



Designation: D1423/D1423M – 16 (Reapproved 2022)

Standard Test Method for Twist in Yarns by Direct-Counting¹

This standard is issued under the fixed designation D1423/D1423M; 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 This test method covers the determination of the amount and direction of twist at the completion of any stage of twisting in single (spun or filament), plied, cabled, or novelty (exclusive of long-term repeat patterns) yarns. The procedures are designed primarily for yarns in packages, but, with special precautions, they are applicable to yarns taken from fabrics. The procedure for spun yarn in 9.2 is also applicable to rovings.

1.2 For plied yarns, this test method covers the determination of the twist of the plied yarns and the twist of the single yarn before plying. For cabled yarns, the test method covers the determination of the cable or hawser twist; the twist of the plied yarn after plying, but prior to the last twisting operation; and the twist of the single yarn before plying. Procedures are also included for the determination of the twists of the single and plied yarn components as they lie in the final structure. Also, directions are included for the determination of twist in plied yarn made with direct cabling technology.

1.3 This test method is not intended for yarns that extend more than 5.0 % when tension is increased from 2.5 to 7.5 mN/tex [0.25 to 0.75 gf/tex]. Following the procedures of this test method for such yarns would be independent of the bias and precision determined for this test method. The report from such testing should include the tension used for this testing.

1.4 *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.

NOTE 1—For a more rapid but less accurate method of determining twist in single spun yarns, refer to Test Method D1422.

NOTE 2—This test method has been evaluated for use in determining twist in open end yarns and is not recommended.

1.5 *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.*

1.6 *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

D123 Terminology Relating to Textiles

D1059 Test Method for Yarn Number Based on Short-Length Specimens

D1422 Test Method for Twist in Single Spun Yarns by the Untwist-Retwist Method

D1776 Practice for Conditioning and Testing Textiles

D1907 Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method

D3888 Terminology for Yarn Spinning Systems

D4849 Terminology Related to Yarns and Fibers

3. Terminology

3.1 Refer to Terminology D4849 for definitions of the following terms used in this standard: direction of twist, single yarn, spun yarn, twist, twist factor, twist multiplier, and yarn.

3.2 Refer to Terminology D123 and Terminology D3888 for definitions of other terms used in this standard.

4. Summary of Test Method

4.1 A specified length of specimen is mounted in a twist device. One end is rotated until all the elements are free of twist. The number of turns is counted and the turns per unit length are calculated.

¹ This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.58 on Yarns and Fibers.

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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.

4.2 The amount of twist in the component elements of a plied or cabled yarn is determined by either of two options.

4.2.1 In the procedure for determining original twist, one end of the yarn is fixed while the other end is rotated until the structural components are parallel. Any one or all of these components may then be used as test specimens.

4.2.2 In the procedure for determining final twist in components, both ends of one component of the yarn are held fixed while all the other components are removed and discarded. The twist is then determined in the remaining component.

5. Significance and Use

5.1 Test Method D1423 for testing twist in yarns by direct-counting is considered satisfactory for acceptance testing of commercial shipments because current estimates of between-laboratory precision are acceptable and the method has been used extensively in the trade for acceptance testing.

5.1.1 If there are differences of practical significance between reported test results for two laboratories (or more), comparative tests should be performed to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum use the samples for such comparative tests as homogeneous as possible, drawn from the same lot of material that resulted in the disparate test results and randomly in equal numbers to each laboratory. The test results from the laboratories involved should be compared using a statistical test for unpaired data, at a probability level chosen prior to the testing series. If a bias is found, either its cause must be found and corrected, or future test results for that material must be adjusted in consideration of the known bias.

5.2 The determination of twist in a straight section of a yarn is not the simple straightforward operation it appears to be, for the test results may be greatly influenced by variations in test procedures and techniques. In all manipulations, extreme care is necessary to prevent specimen rotation altering the twist level before testing begins.

5.3 The twist in a yarn before it is packaged may be different from that of the yarn after it has been withdrawn from the package because of changes in tension and the effect of the method of withdrawal. If the yarn is withdrawn over-end, a slight increase or decrease in twist will take place, depending upon the direction of the twist in the yarn, the direction of winding on the package, and the length of the wrap on the package.

5.4 When a yarn is incorporated into or removed from a more complex structure, alterations may occur as a result of the plying, untwisting, or raveling operation. For example, when determining the twist in plied yarn by the procedure for determining original twist, as the plied yarn is untwisted, a comparable amount of twist is reinserted in, or removed from, the single-yarn components. As a consequence, the single yarns have approximately the original twist prior to the plying operation but not the twist they have when they are functioning as components of the plied yarn. The latter or final twist may be estimated by adding the ply twist to (or subtracting it from) the single-yarn twist depending on the directions of the ply and

singles twist. For a more precise determination, the test procedure must be modified. There are thus two different procedures for preparing specimens of the component elements of a plied or cabled yarn for twist determination. The procedure for the original twist measures the twist in a component of a complex strand after the components have been untwisted. The procedure for final twist measures the twist in a component as it lies in the complex strand. Although the original twist procedure is most often used, selection of a particular procedure will depend on the type of information needed.

NOTE 3—The difference in twist between unwinding from the side and over-end is $1/\pi d$, where d is the diameter of the package.³ Thus, for a 25 mm [1-in.] diameter package, the difference would be about 13 tpm or about $\frac{1}{3}$ tpi.

5.5 When a yarn is taken from a more complex yarn structure or from a fabric, the resultant twist should be considered only an approximation of the original value because of alterations that may have occurred as a result of the effects of unwinding, handling, and mechanical strains met in processing.

5.6 The optimum amount of twist depends upon the use for which the yarn is intended. The amount of twist affects both the strength and elongation properties of the yarn with increased twist being associated with increased elongation. The relationship between twist and strength is more complex.

5.6.1 In filament yarns, some twist up to 280 tpm [7 tpi] or a suitable sizing is required to facilitate textile operations. A small increase in twist results in a slight increase in strength, but a further increase results in a loss in strength. However, higher twist in such yarns may be used to subdue luster or increase elongation, or to secure other special effects, as in crepe fabrics.

5.6.2 In conventional ring spun yarns a certain minimum amount of twist is necessary to bind or hold the individual fibers together to produce a useful yarn. A limited increase in twist will result in an increase in strength until the critical twist level for the particular yarn involved has been reached, but further increase in twist results in a loss in strength.

5.7 The same amount of twist in yarns of different sizes (diameter) will produce yarns with different degrees of compactness, twist character, and twist angles. The twist multiplier or twist factor is approximately proportional to the tangent of the angle that the surface fibers make with the axis of the yarn. Therefore, the greater the angle, the greater the twist multiplier. A constant twist multiplier indicates comparable compactness and degree of liveliness in yarns of different sizes and conversely a difference in twist multiplier indicates a difference in compactness in yarns of the same size. Yarns intended for different uses are frequently made with different twist multipliers, for example, warp yarns and filling yarns.

5.8 Different cabling processes will influence the calculation of twist from single component twist measurement. The length of cabled yarn before untwisting is used for the calculation of twist for single components using direct cabling

³ Woods, H. J., "The Kinematics of Twist, I, The Definition of Twist," *Journal of Textile Science*, Vol 4, 1931, pp 33–36.