



Standard Test Method for Rubber Property—Vulcanization Using Rotorless Cure Meters¹

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1. Scope

1.1 This test method specifies a method for the measurement of selected vulcanization characteristics of rubber compounds using rotorless linear shear, unsealed torsion shear, and sealed torsion shear cure meters. The three types of instruments may not give the same results.

NOTE 1—An alternative method for the measurement of vulcanization characteristics is given in Test Method D 2084.

1.2 The values stated in SI units are to be regarded as the 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

D 1349 Practice for Rubber—Standard Temperatures for Testing²

D 1556 Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method³

D 2084 Test Method for Rubber Property—Vulcanization Using Oscillating Disk Cure Meter²

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

2.2 ISO Standard:⁴

ISO 6502 Rubber—Measurement of Vulcanization Characteristics with Rotorless Curemeters

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *rotorless cure meter*—a name for a class of cure meters that uses one of the two specimen shaping members or

dies to sense the torque or stress during strain application. Rotorless cure meters do not have a third member in the form of a rotor (see definitions of cure meter in Test Methods D 1556 and D 2084).

3.1.2 *torque*—for an oscillating shear cure meter, the value measured by a torque transducer at the peak strain amplitude of the oscillating cycle.

3.1.3 The following measurements may be taken from the recorded curve of force or torque as a function of time (see Fig. 1).

3.1.3.1 *minimum force or torque*—measure of the stiffness of the unvulcanized test specimen at the specified vulcanizing temperature, taken at the lowest point in the vulcanization curve.

3.1.3.2 *maximum, plateau, or highest force or torque*—measure of the stiffness or shear modulus of the vulcanized test specimen at the vulcanization temperature, measured within a specified period of time.

3.1.3.3 *time to incipient cure (scorch time)*—measure of the time at which a specified small increase in force or torque has occurred; it indicates the beginning of vulcanization.

3.1.3.4 *time to a percentage of full cure*—measure of cure based on the time to develop some percentage of the difference in force or torque from the minimum to the maximum.

4. Summary of Test Method

4.1 A rubber test piece is contained in a die cavity which may be closed or almost closed and maintained at an elevated temperature. The cavity is formed by two dies, one of which is oscillated through a small linear or rotary amplitude. This action produces a sinusoidal alternating linear or torsional strain in the test piece and a sinusoidal shear force or torque which depends on the stiffness (shear modulus) of the rubber compound. The envelope curve, which is defined as the amplitude of the oscillating force or torque, is continuously recorded as a function of time (see Fig. 2).

4.2 The stiffness of the rubber test piece increases as vulcanization proceeds. The test is completed when the recorded force or torque rises to either an equilibrium or maximum value, or when a predetermined time has elapsed (see Fig. 1). The time required to obtain a vulcanization curve is a function of the test temperature and the characteristics of the rubber compound.

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

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² Annual Book of ASTM Standards, Vol 09.01.

³ Annual Book of ASTM Standards, Vol 04.08.

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