



Designation: **E2225—18** **E2225 – 19**

## Standard Guide for Forensic Examination of Fabrics and Cordage<sup>1</sup>

This standard is issued under the fixed designation E2225; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This guide is intended to assist individuals and laboratories that conduct examinations of fabrics and cordage for the purposes of identifying and comparing types of fabric, cordage and damage. A complete characterization of the fabrics, including their construction and other materials used in the assemblage of a textile (for example, sewing thread), is a critical component of a comprehensive forensic fabric or cordage examination.

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

1.3 *This standard cannot replace knowledge, skills, or abilities acquired through education, training, and experience and is to be used in conjunction with professional judgment by individuals with such discipline-specific knowledge, skills, and abilities.*

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

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[D123 Terminology Relating to Textiles](#)

[E1459 Guide for Physical Evidence Labeling and Related Documentation](#)

[E1492 Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Science Laboratory](#)

[E2224 Guide for Forensic Analysis of Fibers by Infrared Spectroscopy](#)

[E2227 Guide for Forensic Examination of Non-Reactive Dyes in Textile Fibers by Thin-Layer Chromatography](#)

[E2228 Guide for Microscopical Examination of Textile Fibers](#)

2.2 *AATCC Standards:*<sup>3</sup>

[AATCC Test Method 20: Qualitative Test Method 20—2007 Fiber Analysis: Qualitative](#)

### 3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminology [D123](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *braid, n*—the intertwining of strands in a braiding process to produce a rope structure.

(1)<sup>4</sup>

3.2.2 *cord, n*—a twisted or formed structure composed of one or more single or plied filaments, strands, or yarns of organic polymer or inorganic materials.

**D123**

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709-2215, <http://www.aatcc.org>.

<sup>4</sup> The boldface numbers in parentheses refer to a list of references at the end of this standard.

3.2.2.1 *Discussion*—

Generally, cords have a diameter less than  $\frac{3}{16}$  in.

3.2.3 *cordage*, *n*—a collective term for twines, cords and ropes made from textile fibers and yarns. (1)

3.2.4 *core*, *n*—a textile product (yarn, strand, small diameter rope, etc.) placed in the center of a rope and serving as a support for the strands around it. (1)

3.2.4.1 *Discussion*—

Core can be of any continuous construction including parallel strands, twisted strands or braided strands.

3.2.5 *course*, *n*—in *knitted fabrics*, a row of successive loops in the width direction of the fabric. D123

3.2.6 *crown*, *n*—the raised portion of a strand in twisted cordage.

3.2.7 *fabric*, *n*—in *textiles*, a planar structure consisting of yarns or fibers. D123

3.2.8 *filament*, *n*—in *textiles*, a continuous fiber of extremely long length. D123

3.2.9 *knitted fabric*, *n*—a structure produced by interlooping one or more ends of yarn or comparable material. D123

3.2.10 *meaningful difference*, *n*—a feature or property of a sample that does not fall within the variation exhibited by the comparison sample, considering the limitations of the sample or technique, and therefore indicates the two samples do not share a common origin. The use of this term does not imply the formal application of statistical tests.

3.2.10.1 *Discussion*—

The variation can be based on visual or microscopical comparison of physical and chemical data.

3.2.11 *nonwoven fabric*, *n*—a textile structure produced by bonding or interlocking of fibers, or both, accomplished by mechanical, chemical, thermal, or solvent means and combinations thereof. D123

3.2.12 *ply*, *n*—(1) the number of single yarns twisted together to form a plied yarn, or the number of plied yarns twisted together to form cord; (2) an individual yarn in a plied yarn or cord; (3) one of a number of layers of fabric; (4) the number of layers of fabric as a shirt collar, or of cord in a tire. (2)

3.2.13 *rope*, *n*—a compact and flexible, torsionally balanced structure produced from strands which are laid, plaited, or braided together to produce a product which serves to transmit a tensile force between two points.

3.2.13.1 *Discussion*—

Generally greater than  $\frac{3}{16}$  in. diameter **(1)**; a rope is made up of three or more strands.

3.2.14 *selvage*, *n*—the woven edge portion of a fabric parallel to the warp. D123

3.2.15 *staple*, *n*—natural fibers or cut lengths from filaments. D123

3.2.16 *strand*, *n*—(1) a single fiber, filament, or monofilament; (2) an ordered assemblage of textile fibers having a high ratio of length to diameter and normally used as a unit; includes slivers, roving, single yarns, plied yarns, cords, braids, ropes, etc. (2)

3.2.16.1 *Discussion*—

A strand is often multiple plies joined together. The terms “ply” and “strand” are not synonymous; cordage can have a single-ply strand, but not a stranded ply.

3.2.17 *thermoplastic, n*—a synthetic material that softens or melts at high temperatures.

3.2.18 *thread, n*—a slender strong strand or cord made by plying or twisting yarns, typically used for stitching.

3.2.19 *tracer, n*—A means of distinguishing one rope from another or one manufacturer from another by the use of yarns, tapes or other markers in a rope, either externally, internally or both. Also referred to as a marker.

(1)

3.2.19.1 *Discussion*—

This marker can be different in color, size, or composition, or combination thereof, from that of the basic cordage. It can be found in the core or alongside a ply or strand.

3.2.20 *twist, n*—the number of turns about the axis applied to a fiber, yarn, strand or rope over a given length to combine the individual elements into a larger and stronger structure.

(1)

3.2.20.1 *Discussion*—

The direction of twist in yarns is indicated by the capital letters S and Z. A yarn has an S-twist if, when it is held vertically, the spirals around its central axis slope in the same direction as the middle portion of the letter S, and Z-twist if they slope in the same direction as the middle portion of the letter Z.

3.2.21 *wale, n*—*in knitted fabrics*, a column of successive loops in the length direction of the fabric; *in woven fabrics*, one of a series of raised portions or ribs lying warp-wise in the fabric.

D123

3.2.22 *warp, n*—the yarn running lengthwise in a woven fabric.

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3.2.23 *weft (filling), n*—*in a woven fabric*, the yarn running from selvage to selvage at right angles to the warp.

D123

3.2.24 *woven fabric, n*—a structure produced when at least two sets of strands are interlaced, usually at right angles to each other, according to a predetermined pattern of interlacing, and such that at least one set is parallel to the axis along the lengthwise direction of the fabric.

D123

3.2.25 *yarn, n*—a generic term for a continuous strand of textile fibers, filaments, or material in a form suitable for knitting, weaving, or otherwise intertwining to form a textile fabric.

D123

#### 4. Summary of Guide

4.1 Because of their general availability, fabrics and cordage are often encountered by forensic scientists who examine, identify, and compare these types of evidence. Structural details such as design, construction, and composition provide information that may assist the examiner in reaching a conclusion as to the possible end use or source of an item.

#### 5. Significance and Use

5.1 The construction, composition, and color of textiles contain useful comparative characteristics for forensic examinations. Textiles may appear in a variety of constructions: woven, knit, nonwoven, or in combination. The range of colors in which textiles are offered in the marketplace is vast and constantly changing due to styles and seasons.

5.2 A complete characterization of the fabrics, including their construction, and other materials used in the assemblage of a textile (for example, sewing thread) is a critical component of a comprehensive forensic fabric or cordage examination.

#### 6. Sample Handling

6.1 The general handling and tracking of samples should meet or exceed the requirements of Practice E1492 and Guide E1459.

6.2 Photography of the item, prior to conducting any analyses, is recommended in order to provide documentation of the original condition (for example, shape, position, layers or relation of one yarn to another). Documentation should also include any physical damage (for example, worn, cut, broken, frayed) or the presence of other evidence. Other evidence (for example, hair, blood, paint) that may require additional examination should be collected prior to textile analysis.

6.3 A questioned material (for example, a piece of fabric, yarn, tuft of fibers) shall not be brought into contact with the known fabric from which it is suspected to have originated until a preliminary examination of the questioned specimen has been performed.