



Standard Test Method of Drop Shatter Test for Coal¹

This standard is issued under the fixed designation D 440; 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.

^{ε1} NOTE—Section 10 was added editorially in November 1994.

1. Scope

1.1 This test method of drop shatter test² covers the determination of the relative size stability and its complement, the friability, of sized coal. It affords a means of indicating the ability of coal to withstand breakage when subjected to handling at the mine and during transit to the consumer. The test method is serviceable for ascertaining the similarity of coals in respect to size stability and friability rather than for determining values within narrow limits in order to emphasize their dissimilarity. This test method is considered applicable for testing a selected single size of different coals, for testing different single sizes of the same coal, and for mixed sizes of the same or different coals.

NOTE 1—By single sizes is meant those with fixed upper and lower sieve opening limits, selected from those designated in 4.2; and by mixed sizes is meant either “slack” or a mixture of two or more single sizes.

1.2 This test method appears best suited for measuring the relative resistance to breakage of the larger sizes of coal when handled in thin layers such as from loader to mine car, from loading boom to railroad car, from shovel to chute, etc. While it may not be so well adapted for measuring the liability to breakage of coal when handled in mass, as in unloading open-bottom cars, emptying bins, etc., it is believed that the test method will serve also to indicate the relative size stability of composite sizes of coal where, in commercial handling, the smaller sized pieces have a cushioning effect which tends to lessen the breakage of the larger pieces of coal.

1.3 The values stated in inch-pound units shall be regarded as the standard. Mass may be expressed in metric values.

1.4 *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 appro-*

appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:

D 410 Method for Sieve Analysis of Coal³

D 3038 Test Method for Drop Shatter Test for Coke⁴

E 11 Specification for Wire-Cloth Sieves for Testing Purposes⁵

E 323 Specification for Perforated-Plate Sieves for Testing Purposes⁵

3. Significance and Use

3.1 The values determined in this test method, when evaluated in terms of pertinent experience with other coals, may be used as indications of the extent to which coal will break in conventional transit and handling beyond the point of sampling.

4. Apparatus

4.1 *Shatter Test Machine*, which is the same as that described and illustrated in Test Method D 3038, shall consist of a box 18 in. (457 mm) in width, 28 in. (711 mm) in length, and approximately 15 in. (381 mm) in depth, supported above a rigidly mounted cast iron or steel plate not less than 1/2 in. (12.7 mm) in thickness, 38 in. (965 mm) in width, and 48 in. (1219 mm) in length. The inside of the bottom of the box shall be 6 ft (1.83 m) above the plate. The bottom of the box shall consist of two doors hinged lengthwise and latched so that they will swing open freely and not impede the fall of the coal. Boards about 8 in. (200 mm) in height should be placed around the plate so that no coal is lost. To prevent the breakage of coal, which may occur while placing the sample into the box, the box shall be constructed so that it can be lowered to a convenient level; this is best done by means of a pulley and counterweight. A convenient form of shatter test machine is shown in Fig. 1.

4.2 *Sieves*—Round-hole sieves selected from the following sizes, 8, 6, 4, 3, 2, 1 1/2, 1, 3/4, 1/2, 1/4, and 1/8 in., shall be used. These sieves shall conform to Specification E 11 or Specification E 323. Frames for the sieves may be of either hardwood or metal, and may be square, rectangular, or circular. A nest comprising all the sieves in the series, with 2-ft (610-mm) square plates, that is, of 4-ft² (0.37-m²) area, is

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² For information concerning the development and utilization of this drop shatter test method for coal the following references may be consulted:

Smith, C. M., “An Investigation of the Friability of Different Coals,” University of Illinois, Engineering Experiment Station, *Bulletin No. 196* UIBBA (1929); “The Friability of Illinois Coals,” University of Illinois, Engineering Experiment Station, *Bulletin No. 218* UIBBA (1930).

Yancey, H. F., and Zane, R. E., “Comparison of Methods for Determining the Friability of Coal,” U.S. Bureau of Mines, *Report of Investigations 3215* (1933).

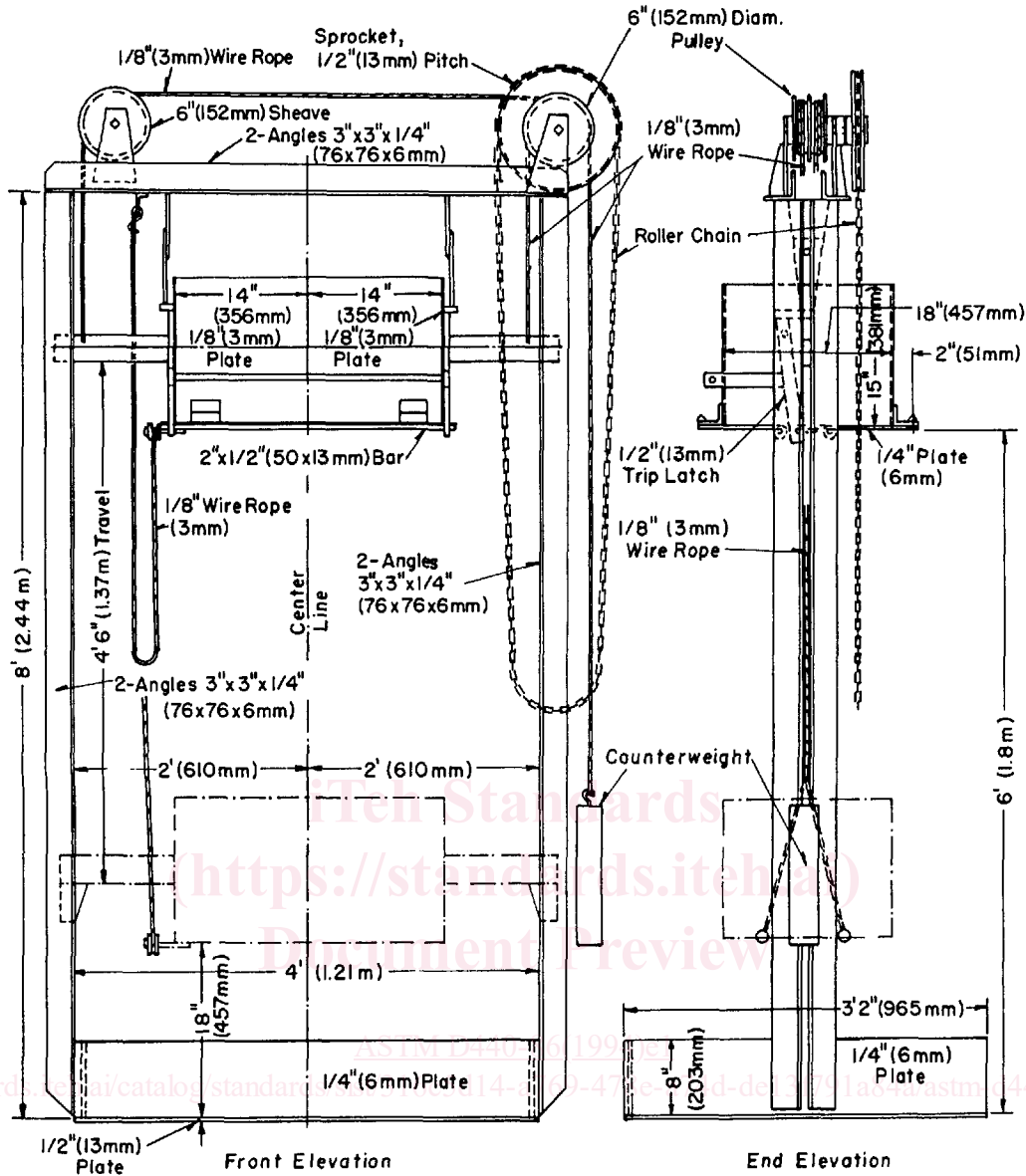
Gilmore, R. E., Nicolls, J. H. H., and Connell, G. P., “Coal Friability Tests,” Canadian Department of Mines, Mines Branch, *No. 762* (1935).

³ Discontinued; see 1988 *Annual Book of ASTM Standards*, Vol 05.05.

⁴ *Annual Book of ASTM Standards*, Vol 05.05.

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

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NOTE—1 in. = 25.4 mm

FIG. 1 Shatter Test Machine

recommended, although plates with areas of 6 to 9 ft² (0.56 to 0.84 m²), are suitable.

5. Samples

5.1 *Collection of Gross Sample*—Collect the gross sample in accordance with Sections 5 thru 7 of Method D 410. In order that the entire quantity of the coal sampled will be represented proportionately in the gross sample, collect increments regularly and systematically. When testing coal as mined, take the sample at the mine before it is subjected to screening and to loading into cars at the tippie. When testing coals subsequent to mining, the sample may be taken at any stage in the transportation from the mine to the place at which it is to be used. For the correct interpretation of the shatter test results, note the elapsed time since mining as well

as a record of the handling and storage of the coal.

5.2 *Preparation of Laboratory Sample:*

5.2.1 Using the sieves designated in 4.2, make a preliminary sieving of a representative portion or all of the gross sample and retain the sieved sizes separately. Sieve successive representative portions of the gross sample to obtain at least 200 lb (90 kg) of the single size selected for test. While the size or sizes to be selected for test are optional in this method, one or more of the sizes larger than 2 to 3 in. (50 to 75 mm) are suggested with preference for the 4 to 6-in. (100 to 150-mm) size (Note 2). In cases where difficulty is experienced in sieving this quantity, the amount obtained by the preliminary sieving may be augmented from larger pieces by dropping them in the shatter test apparatus. This procedure for obtaining from larger pieces an adequate quantity of