



Designation: D8511/D8511M – 23

Standard Guide for Design and Analysis of Local Buckling and Crippling Test Specimens¹

This standard is issued under the fixed designation D8511/D8511M; 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 guide covers designing local buckling and crippling test specimens to obtain empirical strength data for one-edge-free and no-edge-free cross section configurations using solid laminate composite material construction. This guide also discusses data analysis procedures for these test specimens. Test procedures for local buckling and crippling specimens are covered in Test Method **D8510/D8510M**. This guide is intended to be used by persons requesting these test types.

1.2 Local buckling and crippling tests require careful specimen design, instrumentation, data measurement and data analysis. Test requestors designing these specimen need to be familiar with Test Method **D8510/D8510M**, CMH-17 Volume 3 Chapter 9 (**1**)², and the stress analysis methods that will use the resulting local buckling and crippling design data.

1.3 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.3.1 Within the text the inch-pound units are shown in brackets.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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 Recom-*

mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 *ASTM Standards*:³

D883 Terminology Relating to Plastics

D3878 Terminology for Composite Materials

D8510/D8510M

3. Terminology

3.1 *Definitions*:

3.1.1 Terminology **D3878** defines terms relating to high-modulus fibers and their composites. Terminology **D883** defines terms relating to plastics. In the event of a conflict between terms, Terminology **D3878** shall have precedence.

NOTE 1—If the term represents a physical quantity, its analytical dimensions are stated immediately following the term (or letter symbol) in fundamental dimension form, using the following ASTM standard symbology for fundamental dimensions, shown within square brackets: $[M]$ for mass, $[L]$ for length, $[T]$ for time, $[\theta]$ for thermodynamic temperature, and $[nd]$ for non-dimensional quantities. Use of these symbols is restricted to analytical dimensions when used with square brackets, as the symbols may have other definitions when used without the brackets.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *cripling force*, P^{cc} $[MLT^{-2}]$, n —the applied compressive force at or above the local buckling force at which specimen failure occurs.

3.2.2 *cripling stress*, F^{cc} $[ML^{-1}T^{-2}]$, n —the average stress in the test specimen cross-section at failure.

3.2.3 *local buckling force*, P^{lcr} $[MLT^{-2}]$, n —the applied compressive force at which buckling initiates.

3.2.4 *local buckling stress*, F^{lcr} $[ML^{-1}T^{-2}]$, n —the average stress in the test specimen cross-section at which buckling of a compression element within the cross-section initiates.

3.2.5 *slenderness ratio*, L/ρ $[nd]$, n —the ratio of the specimen length adjusted for end boundary condition effects divided by the minimum radius of gyration of the specimen cross-section.

¹ This guide is under the jurisdiction of ASTM Committee **D30** on Composite Materials and is the direct responsibility of Subcommittee **D30.05** on Structural Test Methods.

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² The boldface numbers in parentheses refer to a list of references at the end of this standard.

³ 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.