



Designation: D7846 – 21

Standard Practice for Reporting Uniaxial Strength Data and Estimating Weibull Distribution Parameters for Advanced Graphites¹

This standard is issued under the fixed designation D7846; 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 practice covers the reporting of uniaxial strength data for graphite and the estimation of probability distribution parameters for both censored and uncensored data. The failure strength of graphite materials is treated as a continuous random variable. Typically, a number of test specimens are failed in accordance with the following standards: Test Methods [C565](#), [C651](#), [C695](#), [C749](#), Practice [C781](#) or Guide [D7775](#). The load at which each specimen fails is recorded. The resulting failure stresses are used to obtain parameter estimates associated with the underlying population distribution. This practice is limited to failure strengths that can be characterized by the two-parameter Weibull distribution. Furthermore, this practice is restricted to test specimens (primarily tensile and flexural) that are primarily subjected to uniaxial stress states.

1.2 Measurements of the strength at failure are taken for various reasons: a comparison of the relative quality of two materials, the prediction of the probability of failure for a structure of interest, or to establish limit loads in an application. This practice provides a procedure for estimating the distribution parameters that are needed for estimating load limits for a particular level of probability of failure.

1.3 *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

[C565](#) Test Methods for Tension Testing of Carbon and

[Graphite Mechanical Materials](#)

[C651](#) Test Method for Flexural Strength of Manufactured Carbon and Graphite Articles Using Four-Point Loading at Room Temperature

[C695](#) Test Method for Compressive Strength of Carbon and Graphite

[C749](#) Test Method for Tensile Stress-Strain of Carbon and Graphite

[C781](#) Practice for Testing Graphite Materials for Gas-Cooled Nuclear Reactor Components

[D4175](#) Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

[D7775](#) Guide for Measurements on Small Graphite Specimens

[E6](#) Terminology Relating to Methods of Mechanical Testing

[E178](#) Practice for Dealing With Outlying Observations

[E456](#) Terminology Relating to Quality and Statistics

3. Terminology

3.1 Proper use of the following terms and equations will alleviate misunderstanding in the presentation of data and in the calculation of strength distribution parameters.

3.2 Definitions:

3.2.1 *estimator, n* —a well-defined function that is dependent on the observations in a sample. The resulting value for a given sample may be an estimate of a distribution parameter (a point estimate) associated with the underlying population. The arithmetic average of a sample is, for example, an estimator of the distribution mean.

3.2.2 *population, n* —the totality of valid observations (performed in a manner that is compliant with the appropriate test standards) about which inferences are made.

3.2.3 *population mean, n* —the average of all potential measurements in a given population weighted by their relative frequencies in the population.

3.2.4 *probability density function, n* —the function $f(x)$ is a probability density function for the continuous random variable X if:

$$f(x) \geq 0 \quad (1)$$

and

*A Summary of Changes section appears at the end of this standard

¹ This practice is under the jurisdiction of ASTM Committee [D02](#) on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee [D02.F0](#) on Manufactured Carbon and Graphite Products.

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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.