



# Standard Test Method for Rubber Property—Extrudability of Unvulcanized Compounds<sup>1</sup>

This standard is issued under the fixed designation D2230; 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 ( $\epsilon$ ) 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:<sup>2</sup>

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

[D3185 Test Methods for Rubber—Evaluation of SBR \(Styrene-Butadiene Rubber\) Including Mixtures With Oil](#)

[D3187 Test Methods for Rubber—Evaluation of NBR \(Acrylonitrile-Butadiene Rubber\)](#)

<sup>1</sup> 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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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

### 2.2 ASTM Adjuncts:

Appearance Ratings Photographs<sup>3</sup>

## 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 [D3182](#).

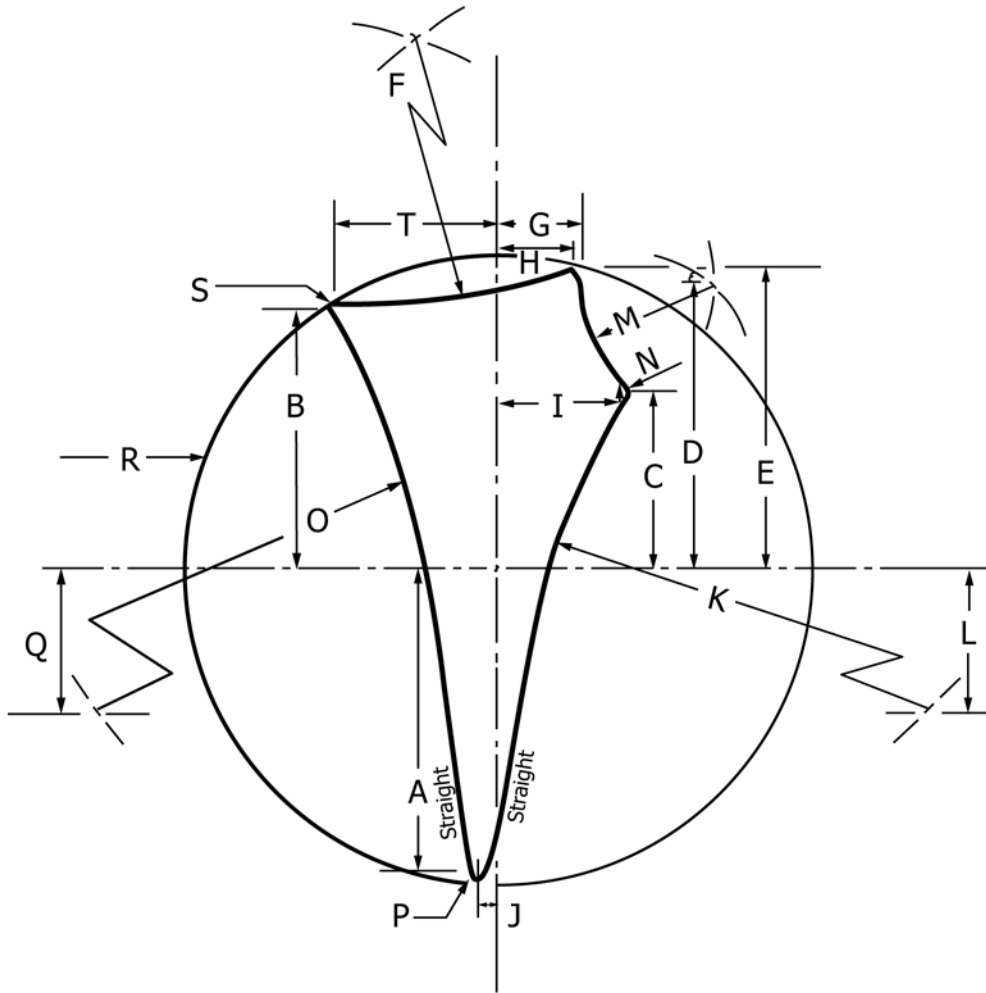
5.2 *Die*—ASTM Extrusion Die, Garvey type, conforming to the dimensions and shape shown in [Fig. 1](#) shall be used.

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

<sup>3</sup> Glossy prints of Figs. 3 and 4 are available at a nominal cost from ASTM International Headquarters. Order Adjunct No. [ADJD2230](#). Original adjunct produced in 1986.



Dimension	mm	in.	Dimension	mm	in.
A	7.62	0.300	K	13.33 R	0.525 R
B	6.60	0.260	L	3.56	0.140
C	4.44	0.175	M	3.301 R	0.130 R
D	7.24	0.285	N	0.32 R	0.013 R
E	7.62	0.300	O	20.32 R	0.800 R
F	13.97 R	0.550 R	P	0.25 R	0.010 R
G	2.16	0.085	Q	3.56	0.140 R
H	1.90	0.075	R	15.87 Dia	0.625 Dia
I	3.05	0.120	S	0.13	0.005
J	0.51	0.020	T	4.06	0.160

Tolerance,  $\pm 0.025$  mm ( $\pm 0.001$  in.)  
 Area, 50 mm<sup>2</sup> (0.0776 in<sup>2</sup>)  
 Thickness of die,  $5 \pm 2.0$  mm ( $0.197 \pm 0.79$  in.)

FIG. 1 ASTM Extrusion Die, Garvey Type

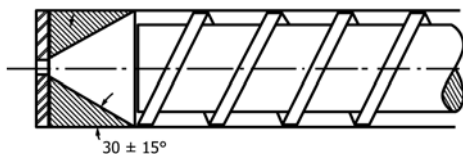


FIG. 2 Diagram Showing Stock Flow from End of Screw to ASTM Extrusion Die

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.

5.4.1 The extruder shall be equipped with devices capable of monitoring the temperature of the barrel, the head, the discharged heating fluid from the screw, and the surface of the die. These monitoring devices shall have a sensitivity of  $\pm 0.5^\circ\text{C}$  ( $1^\circ\text{F}$ ).

5.5 *Take-away Conveyor*—A motor-driven belt conveyor at least 150 mm (6 in.) wide, at least 1.5 m (5 ft) long and variable in speed up to at least 75 mm/s (15 ft/min).

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.