



PIA-C-5040F

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**Superseding
PIA-C-5040E**

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The following commercial specification is adopted from the military document. Revision A includes all known accepted revisions, amendments, notices, and Department of Defense (DoD) engineering changes previously developed for this item. Revision B and forward include changes adopted to reflect technology and design evolution.

CORD, FIBROUS, NYLON

The Parachute Industry Association makes this document available for use by Industry and Government organizations that wish to apply this specification to their products.

1. SCOPE

1.1 Scope. This specification covers braided nylon cord.

1.2 Classification. The braided cord shall be of the type specified (see TABLE I and 6.1). A part or identifying number for the cord shall be as specified in 6.4 and be applicable to TABLE I. After treated cordage shall be of the following class as specified (see 6.1):

Class F – Fluorocarbon Impregnated.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in Sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification nor is it recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, documents users are cautioned that they must meet all specified requirements documents cited in Sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government publications.

2.2.1 Government publications. The following Government publications form a part of this document.

STANDARDS

FEDERAL

FED-STD-595

- Colors used in Government Procurement

FED-STD-595/34094 - Camouflage Green 483

FED-STD-595/24165 - Foliage Green 504

FED-STD-595/20180 - Tan 499

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FEDERAL TRADE COMMISSION (FTC)

16 CFR 303 - Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies are available online at: www.ftc.gov or from the Federal Trade Commission, 600 Pennsylvania Avenue, N.W. Washington, DC 20580-0001. Electronic copies may also be obtained from <http://www.access.gpo.gov/>.)

2.3 Non-government publications. The following documents form a part of this document.

AMERICAN SOCIETY FOR QUALITY (ASQ)

ANSI/ASQ Z1.4 - Sampling Procedures and Tables for Inspection by Attributes

(Copies are available online at: www.asq.org or from the American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203. Electronic copies may also be obtained from www.access.gpo.gov/.)

ASTM INTERNATIONAL (ASTM)

- ASTM D276 - Standard Test Methods for Identification of Fibers in Textiles
- ASTM D1422 - Standard Test Method for Twist in Single Spun Yarns by the Untwist-Retwist Method
- ASTM D1423 - Standard Test Method for Twist in Yarns by Direct-Counting
- ASTM D1776 - Standard Practice for Conditioning and Testing Textiles
- ASTM G151 - Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources
- ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

(Application for copies should be addressed to the ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Electronic copies may be obtained from www.astm.org.)

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

- AATCC 16.2 - Colorfastness to Light: Carbon-Arc
- AATCC 16.3 - Colorfastness to Light: Xenon-Arc
- AATCC 20A - Fiber Analysis: Quantitative
- AATCC 61 - Colorfastness to Laundering: Accelerated

- AATCC 81 - pH of the Water-Extract from Wet Processed Textiles
 - AATCC 132 - Colorfastness to Drycleaning
 - AATCC 192 - Weather Resistance of Textiles: Sunshine-Arc Lamp Exposure with and without Wetting
- AATCC Evaluation Procedures:

- 1 Gray Scale for Color Change
- 2 Gray Scale for Staining
- 8 AATCC 9-Step Chromatic Transference Scale
- 9 Visual Assessment of Color Difference of Textiles

(Applications for copies should be addressed to the AATCC National Headquarters, P.O. Box 12215, Research Triangle Park, NC 27709-2215. Electronic copies may be obtained from www.aatcc.org.)

PARACHUTE INDUSTRY ASSOCIATION (PIA)

- PIA-STD-905 - IDENTIFICATION: NYLON CORD MANUFACTURERS' COLOR CODE
- PIA-TEST METHOD-3000 - PERCENT SOLIDS ADD-ON FOR CORD, NYLON, CLASS F, DETERMINATION OF
- PIA-TEST METHOD-6004 - LENGTH PER UNIT WEIGHT; CORDAGE
- PIA-TEST METHOD-6016 - STRENGTH AND ELONGATION BREAKING OF CORDAGE; NON-SPLICED METHOD

(Electronic copies may be obtained from www.pia.com.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Government and supply purchases. The requirements specified in 3.12 and 3.13 apply only to cord purchased directly by the Government. All other requirements apply to cord purchased by a contractor as a component for an end item and to cord purchased directly by the Government.

3.2 Standard. The cord shall match the standard for shade and appearance, and shall, unless otherwise indicated, be equal to or better than the standard with respect to all characteristics for which the standard is referenced (see 6.2).

3.2.1 First article. When specified (see 6.1), a sample representative of production quality shall be submitted for first article inspection in accordance with 4.2.

3.3 Materials. The nylon yarn in the manufacture of the cord shall be a bright, high-tenacity, light-resistant, and heat-resistant polyamide prepared from hexamethylene diamine and adipic acid or its derivatives. It shall have a minimum melting point of 244°C (471° F) when tested as specified in 4.3.1. The plied yarns shall be twisted only from the deniers specified in TABLE I. It is encouraged that recycled material be used when practical as long as it meets the requirements of this specification.

3.3.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Processing of yarns.

3.4.1 Core yarns. The core yarns shall be wet shrunk for a minimum of 60 minutes at a temperature of $93 \pm 3^{\circ}\text{C}$ ($200 \pm 5^{\circ}\text{F}$), after which they shall be dried at a temperature not exceeding 93°C (200°F) before manufacture of the core (see 4.3.2). No oil shall be added to this yarn.

3.4.2 Sleeve yarns. Sleeve yarns shall be wet shrunk for a minimum of 30 minutes at a temperature of $71 \pm 3^{\circ}\text{C}$ ($160 \pm 5^{\circ}\text{F}$), after which they shall be dried at a temperature not exceeding 71°C (160°F) before braiding (see 4.3.2). No oil shall be added to this yarn.

3.4.3 Stretching. The yarns used to manufacture the cord shall not be subjected to a stretching operation (see 4.3.2).

3.5 Bleaching. The yarn or the fabricated cord shall not be subjected to any type of bleaching process.

3.6 Construction and physical requirements. The fabricated cord shall conform to the applicable requirements specified in TABLES I and II and the following paragraphs for the respective Types when tested as specified in 4.3.1 and 4.3.4.

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TABLE I Construction.

Dash number	Type		Yarns (denier/ply)	Twist (turns/inch)		Number of core ends	Picks per inch	Number of carriers and ends per carrier
				Single yarn/initial	Plied yarn/final			
-1	I	Core	210/3	7.0-9.5	5-7	4-7	--	--
		Sleeve	70/3	20-24.0	15-19	--	26-28	32/1 or 16/2
-2	IA	Core	--	--	--	--	--	--
		Sleeve	210/3	7.0-9.5	5-7	--	26-28	16/1
-3	II	Core	1050/3 ^{1/}	10-16	6-8	5	--	--
		Sleeve	210/3	7.0-9.5	5-7	--	26-28	32/1 or 36/1
-4	IIA	Core	--	--	--	--	--	--
		Sleeve	210/3	7.0-9.5	5-7	--	26-28	32/1 or 36/1
-5	III	Core	1050/3 ^{1/}	10-16	6-8	7-9	--	--
		Sleeve	210/3	7.0-9.5	5-7	--	26-28	32/1 or 36/1
-6	IV	Core	1050/3 ^{1/}	10-16	6-8	11	--	--
		Sleeve	210/3	7.0-9.5	5-7	--	26-28	32/1, 36/1 or 44/1
-7	II Class F ^{2/}	Core	1050/3 ^{1/}	10-16	6-8	5	--	--
		Sleeve	210/3	7.0-9.5	5-7	--	26-28	32/1 or 36/1
-8	IIA Class F ^{2/}	Core	--	--	--	--	--	--
		Sleeve	210/3	7.0-9.5	5-7	--	26-28	32/1 or 36/1
-9	III Class F ^{2/}	Core	1050/3 ^{1/}	10-16	6-8	7-9	--	--
		Sleeve	210/3	7.0-9.5	5-7	--	26-28	32/1 or 36/1

Notes:

^{1/} As an option, five 210 denier yarns can be plied together for the singles/initial twist to result in a 1050 denier yarn.

Three of these yarns will be plied together for the final/plied twist to result in a final core size of 3150 denier.

^{2/} Class F - Fluorocarbon impregnated (see 1.2).

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TABLE II Physical requirements.

Characteristic	Type I	Type IA	Type II	Type IIA	Type III	Type IV
Breaking strength (pounds), minimum	95	100	400	225	550	750
Elongation (percent), minimum	30	30	30	30	30	30
Length per pound of cord (feet), minimum	950	1050	260	495	225	165
Length per pound of cord with Fluorocarbon treatment (feet), minimum	--	--	240	460	208	--

3.6.1 Lapping of the core ends. Lapping of the core ends or a sewn overlap where two core yarns are held together by the wrapping of thread around them is permissible, providing the overlap is more than 5 inches but does not exceed 10 inches in length. Splicing or knotting of the core lines is not permissible (see 6.3). The minimum distance between a core end overlap or any adjacent core end overlap shall be 100 feet.

3.6.1.1 Protruding core ends. When any core end projects through the sleeve as a result of overlapping (see 3.6.1 and 6.3), the end(s) shall be cut flush with the surface of the sleeve with the cord in a relaxed condition. CAUTION: Do not hot knife the end(s) and be extremely careful not to damage the sleeve.

3.6.2 Extractable matter (water-soluble material). No material shall be added for the purpose of weighing the cord. The water-soluble material of the cord shall not exceed 2.0 percent when tested as specified in 4.3.4.

3.6.2.1 pH. The pH of the water extract of the finished cord shall not be lower than 5.5 or higher than 9.0 when tested as specified in TABLE VII.

3.6.3 Nonfibrous materials.

3.6.3.1 Fluorocarbon treatment. The fluorocarbon is to be evenly distributed throughout the treated cordage (Class F). The percent solid add-on for Types II, IIA and III, Class F, Cord, Fibrous, Nylon shall be 5 ± 2 percent by weight when tested as specified in 4.3.4. The fluorocarbon shall be applied from a water dispersion, and when dried, shall form a coating that is evenly deposited and adhered on the yarns of the braided cord. The finish application process shall have no detrimental effect to the physical or chemical properties of the cord. Only approved fluorocarbon shall be used (see 6.5).

3.7 Resistance to light and heat. The nylon cord shall lose not more than 15 percent of its original breaking strength after exposure to light and heat when tested as specified in 4.3.4.

3.8 Color. The color of the cord and referenced color shall be specified in the contract, purchase order or procurement document (see 6.1). When colored cord is specified, the color shall be obtained by yarn dyeing. Color matching is required prior to fluorocarbon application.