Designation: D 1937 – 03

# Standard Test Method for Carbon Black, Pelleted—Mass Strength[1]

This standard is issued under the fixed designation D 1937; 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 mass strength of pelleted carbon black. It is designed to determine the force required to pack of a cylindrical column of pelleted carbon black. The results of this test are believed to relate to the ability of the carbon black to flow in bulk handling systems.

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 1799 Practice for Carbon Black—Sampling Packaged Shipments[2]

D 1900 Practice for Carbon Black—Sampling Bulk Shipments[2]

## 3. Summary of Test Method

3.1 A sample of carbon black is placed in a cylinder and pressed with a plunger for 10 s. The force required to pack the carbon black so that it will not fall out of the cylinder is defined as the mass strength.

## 4. Significance and Use

4.1 Mass strength gives an indication of the flowability in bulk handling. It is affected by pellet properties such as hardness, size, shape, and especially fines content. Due to the influence of other variables, the user and the producer must determine an acceptable mass strength level.

## 5. Apparatus

5.1 *Mass Strength Tester*. [3]

5.2 *Calibrating Block*, made from a cylindrical wooden shaft, 47 mm (1.8 in.) in diameter and 250 mm (10 in.) long.

5.3 *Platform Scale*, [4] to 50-kg (100 lb) capacity with a sensitivity of 0.1 kg (0.02 lb) for air pressure gage calibration.

## 6. Sampling

6.1 Samples shall be taken in accordance with Practices D 1799 or D 1900.

## 7. Calibration

7.1 Remove the original faceplate from the pressure gage and replace with a blank plate made from aluminum or other suitable material.

7.2 Place the platform scale under the cylinder. With the sliding door in an open position, pass the calibrating block through the cylinder so it will rest on the platform of the platform scale. The top of the calibrating block shall be near the cylinder top. The calibrating block must fit freely in the cylinder and not bind against any inside surface. Adjust the platform scale for zero position with the calibrating block in place. Mark the zero position on the blank plate.

7.3 Adjust the air-flow regulator until the needle on the air pressure gage has moved from rest or zero position, to one-third or more of total gage capacity.

7.4 Activate the timer, allowing the plunger to press against the calibrating block. Measure the equivalent mass produced by the plunger with the platform scale.

7.5 Repeat 7.4, adjusting the regulator until even multiples of 50 N or 10 lbf are obtained. Mark the plate at these values.

7.6 Between each 50 N or 10 lbf mark on the plate, place graduations representing each 10 N or 2 lbf. This may be done from measurement, since the gage should be linear in calibration. Check these marks for accuracy with the platform scale.

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[1] This test method is under the jurisdiction of ASTM Committee D24 on Carbon Black and is the direct responsibility of Subcommittee D24.51 on Carbon Black Pellet Properties.

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[2] *Annual Book of ASTM Standards*, Vol 09.01

[3] Available from Titan Specialties, Inc., P.O. Box 2316, Pampa, TX 79066-2316. Test Method D 1937 – 84 contains details for the construction of this apparatus.

[4] A Fairbanks Morse platform scale, Model 41–1000 (beam suffix FM) is suitable for this purpose.

7.7 From this calibrated gage plate, another gage plate may be prepared by making the graduations coincide with those measured on the calibrated plate. All graduations shall be checked with the platform scale for accuracy.

7.8 The calibrated air pressure gage shall be recalibrated at least once a month, or more frequently as deemed necessary.

## 8. Procedure

8.1 Clean the cylinder with a brush to remove any adhering carbon black. With the sliding door closed and the overflow cup in position, pour carbon black pellets into the cylinder until an excess of pellets forms a cone above the rim. Level the surface with a single sweep of a straightedge or spatula held perpendicular to, and in firm contact with the top of the cylinder. The top surface of the carbon black column shall be level to prevent unequal pressure on the column.

8.2 Select the force to be applied by adjusting the air-flow regulator until the calibrated gage indicates the desired value. The setting for the initial press is discretionary and is based usually on lab experience.

NOTE 1—Soft pellets with irregular shape and high fines tend to have low mass strength. For these materials an initial setting of 100 N or 20 lbf is suggested. More spherical pellets with higher pellet hardness and low fines tend to have high mass strength. For these materials an initial setting of 250 N or 50 lbf is suggested.

8.3 Press the timer switch activating the mechanism, allowing air flow to the air cylinder. The timer shall be set to allow a total plunger application time of 10 s on the sample.

8.4 After the plunger returns to the rest position above the sample, open the sliding door and observe the inside of the cylinder. If no black remains in the cylinder, the end point has not been reached. The test is then repeated on untested portions of the sample using successively higher pressures following the test sequence in 8.1-8.4

NOTE 2—The increments of increased force are discretionary. Steps of 50 or 100 N (10 or 20 lbf) are appropriate.

8.5 Once a bridge of pressed carbon black is formed, the end point has been reached or exceeded. An additional test should be performed at a lower pressure to confirm the end point has not been exceeded. The end point is the lowest number of newtons (pounds-force) required to produce a ring or bridge of pressed carbon black in the cylinder.

## 9. Report

9.1 Report the following information:

9.1.1 Proper identification of the sample and,

9.1.2 Result obtained from an individual determination reported to the nearest newton (pound-force).

## 10. Precision and Bias [5]

10.1 These precision data are based on duplicate tests of four samples by four laboratories on two days. The range of samples studied was from about 5 N (1.1 lbf) to about 400 N (90 lbf). Precision is expressed in relative terms.

10.2 *Repeatability (Single-Operator)*—The repeatability has been estimated to be ±8 % of a test result. Two test results are significantly different if their difference exceeds 11 % of their average value.

10.3 *Reproducibility (Multilaboratory)*—The reproducibility has been estimated to be ±22 % of a test result. Two test results are significantly different if their difference exceeds 31 % of their average value.

10.4 *Bias*—In test method statistical terminology, bias is the difference between an average test value and the reference or true test property value. Reference values do not exist for this test method since the value or level of the test property is exclusively defined by this test method. Bias, therefore, cannot be determined.

NOTE 3—This precision statement was developed following the guidelines presented in Practices D 3051 and D 3396.

## 11. Keywords

11.1 bulk handling systems; carbon black; flow in bulk handling systems; mass strength; pelleted carbon black

[5] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D24–1009.