the initial measurement of the counterforce take place at $23 \pm 2^\circ\text{C}$ ($73 \pm 4^\circ\text{F}$); the test specimen is then stored in a chamber controlled at the test temperature, but it is removed from the chamber for each of the subsequent force measurements, which are made at $23 \pm 2^\circ\text{C}$ ($73 \pm 4^\circ\text{F}$).

4.3 The two methods, A and B, of carrying out the measurement do not give the same values of force decay and comparison of values obtained from the two methods must be avoided. The method selected for use depends on the purpose of the test. Thus, for fundamental studies and in applications where sealing at elevated temperatures is a problem, method A may be preferred, and in applications where temperature cycling from normal to an elevated temperature is a problem, method B may be preferred.