



Designation: D 291 – 86 (Reapproved 1994)<sup>ε1</sup>

## Standard Test Method for Cubic Foot Weight of Crushed Bituminous Coal<sup>1</sup>

This standard is issued under the fixed designation D 291; 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.

<sup>ε1</sup> NOTE—Section 12 was added editorially in November 1994.

### 1. Scope

1.1 This test method covers two procedures for determining the cubic foot weight of crushed coal less than 1½ in. (37 mm) in size, such as is charged into coke ovens, as follows:

1.1.1 *Procedure A*—The cone procedure for determining an uncompacted weight per cubic foot (cubic metre).

1.1.2 *Procedure B*—The dropped-coal procedure for determining a compacted weight per cubic foot (cubic metre), comparable to actual bulk densities attained in coke ovens.

1.2 This method is not applicable to the testing of powdered coal as used in boiler plants, nor to the determination of weights per cubic foot of coal in storage piles.

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

### 2. Referenced Documents

#### 2.1 ASTM Standards:

D 311 Method for Sieve Analysis of Crushed Bituminous Coal<sup>2</sup>

D 440 Method of Drop Shatter Test for Coal<sup>3</sup>

D 2234 Test Methods for Collection of a Gross Sample of Coal<sup>3</sup>

D 3038 Test Method for Drop Shatter Test for Coke<sup>3</sup>

D 3302 Test Method for Total Moisture in Coal<sup>3</sup>

### 3. Significance and Use

3.1 This test method concerns the compaction of crushed coal to determine either its compacted or uncompacted weight, for purposes such as charging coke ovens.

### PROCEDURE A—CONE PROCEDURE FOR UNCOMPACTED CUBIC FOOT (CUBIC METRE) WEIGHT

#### 4. Apparatus

4.1 *Measuring Box*, of rigid construction, having inside dimensions of 12.0 by 12.0 by 12.0 in. (305 by 305 by 305 mm), and a volume of  $1728 \pm 5$  in.<sup>3</sup> ( $0.0283 \text{ m}^3 \pm 82 \text{ cm}^3$ ). The exact volume of the box shall be determined by water calibration.

4.2 *Cone*, conforming to Fig. 1 for filling the box. This cone shall be 2 ft 0 in. (610 mm) high and 1 ft 8 in. (508 mm) in inside diameter at the top, with a circular opening 4½ in. (114 mm) in diameter at the bottom. A slide valve consisting of a sliding-plate shutter and its supports shall be welded to the bottom of the cone in such a manner that the valve may be opened and closed with ease by removing or inserting the shutter in its supporting slides. The cone shall be supported in a tripod frame having a circular opening at the top of about 1 ft 6 in. (457 mm) in diameter. This frame shall support the cone so that the top-side of the shutter shall be 1 ft 10 in. (559 mm) from the inside bottom surface of the box. (See Fig. 1.)

4.3 *Leveling Bar*, a steel strip 2 ft 6 in. long by 1½ in. wide (762 by 38 mm) and approximately ⅜ in. (5 mm) thick.

4.4 *Scales*, platform, capable of weighing up to 200 lb (100 kg) and sensitive to 0.1 lb (0.05 kg).

#### 5. Sampling

5.1 *Gross Sample*—For collecting gross samples of crushed bituminous coal, the procedure described in Sections 7 and 8 of Methods D 2234 shall apply. During the period of collecting the gross sample, the increments of the sample shall be stored in a waterproof container with a tightly fitting cover in order to prevent the loss of moisture. The minimum number and weights of increments collected shall be in accordance with Table 2 of Methods D 2234. The minimum gross weight of the sample shall be 300 lb (136 kg).

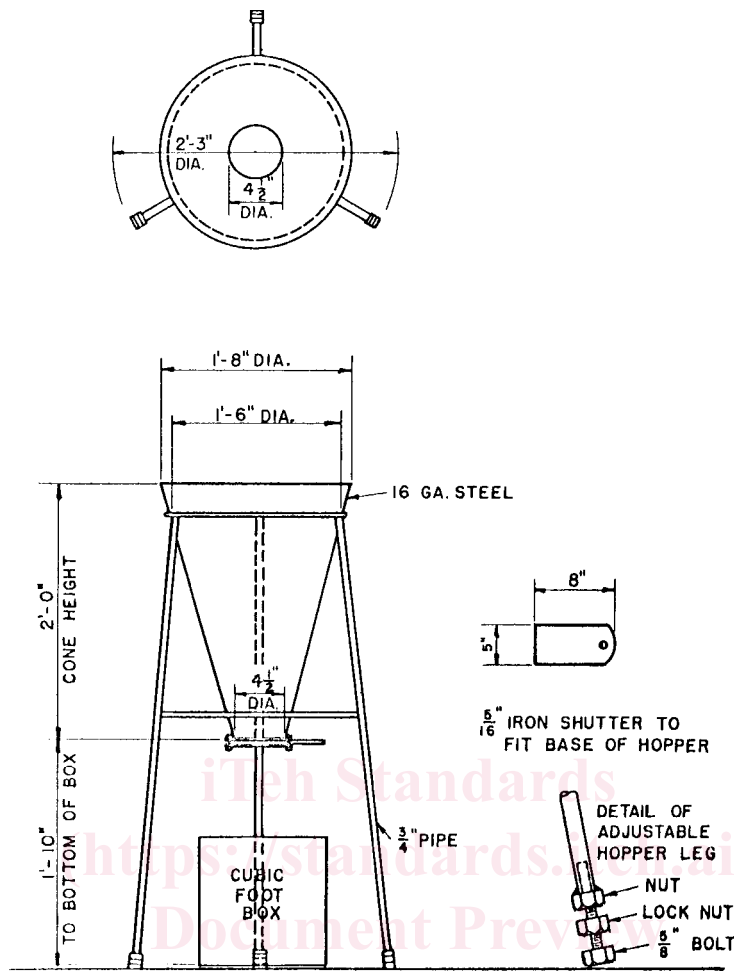
5.2 *Laboratory Sample*—The gross sample of coal shall be thoroughly mixed and subdivided, without crushing, into four 75-lb (34-kg) portions. This operation shall be done as quickly as possible to avoid loss of moisture, and the cubic foot (cubic

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-5 on Coal and Coke and is the direct responsibility of Subcommittee D05.07 on Physical Characterization and Beneficiation of Coal and Coal Slurries.

Current edition approved Sept. 26, 1986. Published November 1986. Originally published as D 291 – 27 T. Last previous edition D 291 – 60 (1980).

<sup>2</sup> Discontinued; see 1988 Annual Book of ASTM Standards, Vol 05.05.

<sup>3</sup> Annual Book of ASTM Standards, Vol 05.05.



NOTE 1—1 in. = 25.4 mm

FIG. 1 Apparatus for Cone Procedure

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metre) weight shall be determined immediately. If this determination cannot be made immediately, the samples shall be kept in waterproof containers with tightly fitting covers until the time for making the determination.

## 6. Procedure

6.1 Before filling the cone hopper, level it in its tripod on a solid floor. Pour the prepared sample into a pile on the floor and carefully flatten it to about 4 in. (100 mm) in thickness. Avoid pounding of the pile with the back of the shovel. Take successive shovelfuls from uniformly distributed points in the pile, and allow them to slide gently from the shovel into the hopper at different peripheral points. This will prevent segregation and packing while the hopper is being filled. Place about 75 lb (34 kg) of coal in the hopper.

6.2 Center the previously weighed cubic foot (cubic metre) box under the valve of the cone. Then remove the valve shutter completely, allowing all of the coal to flow into the box and overflow the edges. Loosen wet coal, not flowing freely from the hopper, by gently thrusting downward through the coal to the valve with the leveling bar.

6.3 After filling the box, carefully level off the excess coal above the box edge by means of the leveling bar, and place the

box on the platform scale and weigh it to the nearest 0.1 lb (0.05 kg). Avoid jarring or shifting of the filled box until all excess coal is leveled off. Record the difference in weight between the filled and empty box to the nearest 0.1 lb (0.05 kg) as the uncompacted cubic foot weight.

NOTE 1—Aside from the character of the coal itself, moisture content and size distribution of the coal are the two main factors which affect the cubic foot weight. A moisture determination and sieve analysis of the coal should be reported along with the cubic foot weight for proper interpretation of the cubic foot weight. For directions for making these determinations, see the following:

*Moisture*—Test Method D 3302.

*Sieve Analysis*—Method D 311.

## 7. Precision and Bias

### 7.1 Repeatability:

7.1.1 Duplicate results by the same operator in a given laboratory on consecutive tests determined within a minimum interval of time shall be considered suspect if they differ by more than 0.6 lb/ft<sup>3</sup> (9.6 kg/m<sup>3</sup>).

7.1.2 When two results are obtained that differ by more than this value, two additional tests shall be made. If the second pair of results differs by less than the repeatability, the first pair shall be discarded and the mean of the second pair shall be