



Standard Test Method for Rubber Property—Measurement of the Viscous and Elastic Behavior of Unvulcanized Raw Rubbers and Rubber Compounds by Compression Between Parallel Plates¹

This standard is issued under the fixed designation D 6049; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This test method is an adaptation of the German Standard DIN 53514, a further development of the former “Defo Test” (see Appendix X1).

1.2 This test method is capable of measuring and characterizing the rheological behavior (viscosity and elasticity) of unvulcanized raw rubbers and rubber compounds, relating to the macro structure of rubber polymers (average molecular weight, molecular weight distribution, long chain branching, and micro- and macro-gel).

1.3 The viscosity and elasticity of unvulcanized rubbers and rubber compounds are determined by subjecting cylindrical test pieces to a compression/recovery cycle. The dependency on shear rate at constant shear stress is evaluated and the material fatigue behavior is determined in repeat cycle testing.

1.4 The non-Newtonian viscous and elastic behavior of rubbers and rubber compounds can also be evaluated.

1.5 Statistical evaluation of the test data provides an indication of data variation, which may be employed as an estimate of the homogeneity of the material tested.

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

1.7 *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:

D 297 Test Methods for Rubber Products—Chemical Analysis²

D 926 Test Method for Rubber Property—Plasticity and Recovery (Parallel Plate Method)²

D 4483 Practice for Determining Precision for Test Method Standards in the Rubber and Carbon Black Industries²

D 6048 Practice for Stress Relaxation Testing of Raw Rubber, Unvulcanized Rubber Compounds, and Thermoplastic Elastomers²

2.2 DIN Standards:

DIN 53514 Testing of Rubber—Determination of Viscosity and Elasticity Related Numbers of Raw Rubber and Rubber Mixes in a Compression Test between Parallel Plates³

DIN 53523, Part 1 Testing of Rubber and Elastomers—Testing with the Mooney Shearing Disk Viscometer; Preparation of Test Pieces³

2.3 ISO Standards:

ISO 5725 Precision of Test Methods—Determination of Repeatability and Reproducibility for a Standard Test Method by Interlaboratory Tests⁴

ISO 7323 Rubber—Raw and Unvulcanized Compounded—Determination of Plasticity Number and Recovery Number; Parallel Plate Method⁴

3. Terminology

3.1 *Definitions*—The following terms appear in logical order for the sake of clarity.

3.1.1 *Multiple Compression Force Test*—refer to Section 10 for more details.

3.1.1.1 *viscosity number*, V_{10} (Ns)—the product of the force F in N required to compress a test piece the final 0.5 mm (0.02 in.) in a 6.0 mm (0.24 in.) total compression cycle (from 13.0 to 7.0 mm (0.51 to 0.28 in.)) and the compression time dt_1 equaling 10 s.

3.1.1.2 *total compression time*, t_T —the time in s required to compress a test piece the full 6.0 mm (0.24 in.), that is, from 13.0 to 7.0 mm (0.51 to 0.28 in.).

3.1.1.3 *elasticity number*, DE_{30} —the elastic recovery expressed in units of 0.1 mm (0.004 in.) calculated from the height h_2 of the test piece after compression from 13.0 to 7.0 mm (0.51 in. to 0.28 in.) within 30 s followed by a recovery period of 30 s.

¹ This test method is under the jurisdiction of Committee D11 on Rubber and is the direct responsibility of Subcommittee D11.12 on Processability Tests.

Current edition approved June 10, 2003. Published June 2003. Originally approved in 1996. Last previous edition approved in 2002 as D 6049 - 02.

² *Annual Book of ASTM Standards*, Vol 09.01.

³ Available from Deutsches Institut für Normung, Burggrafenstr 6, D 10787 Berlin 30, Germany.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.