



PIA-W-530B
01 December 2011

Superseding
PIA-W-530A
17 February 2000

The following commercial specification is originally 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 by DoD and Industry to reflect technology and design evolution.

WEBBING, TEXTILE, COTTON, GENERAL PURPOSE, NATURAL OR IN COLORS

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 document covers various types of cotton webbing.

1.2 Classification. The webbing shall be of the following types and classes as specified (see 6.1):

- Type II - Medium weight webbing (hard texture)
- Type IIa - Medium weight webbing (soft texture)
- Type IIb - Medium heavyweight webbing
- Type III - Heavyweight webbing
- Type IV - Webbing, special use
- Type V - Webbing, multiple weave
- Type VI - Webbing, special (appliances and wicks)
- Class 1 - Natural
- Class 1a - Natural, water repellent, mildew resistant, Copper-8-quinolinolate in a aqueous bath (see 6.1)
- Class 1b - Currently not available - New treatments in development
- Class 2 - Bleached
- Class 2a - Bleached, water repellent, mildew resistant Copper-8-quinolinolate in a aqueous bath (see 6.1)
- Class 3 - Dyed
- Class 4 - Currently not available - New treatments in development
- Class 7 - Dyed, water repellent, mildew resistant, Copper-8-quinolinolate in a aqueous bath (see 6.1)
- Class 8 - Dyed, water repellent.

2. APPLICABLE DOCUMENTS

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Documents
AVA Document Sharing Hub

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 or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of the 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.

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 20580-001. Electronic copies may also be obtained from 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/.)

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 8 - Colorfastness to Crocking; Crockmeter Method
 AATCC 20A - Fiber Analysis: Quantitative
 AATCC 20 - Fiber Analysis: Qualitative
 AATCC 30 - Mildew and Rot Resistance of Textiles: Fungicides
 AATCC 61 - Colorfastness to Laundering: Accelerated
 AATCC 70 - Water Repellency: Tumble Jar Dynamic Absorption Test
 AATCC 81 - pH of the Water-Extract from Wet Processed Textiles
 AATCC 111A - Weather Resistance of Textiles: Exposure to Daylight and Weather
 AATCC Evaluation Procedures:

- 8 AATCC 9 - Step Chromatic Transference Scale

(Application 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.)

ASTM INTERNATIONAL (ASTM)

ASTM D 1776	- Standard Practice for Conditioning and Testing Textiles
ASTM D 1777	- Standard Test Method for Thickness of Textile Materials
ASTM D 1907	- Standard Test Method for Linear Density of Yarn (Yarn Number) by Skein Method
ASTM D 3775	- Standard Test Method for Warp (End) and Filling (Pick) Count of Woven Fabrics
ASTM D 3776	- Standard Test Methods for Mass Per Unit Area (Weight) of Woven Fabric
ASTM E 478	- Standard Test Methods for Chemical Analysis of Copper Alloys

(Application for copies should be addressed to the ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-259. Electronic copies may be obtained from www.astm.org.)

PARACHUTE INDUSTRY ASSOCIATION (PIA)

PIA-TEST METHOD-4108 - STRENGTH AND ELONGATION, BREAKING;
TEXTILE WEBBING, TAPE AND BRAIDED ITEMS

(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 shall take precedence. Nothing in this document, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Standard. The dyed webbing shall match the standard for shade and appearance and shall be equal to or better than the standard with respect to all characteristics for which the standard is referenced (see 6.2).

3.2 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.

3.2.1 First article. When specified (see 6.1), a sample representative of the production quality shall be submitted for first article inspection in accordance with 4.3.

3.3 Material.

3.3.1 Yarns. The yarns shall be made from cleaned and carded cotton or combed cotton, except that the catch-cord utilized on the shuttleless loom shall be combed peeler cotton yarn or as specified in the applicable TABLE. The yarns shall be spun and twisted into ply yarns as specified in 3.9.

3.4 Color. Webbing shall be unbleached, bleached white, or dyed Olive Drab 7, Camouflage Green 483, black, or other color as specified (see 6.1).

3.4.1 Dyeing. Dyed webbing shall be stock or yarn dyed, except Type IIa, which may be piece dyed. The Type IIb, Class 4, webbing may also be piece dyed (see 3.4.1.1). Except for Type IV, 1-1/4 inch webbing, only those warps of stock or yarn dyed webbing specifically listed as “stuffer warps” may, if properly covered, be undyed. Type IV, 1-1/4 inch webbing “stuffer warps” shall be dyed the same shade as the standard. When webbing conforming to Classes 4, 7 and 8 is required, the shade of the dyed webbing prior to the application of finish shall, unless otherwise specified, match the standard. The shade of the webbing after finishing (Classes 4, 7 and 8) shall be that resulting from the combination of the base shade and the color imparted by the specific finish. Unless specifically authorized by the contracting officer, the use of coloring matter as a component of the finish is not permitted. The dyed webbing shall show good dye penetration and the dye shall be oxidized. The webbing shall be well soaped and washed after dyeing.

3.4.1.1 Piece dye. In addition to the requirements of 3.4.1, the Type IIb, Class 4 webbing, when piece dyed, shall be equal to or better than the piece dyed standard for determination of dye penetration. This shall be done by comparing warp and filling yarns separated from the submitted piece dyed webbing to the warp and filling yarns from the piece dyed standard. The piece dyed submitted webbing shall also be equal to or better than the yarn dyed standard when tested for scrubbing resistance. Testing shall be as specified in 4.4.3.

3.4.2 Labile sulfur. The use of dyes and compounds containing elementary sulfur capable of oxidation to sulfuric acid is prohibited. The dyestuff shall be chosen and applied so that the dyed and finished webbing shall contain no more labile sulfur than shown by the standard when tested as specified in 4.4.3. When a standard is not available, the dyed and finished webbing shall show no more than a slight trace of labile sulfur as defined in the test method specified in 4.4.3.

3.4.3 Visual shade matching. When evaluated in accordance with 4.5.5, the color of the dyed webbing shall match the standard with sources simulating artificial daylight and shall be a good match to the standard sample under incandescent lamplight.

3.4.4 Colorfastness. When tested as specified in 4.4.3, the dyed webbing shall show fastness to weathering, laundering and crocking as follows.

3.4.4.1 Class 3. The Class 3 dyed webbing shall show fastness as follows:

Characteristic	Rating, minimum
Accelerated Weathering ^{1/}	2-3
Crocking: ^{2/} , ^{3/}	
Wet	3.5
Dry	3.5
Laundering (3 cycles), Type IV, 1 ¼ and 1 inch only ^{4/}	3-4

Notes:

^{1/}Rated using AATCC Evaluation Procedure 1, Gray Scale for Color Change.

^{2/}Rated using AATCC Evaluation Procedure 8, AATCC 9-Step Chromatic Transference Scale.

^{3/}Except that colors Vat Black 174 and Dark Blue 1089 shall rate no lower than 1.5.

^{4/}Rated using AATCC Evaluation Procedure 1, Gray Scale for Color Change and AATCC Evaluation Procedure 2, Gray Scale for Staining.

3.4.4.2 Classes 4 and 7. The Classes 4 and 7 dyed and finished webbing shall show fastness as follows:

Characteristic	Rating, minimum
Accelerated Weathering ^{1/}	2-3
Crocking ^{2/}	
Wet	1.5
Dry	1.5

Notes:

^{1/}Rated using AATCC Evaluation Procedure 1, Gray Scale for Color Change.

^{2/}Rated using AATCC Evaluation Procedure 8, AATCC 9-Step Chromatic Transference Scale.

3.4.4.3 Class 8. The Class 8 dyed and finished webbing shall show fastness as follows:

Characteristic	Rating, minimum
Accelerated Weathering ^{1/}	2-3
Crocking ^{2/}	
Wet	3.5
Dry	3.5
Laundering (3 cycles) ^{3/}	3-4

Notes:

^{1/}Rated using AATCC Evaluation Procedure 1, Gray Scale for Color Change.

^{2/}Rated using AATCC Evaluation Procedure 8, AATCC 9-Step Chromatic Transference Scale.

^{3/}Rated using AATCC Evaluation Procedure 1, Gray Scale for Color Change and AATCC Evaluation Procedure 2, Gray Scale for Staining.

3.5 Spectral reflectance for Camouflage Green 483. When color 483 is specified, all finished webbing greater than 1-1/4 inches in width shall meet the spectral reflectance factors (in percent) for the visible/near infrared wavelength range 600 to 860 nanometers (nm) as specified below, when tested as specified in 4.4.3.

TABLE I Spectral reflectance requirements for Camouflage Green 483.

Wavelength (nm)	Reflectance (%)		Wavelength (nm)	Reflectance (%)	
	Max.	Min.		Max.	Min.
600	10	4	740	40	14
620	10	4	760	49	18
640	11	4	780	55	23
660	13	4	800	60	29
680	15	4	820	64	34
700	20	6	840	67	39
720	30	9	860	69	45

3.6 Nonfibrous materials. The starch and protein content, including chloroform-soluble and water-soluble materials, of Types II, IIa, IIb, III and V webbing shall not exceed 5.0 percent and Type VI shall not exceed 3.0 percent, when tested as specified in 4.4.3. For treated webbing, determination shall be made after dyeing and prior to application of the finish.

3.7 Finish. When specified (see 6.1), the webbing shall be treated for resistance to mildew, water, or combination thereof.

3.7.1 Water repellency. Classes 1a, 2a, 7, and 8 webbing shall be given one of the following water-repellent treatments. The water repellent shall consist of aluminum salts of saturated carboxylic acid (such as formate, acetate, palmitate, or stearate), zirconium salts of such saturated carboxylic acids, or a combination of both mixed with refined mineral and vegetable waxes, titanate esters, or a combination of both. The water repellent shall be applied either in the form of an aqueous emulsion or in the form of a water-free solvent solution. The dynamic absorption of the treated material shall be no more than 40 percent when tested as specified in 4.4.3.

3.7.2 Mildew inhibitors.

3.7.2.1 Copper-8-quinolinolate in an aqueous bath. Classes 1a, 2a and 7 webbings shall be treated for mildew resistance by evenly depositing, within the webbing, a minimum of 0.13 percent to a maximum of 0.40 percent copper as metal from Copper-8-quinolinolate in an aqueous bath using the method of application specified in 3.7.2.1.1. The test for copper content shall be as specified in 4.4.3.

3.7.2.1.1 Application. The method of application shall be a one-bath or approved aqueous (see 6.4) process containing a solubilized form of Copper-8-quinolinolate. The finished webbing shall be free from residual solvent.

3.8 pH. The pH value of the water extract of Classes 1a, 2a, 7 and 8 shall be not less than 5.5 nor more than 9.0 when tested as specified in 4.4.3.

3.9 Physical requirements. The physical requirements of the unfinished (not treated) and finished webbing shall be as shown in TABLES II to VIII inclusive. Webbings shall be furnished in the widths shown in TABLES II to VIII inclusive, as specified (see 6.1). The tolerances in width for webbing (except Type IV, 1 inch and 1-1/4 inches webbing) TABLES II to VI inclusive, shall be -1/32 and +1/16 inch for webbing up to and including 1-1/2 inches in width; $\pm 1/16$ inch for webbing over 1-1/2 inches and up to and including 2-3/4 inches; and $\pm 3/32$ inch for webbing over 2-3/4 inches in width. The Type IV, 1 inch and 1-1/4 inches webbing shall have a width tolerance of $\pm 1/32$ inch.

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TABLE II Physical requirements for Type II, medium weight webbing (hard texture).

		Yarns, minimum		Breaking strength, minimum (pounds)			Yarn sizes (± 5 percent)	
Width (inches)	Weight per linear yard, minimum (ounces)	Full width total warp	Yarns per inch filling ^{1/}	Warp Full width	Per inch	Filling jaws 1 inch apart Per inch	Warp ^{2/}	Filling ^{1/}
3/8	0.20	48	40 or 80	100	-	-	16/2	16/2 or 36/2
1/2	0.32	24	14 or 28	160	-	-	8/4	8/4 or 16/4
5/8	0.40	30	14 or 28	200	-	-	8/4	8/4 or 16/4
3/4	0.48	36	14 or 28	235	-	-	8/4	8/4 or 16/4
1	0.65	48	14 or 28	315	-	-	8/4	8/4 or 16/4
1-1/4	0.81	60	14 or 28	385	-	-	8/4	8/4 or 16/4
1-1/2	0.97	72	14 or 28	460	-	-	8/4	8/4 or 16/4
2	1.30	96	14 or 28	585	-	-	8/4	8/4 or 16/4
2-3/4	1.78	132	14 or 28	760	-	-	8/4	8/4 or 16/4
3	1.95	144	14 or 28	810	-	140	8/4	8/4 or 16/4
3-3/4	2.43	180	14 or 28	-	315	140	8/4	8/4 or 16/4
5	3.25	240	14 or 28	-	315	140	8/4	8/4 or 16/4
5-5/8	3.65	270	14 or 28	-	315	140	8/4	8/4 or 16/4

Notes:

^{1/} 40 yarns per inch (1 yarn per shed) of 16/2 ply, or 80 yarns per inch (2 yarns per shed) of 36/2 ply; 14 yarns per inch (1 yarn per shed) of 8/4 ply or 28 yarns per inch (2 yarns per shed) of 16/4 ply.

^{2/} The catch-cord for the bobbin type edge shall be 24/4 ply combed peeler cotton yarn and 40/2 combed peeler cotton yarn. The color of the catch cord (either type) shall be the color of the webbing for the latch-needle type edge.

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TABLE III Physical requirements for Type IIa, medium weight webbing (soft texture).

		Yarns, minimum full width					Yarn sizes (± 5 percent)		
Weight (inches)	Weight per linear yard, minimum (ounces)	Face and back warp	Binder warp	Stuffer warp	Yarns per inch filling ^{1/}	Breaking strength, minimum (pounds) Warp, full width	Warp except stuffer ^{2/}	Filling ^{1/}	Stuffer warp
3/8	0.25	41	5	10	36 or 72	130	12/2	12/2 or 24/2	8/3
1/2	0.33	47	6	12	36 or 72	160	12/2	12/2 or 24/2	8/3
5/8	0.41	53	7	14	36 or 72	195	12/2	12/2 or 24/2	8/3
3/4	0.49	65	9	18	36 or 72	230	12/2	12/2 or 24/2	8/3
1	0.65	83	12	24	36 or 72	300	12/2	12/2 or 24/2	8/3
1-1/4	0.81	101	15	30	36 or 72	370	12/2	12/2 or 24/2	8/3
1-1/2	0.97	119	18	36	36 or 72	440	12/2	12/2 or 24/2	8/3
2	1.30	155	24	48	36 or 72	580	12/2	12/2 or 24/2	8/3
2-1/4	1.47	173	27	54	36 or 72	645	12/2	12/2 or 24/2	8/3

Notes:

^{1/} 36 yarns per inch (1 yarn per shed) of 12/2 ply or 72 yarns per inch (2 yarns per shed) of 24/2 ply.^{2/} The catch-cord for the bobbin type edge shall be 24/2 ply combed peeler cotton yarn and 40/2 ply combed peeler cotton yarn. The color of the catch-cord (either type) shall be the color of the webbing for the latch-needle type edge.

TABLE IV Physical requirements for Type IIb, medium heavyweight webbing.

		Yarns, minimum full width				Yarn sizes (± 5 percent)	
Width (inches)	Weight per linear yard, minimum (ounces)	Face and back warp	Binder warp	Yarns per inch filling ^{1/}	Breaking strength, minimum (pounds) Warp full width	Warp ^{2/}	Filling ^{1/}
5/8	0.60	49	5	24 or 48	310	8/4	10/3 or 20/3
3/4	0.72	57	6	24 or 48	365	8/4	10/3 or 20/3
1	0.96	73	8	24 or 48	475	8/4	10/3 or 20/3
1-1/4	1.20	89	10	24 or 48	590	8/4	10/3 or 20/3
1-1/2	1.44	105	12	24 or 48	700	8/4	10/3 or 20/3
2	1.92	137	16	24 or 48	925	8/4	10/3 or 20/3
2-1/4	2.25	161	19	24 or 48	1050	8/4	10/3 or 20/3
3	2.88	201	24	24 or 48	1375	8/4	10/3 or 20/3

Notes:

^{1/} 24 yarns per inch (1 yarn per shed) of 10/3 ply or 48 yarns per inch (2 yarns per shed) of 20/3 ply.^{2/} The catch-cord for the bobbin type edge shall be 24/4 ply combed peeler cotton yarn and 40/2 ply combed peeler cotton yarn. The color of the catch-cord (either type) shall be the color of the webbing for the latch-needle type edge.