



Designation: D 3402 – 93

Standard Test Method for Tumbler Test for Coke¹

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1. Scope

1.1 This test method describes a procedure for obtaining a relative measure of the resistance to degradation of coke by impact and abrasion.

1.2 *Standard Procedure*—This procedure uses a coke sample sized to -75 mm (-3 in.) and $+50$ mm ($+2$ in.).

1.3 *Alternative Procedure*—This procedure using coke sized 50 % of 63 by 50 mm ($2\frac{1}{2}$ by 2 in.) and 50 % of 50 by 37.5 mm (2 by $1\frac{1}{2}$ in.).

1.4 The values stated in SI units shall be regarded as standard. Inch-pound units shall be accepted on an equivalent basis.

1.5 *This standard does not purport to address all of the safety problems, 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 293 Test Method for the Sieve Analysis of Coke²

D 294 Tumbler Test for Coke³

D 346 Practice for Collection and Preparation of Coke Samples for Laboratory Analysis²

D 4621 Guide for Accountability and Quality Control in the Coal Analysis Laboratory²

E 11 Specification for Wire-Cloth Sieves for Testing Purposes⁴

E 323 Specification for Perforated-Plate Sieves for Testing Purposes²

3. Summary of Test Method

3.1 A sample of dry coke of designated size is tumbled in a rotating drum at a specified turning rate for a specified number of revolutions. Two indexes of its strength, the stability factor

and the hardness factor, are determined by sieve analysis of the coke after treatment. Studies have indicated that there is no real difference in the stability factor as determined by the standard and alternative procedures. The alternative procedure produces hardness factor results averaging slightly higher than the standard procedure.

4. Significance and Use

4.1 Coke undergoes various degrees of degradation during removal from coke ovens, transportation, and its descent within a blast furnace to the combustion zone. These processes subject the coke to impact and abrasion. This test method is a relative measure of the resistance of coke to breakage when subjected to these degradation processes.

5. Apparatus

5.1 *Tumbler Machine* (see Fig. 1)—The tumbler machine consisting of a cylindrical steel drum 910 mm (36 in.) in inside diameter and 455 mm (18 in.) in inside width and made of plate at least 6 mm ($\frac{1}{4}$ in.) thick. The machine may be constructed as a double drum mounted on a common shaft so that duplicate coke samples may be tested at the same time. Two equally spaced 50 by 50 by 6-mm (2 by 2 by $\frac{1}{4}$ -in.) steel angles extending across the width of each drum are solidly fastened inside each drum as shown. These angles are fastened to the shell so that the attached legs point away from the direction of rotation, thus giving a clear unobstructed shelf for lifting the coke. At least one door must be provided in each drum for charging and discharging the coke sample. This door preferably should extend nearly across the width of each drum. As an alternative, a door in the side of the drum is permissible. During the test the door must be fastened rigidly to the shell and must fit into the shell in order to have a smooth continuous inner surface. A dust-tight gasket must be provided to prevent loss of the abraded fines during the test. To provide for rotation, the drum is mounted on stub axles about 37.5 mm ($1\frac{1}{2}$ in.) in diameter by means of flanges welded or bolted to the ends of the drum providing smooth inner surfaces. It is desirable that the apparatus be fitted with a revolution counter and preferably be equipped with an automatic device to stop the drum after the specified number of revolutions (1400). The tumbler drum must be replaced when the wear reduced the thickness to 3 mm

¹ This test method is under the jurisdiction of ASTM Committee D-5 on Coal and Coke and is the direct responsibility of Subcommittee D05.15 on Plasticity and Swelling of Coal.

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² *Annual Book of ASTM Standards*, Vol 05.05.

³ Discontinued: see *1976 Annual Book of ASTM Standards*, Part 26.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.