



Designation: D 3629 – 99

Standard Test Method for Rubber Property—Cut Growth Resistance¹

This standard is issued under the fixed designation D 3629; 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 test method covers a procedure for measuring the cut growth resistance of precut vulcanizate specimens, under controlled conditions of environment, temperature, frequency, and severity.

1.2 The values stated in SI units are to be regarded as the standard.

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 3185 Test Methods for Rubber—Evaluation of SBR (Styrene-Butadiene Rubber) Including Mixtures With Oil²
- D 3767 Practice for Rubber—Measurement of Dimensions²
- D 4483 Practice for Determining Precision for Test Method Standards in the Rubber and Carbon Black Industries²

3. Summary of Test Method

3.1 T-shaped, grooved specimens are pierced, mounted circumferentially along the periphery of rotating disks and bent or flexed as they strike against freely rotating deflector bars at a controlled frequency. The growth of the cut is measured and expressed as the number of kilocycles required for a 5- or 10-fold increase in cut length.

4. Significance and Use

4.1 Fatigue life tests on rubber show notoriously high variance. Therefore, they are not well-suited for specifications or regulatory statutes. This test method, however, has been shown to be useful for development studies of polymer, compounding variables, and test temperature on cut growth resistance, and it has also been shown in numerous instances to relate qualitatively to tire cut growth.

5. Apparatus

5.1 *Flex Tester*—The tester is shown in Fig. 1 and Fig. 2. The entire mechanism is enclosed in a temperature controlled test chamber capable of maintaining temperatures between 25 and 125°C (77 and 257°F). Slotted disks, with spring-loaded specimen-mounting locations, are connected to a variable-speed drive that is controllable between 10.5 and 89.0 rad/s (100 and 800 rpm). Test severity can be varied further by adjusting the flexing angle, which is accomplished by varying the gap width between the revolving disks and the two deflector bars using the micrometer screws attached to the deflector bars.

NOTE 1—There are two flexes for each revolution of the disk. Therefore, the total number of flexes or cycles will be twice the machine revolutions as registered on the counter.

5.2 *Mold*—A mold is required, preferably of a multiple-cavity design and having adequate overflow cavities (Fig. 3).

5.3 *Thickness Gage*—The gage used for measuring the thickness of the specimens shall be in accordance with the specifications in Practice D 3767.

5.4 *Piercing Instrument*—A precision piercing instrument, shown in Fig. 4 and Fig. 5, is used to initiate a 2.0-mm (0.08-in.) cut in the exact center of the groove of the specimen. The instrument consists of a holder that keeps the specimen precisely in the desired position for piercing and a spring-mounted plunger with a sharp 2.0-mm wide flat blade at the end.

6. Preparation of Specimen

6.1 Sheet the compound to 5.8 ± 0.3 mm (0.23 ± 0.01 in.), and mark the direction of the mill grain. Cut a rectangular piece 45 ± 0.3 mm (1.75 ± 0.01 in.) long by 25.4 ± 0.3 mm (0.5 ± 0.01 in.) wide from the sheeted stock with the mill grain parallel to the width. Then cut 1.3 ± 0.3 mm (0.5 ± 0.01 in.) off from the length and load a “T” shaped preform into the mold and cure. The grain orientation of the final specimen should be parallel to the molded groove.

NOTE 2—Using typical passenger tire tread formulations, a sample mass of 8 to 9 g is obtained. Recipe 1A of Methods D 3185 can be used for a typical tire tread compound. Care should be taken in the preparation of preforms, since excess compound prevents proper mold closure and results in cured specimens exceeding the dimensions shown in Fig. 3.

¹ This test method is under the jurisdiction of ASTM Committee D-11 on Rubber and is the direct responsibility of Subcommittee D11.15 on Degradation Tests.

Current edition approved Nov. 10, 1999. Published December 1999. Originally published as D 3629 – 78. Last previous edition D 3629–94.

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

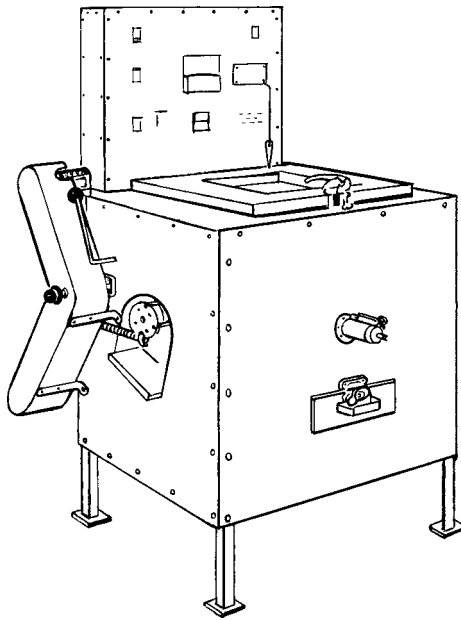


FIG. 1 TEXUS® Flex Tester (The TEXUS Flex Tester is a trademark of Texas-U.S. Chemical Company)

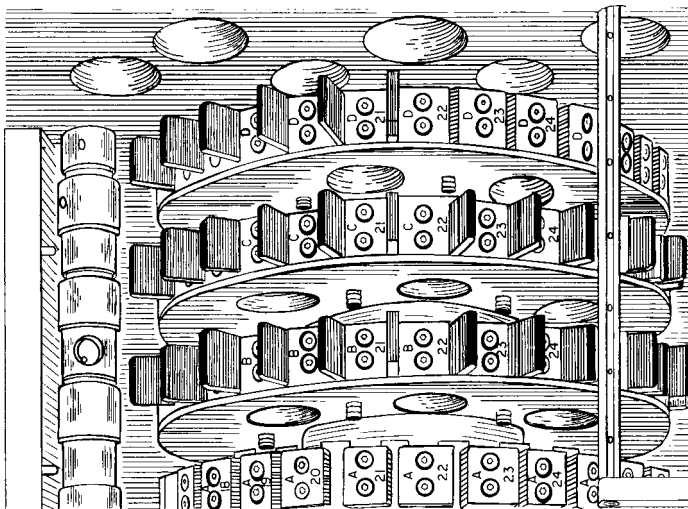


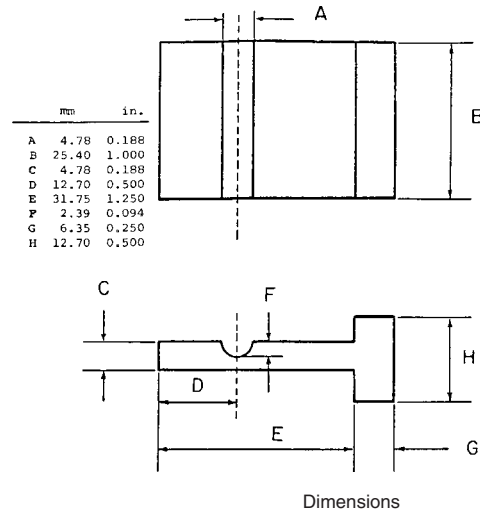
FIG. 2 Rotating Disks

6.2 Specimens shall have smooth surfaces and be free of surface irregularities and defects in the groove and adjacent area. Measure the thickness in the area adjacent to the grooves. The thickness shall be 4.75 ± 0.1 mm (0.188 ± 0.005 in.).

6.3 Deflash without rounding edges or pitting the specimens and initiate a 2.0 ± 0.02 -mm (0.08 ± 0.001 -in.) cut with the piercing instrument.

7. Equipment Adjustment

7.1 Before starting a test, check the instrument to assure that the axes of the deflector bars and rotating disks are parallel. This is accomplished by measuring the gap width between the surfaces of the rotating disks and deflector bars using a telescopic thickness gage. Make any adjustments required. The micrometer head at each end must be calibrated and adjusted so its readings correspond directly to the gap width.



	Dimensions	
	in.	mm
A	0.19 ± 0.004	4.8 ± 0.1
B	1.00 ± 0.05	25.4 ± 1.25
C	0.19 ± 0.004	4.8 ± 0.1
D	0.50 ± 0.04	12.7 ± 1.0
E	1.25 ± 0.06	31.8 ± 1.5
F	0.09 ± 0.001	2.4 ± 0.025
G	0.25 ± 0.01	6.4 ± 0.25
H	0.50 ± 0.04	12.7 ± 1.0

FIG. 3 Test Specimen

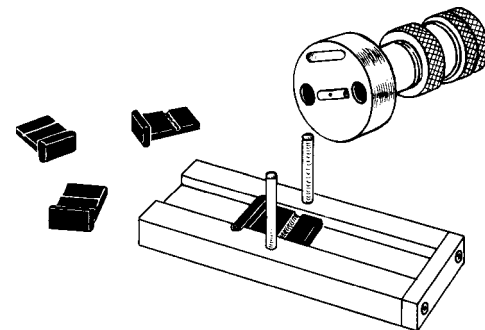


FIG. 4 Piercing Instrument

NOTE 3—For frequent checking and setting of specific flex angles such as 45 and 60°, a spacer block of 21.1 by 17.7 mm (0.830 by 0.700 in.) may be fabricated.

8. Procedure

8.1 Mount the specimens onto the peripheries of the rotating disks by sliding them into the slots of the spring-loaded sample holders. The grooves must face the direction of revolution of the disk and face the deflector bars. Space the samples symmetrically around the periphery to eliminate vibration. It is advisable to have at least four slots on each disk opposite the deflector bars vacant, so as to avoid bending of any sample during the preheating period.

8.1.1 Test at least six specimens of each sample or article and average the results. It is desirable, when possible, to test a standard compound as a control. For greater test precision, twelve samples may be tested.

8.2 Set the temperature selector to the desired test temperature.