



Standard Guide for Forensic Examination of Fabrics and Cordage¹

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 (ϵ) 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 analyzing 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 is intended for use by competent forensic science practitioners with the requisite formal education, discipline-specific training (see Practice E2917), and demonstrated proficiency to perform forensic case work*

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:*²

D123 Terminology Relating to Textiles

E620 Practice for Reporting Opinions of Scientific or Technical Experts

E1459 Practice 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 Dyes in Textile Fibers by Thin-Layer Chromatography

E2228 Guide for Microscopical Examination of Textile Fibers

E2917 Practice for Forensic Science Practitioner Training, Continuing Education, and Professional Development Programs

2.2 *AATCC Standards:*³

AATCC Test Method 20: Qualitative Test Method 20–2007 Fiber Analysis: Qualitative

2.3 *Other Documents:*

ISO 17025 Testing and calibration laboratories⁴

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)⁵

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

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)

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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.

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

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁵ The boldface numbers in parentheses refer to a list of references at the end of this standard.

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 *exclusionary difference, n*—a difference in one or more characteristics between compared items that is sufficient to determine that the compared items did not originate from the same source, are not the same source, or do not share the same composition or classification.

3.2.7.1 *Discussion*—What is sufficient depends on the performance and limitations of the method used on the material in question.

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

D123

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

D123

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

D123

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-plied 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.

D123

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