



Standard Test Method for Rubber Property—Extrudability of Unvulcanized Compounds¹

This standard is issued under the fixed designation D 2230; 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 the determination of the extrudability of unvulcanized SBR and NBR rubber compounds through a screw-type extruder equipped with ASTM Extrusion Die, Garvey type. This test method is designed to allow the observation of the appearance and contours of the extrusion. Rating systems are provided along with recipes for compounds of known extrusion characteristics. The utility of the test method for evaluating rubbers or compounding materials other than those listed has not been established. Since extrusion machines differ among laboratories, the procedure includes techniques that minimize differences between machines.

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 3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets²

D 3185 Test Methods for Rubber—Evaluation of SBR (Styrene-Butadiene Rubber) Including Mixtures With Oil²

D 3187 Test Methods for Rubber—Evaluation of NBR (Acrylonitrile-Butadiene Rubber)²

D 3674 Test Method for Carbon Black—Relative Extrusion Mass³

3. Summary of Test Method

3.1 A standard compound is prepared and extruded through a specially shaped die that produces an extrusion having a

combination of relatively flat surfaces, sharp corners, and thin sections. The operating conditions are varied until a satisfactory extrusion of the standard compound is obtained. The test compound is then extruded, using the conditions just established, and the nature of the extrusion is rated visually for smoothness, sharp corners, and integrity of thin sections.

4. Significance and Use

4.1 One objective in the extrusion of rubber compounds is to obtain a smooth extrusion that closely reproduces the contours of the extrusion die. This test method provides for a subjective determination of this under controlled conditions. As the rating is subjective, it does not lend itself readily to incorporation as a specification requirement. It does not measure other aspects of extrudability such as rate of extrusion or die swell in a quantitative manner.

5. Apparatus

5.1 *Mill*, 150 by 300 mm (6 by 12 in.), as described in Practice D 3182.

5.2 *Die*—ASTM Extrusion Die, Garvey type, conforming to the dimensions and shape shown in Fig. 1 shall be used.

NOTE 1—Good precision in the manufacture of the opening in the die can be attained by ultrasonic machining. The die should be replaced when a dimension has changed by 0.02 mm (0.001 in.) from its original value or if the die is damaged.

5.3 *Adapter*—A hollow, cone-shaped ring insert tapered with an angle of $30 \pm 15^\circ$ (shown in Fig. 2) shall be used with the die to contour the interior of the extruder head. This will reduce turbulent flow of the rubber.

5.4 *Extruder*—A screw-type laboratory extruder having a screw diameter of 50 mm or less and which will accommodate the specified die may be used. The distance between the end of the screw and the die shall be from 1 to 2 times the diameter of the screw, the ratio of the length to diameter of the screw shall be 5:1 or greater, and the compression ratio shall be 1:1. The use of breaker plates, screens, or spiders in the extruder is not recommended. Solid or hollow screws are acceptable; however, fluid temperature shall be controlled in hollow screws.

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. Current edition approved Dec. 10, 2002. Published February 2003. Originally approved in 1963. Last previous edition approved in 1996 as D 2230 – 96¹.

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

³ Discontinued, see 1999 *Annual Book of ASTM Standards*, Vol 09.01.