



Designation: D1506 – 23

Standard Test Methods for Carbon Black—Ash Content¹

This standard is issued under the fixed designation D1506; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 These test methods cover the determination of the ash content of carbon black.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements see Sections 6 and 13.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D1799 Practice for Carbon Black—Sampling Packaged Shipments

D1900 Practice for Carbon Black—Sampling Bulk Shipments

D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries

3. Summary of Test Method

3.1 A pre-dried sample (1 h at 125°C) is weighed before and after combustion for 16 h at 550°C. The remaining ash is weighed and calculated as a percent of the dried sample.

¹ These test methods are under the jurisdiction of ASTM Committee D24 on Carbon Black and are the direct responsibility of Subcommittee D24.31 on Non-Carbon Black Components of Carbon Black.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Significance and Use

4.1 The ash content of a carbon black is the amount of non-carbon components present after combustion. Primary contributors to ash are the manufacturing process water and the catalyst in the feedstock.

Method A—Muffle Furnace Method

5. Apparatus

5.1 *Muffle Furnace*, capable of temperature regulation of $\pm 25^\circ\text{C}$ at 550°C, including capability of air exchange.

5.2 *Crucibles:*

5.2.1 *Porcelain Crucible*, high-form, size O, rim 35 mm, height 29 mm, capacity 15 cm³, with cover size E.

5.2.2 *Porous Quartz Fiber Crucible*, 20, 50, and 100 mL with optional disk inserts and lids.³

5.3 *Analytical Balance*, having a sensitivity of 0.1 mg.

5.4 *Desiccator*.

5.5 *Oven*, gravity-convection type, capable of temperature regulation within $\pm 1^\circ\text{C}$ at 125°C and temperature uniformity within $\pm 5^\circ\text{C}$.

6. Hazards

6.1 *Precautions:*

6.1.1 Open, if available, adjustable air inlets – for example, integrated in the door – to ensure a continuous stream of air passing through the furnace to support the combustion.

6.1.2 Exert care in removing ashed sample from furnace to desiccator.

6.1.3 Always keep the cover on the crucible when transferring it to and from the desiccator to prevent the loss of ash due to air currents.

6.1.4 After the sample has cooled in the desiccator, admit air slowly to avoid loss of ash from the crucible.

³ The sole source of supply of the apparatus (quartz ashing dishes, Part Number 303040) known to the committee at this time is CEM Corporation, P.O. Box 200, Matthews, NC 28106. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

7. Sampling

7.1 Samples shall be taken in accordance with Practices **D1799** or **D1900**.

8. Procedure

8.1 Porous quartz fiber crucibles and optional disks should be ignited in the furnace at $550 \pm 25^\circ\text{C}$ for at least 15 min. Porcelain crucibles should be ignited with cover in the muffle furnace at $550 \pm 25^\circ\text{C}$ for 1 h. Place the crucible and cover in the desiccator. Cool to room temperature and weigh to nearest 0.1 mg.

8.2 Dry an adequate sample of carbon black for 1 h in the gravity-convection oven set at 125°C in an open container of suitable dimensions, so that the depth of the black is no more than 10 mm. Cool and store the sample in a desiccator.

8.3 Weigh 2 ± 0.1 g of the dried carbon black into the ignited crucible and weigh to the nearest 0.1 mg. Place the uncovered crucible and its cover into the furnace (**Note 1**) at 550°C for 16 h (porcelain crucible) or 1.5 h (porous quartz fiber crucible—see **6.1.1**). Cover the crucible containing the ash, remove from the furnace to the desiccator, and allow to cool to room temperature. Weigh the covered crucible to the nearest 0.1 mg. Put the covered crucible back into the furnace for additional 0.5 h. Reweigh to the nearest 0.1 mg. Repeat this weighing process until constant mass is obtained.

NOTE 1—For carbon blacks with very low ash content (such as high purity blacks) larger sample mass and longer ashing time may be required.

NOTE 2—If control testing is done at temperatures exceeding 550°C , some volatile salts may be lost from inorganic ash.

9. Calculation

9.1 Calculate the percent ash to the nearest 0.01 % as follows:

$$A = [(D - B)/(C - B)] \times 100 \quad (1)$$

where:

- A = ash, %,
- B = mass of crucible, g,
- C = mass of crucible plus the sample, g, and
- D = mass of crucible plus the ash, g.

10. Report

10.1 Report the following information:

- 10.1.1 Proper identification of the sample, and
- 10.1.2 A result obtained from an individual determination reported to the nearest 0.01 %.

11. Precision and Bias

11.1 These precision statements have been prepared in accordance with Practice **D4483**. Refer to this practice for terminology and other statistical details.

11.2 The precision results in this precision and bias section give an estimate of the precision of this test method with the materials used in the particular interlaboratory program described below. The precision parameters should not be used for acceptance or rejection testing of any group of materials without documentation that they are applicable to those par-

ticular materials and the specific testing protocols of the test method. Any appropriate value may be used from **Table 1**.

11.3 A type 1 inter-laboratory precision program was conducted as detailed in **Table 2**. Both repeatability and reproducibility represent short term (daily) testing conditions. The testing was performed using two operators in each laboratory performing the test once on each of two days (total of four tests). A test result is the value obtained from a single determination. Acceptable difference values were not measured. The between operator component of variation is included in the calculated values for *r* and *R*.

11.4 The results of the precision calculations for this test are given in **Table 1**. The materials are arranged in ascending “mean level” order.

11.5 *Repeatability*—The pooled relative repeatability, (*r*), of this test has been established as 16.0 %. Any other value in **Table 1** may be used as an estimate of repeatability, as appropriate. The difference between two single test results (or determinations) found on identical test material under the repeatability conditions prescribed for this test will exceed the repeatability on an average of not more than once in 20 cases in the normal and correct operation of the method. Two single test results that differ by more than the appropriate value from **Table 1** must be suspected of being from different populations and some appropriate action taken.

NOTE 3—Appropriate action may be an investigation of the test method procedure or apparatus for faulty operation or the declaration of a significant difference in the two materials, samples, etc., which generated the two test results.

11.6 *Reproducibility*—The pooled relative reproducibility, (*R*), of this test has been established as 29.7 %. Any other value in **Table 1** may be used as an estimate of reproducibility, as appropriate. The difference between two single and independent test results found by two operators working under the prescribed reproducibility conditions in different laboratories on identical test material will exceed the reproducibility on an average of not more than once in 20 cases in the normal and correct operation of the method. Two single test results produced in different laboratories that differ by more than the appropriate value from **Table 1** must be suspected of being from different populations and some appropriate investigative or technical/commercial action taken.

11.7 *Bias*—In test method terminology, bias is the difference between an average test value and the reference (true) test property value. Reference values do not exist for this test

TABLE 1 Precision Parameters for D1506 Ash Content, (Type 1 Precision)

Units Material	Percent Ash		(r)	SR	(R)
	Mean Level	Sr			
IRB#6 (N330)	0.233	0.018	21.4	0.027	32.4
SRB D5 (N762)	0.258	0.015	16.0	0.030	32.6
N650	0.289	0.019	18.7	0.031	30.4
N550	0.436	0.025	16.1	0.037	23.7
SRB A5 (N135)	0.565	0.023	11.5	0.056	27.9
Average	0.356				
Pooled Values		0.020	16.0	0.037	29.7