



UL 1191

Underwriters Laboratories Inc. Standard for Safety

Components for Personal Flotation Devices



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UL Standard for Safety for Components for Personal Flotation Devices, UL 1191

Fourth Edition, Dated December 12, 2008

Summary of Topics

This revision to ANSI/UL 1191 includes a change to the Minimum Gross Weight Tolerance for CO₂ Cylinders.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated July 15, 2011.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

The following table lists the future effective dates with the corresponding reference.

Future Effective Dates	References
February 27, 2012	Paragraphs 31.1.4, 31.1.5, 31.4.5 and 31.7.1



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1

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Standard for Components for Personal Flotation Devices

Previous numbered and unnumbered editions of standards covering components for personal flotation devices have been published since January, 1976.

First Edition – January, 1976
Second Edition – May, 1993
Third Edition – June, 1997

Fourth Edition

December 12, 2008

This ANSI/UL Standard for Safety consists of the Fourth Edition including revisions through August 24, 2011.

The most recent designation of ANSI/UL 1191 as an American National Standard (ANSI) occurred on August 24, 2011. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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CONTENTS

INTRODUCTION

1 Scope	6
2 General	7
2.1 Units of measurement	7
2.2 Use codes	7
2.3 Material	8
2.4 Color	8
3 Definitions	9

THREAD

4 Construction	11
5 Performance	11
6 Marking	12

FABRIC

7 Construction	12
8 Performance	12
8.1 General	12
8.2 Yarn slippage – woven fabric only	12A
8.3 Openness of weave	13
9 Marking	17

WEBBING AND TIE TAPE

10 Construction	17
11 Performance	17
11.1 General	17
11.2 Friction	17
11.3 Flexibility	18
11.4 Strength/slippage	18
11.5 Torsional stiffness	19
12 Marking	22

LACING

13 Construction	22
14 Performance	23
14.1 General	23
14.2 Untieability	23
15 Marking	24

ZIPPERS

16 Construction	24
17 Performance	25
17.1 General	25
17.2 Operability force test	25

17.3 Crosswise strength test	27
18 Marking	28

HARDWARE

19 Webbing Closures and Adjusters	28
19.1 General	28
19.2 Construction	28
19.3 Performance	28
19.4 Marking	32
20 Lacing Closures and Adjusters	33
20.1 General	33
20.2 Construction	34
20.3 Performance	34
20.4 Marking	37
21 Sailboard Harness Hooks	37
21.1 General	37
21.2 Performance	37
21.3 Marking	43
22 Multi-Eyelet Guides	44
22.1 General	44
22.2 Performance	44
22.3 Marking	44

FOAM FLOTATION MATERIAL

23 General	45
24 Performance	47
24.1 Density	47
24.2 Specific buoyancy	48
24.3 Buoyancy retention factors	49
24.4 Tensile strength	52
24.5 Oil resistance	53
24.6 Flexibility	53
24.7 Compression deflection	53
24.8 Dimensional analysis	54
24.9 Thickness	54
25 Marking	55

POLYMERIC ENCLOSURES FOR KAPOK

26 Performance	55
26.1 General	55
26.2 Air-leakage	56
26.3 Cold crack	57
27 Marking	61

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RF WELDED, URETHANE COATED NYLON COMPARTMENT MATERIALS FOR HYBRID AND FULLY INFLATABLE RECREATIONAL PFDs

28 General	61
29 Performance	61
29.1 Breaking load test	61
29.2 Trapezoid tear strength test	64B
29.3 Weight loss	64B
30 Marking	64C

INFLATION SYSTEMS FOR HYBRID AND FULLY INFLATABLE RECREATIONAL PFDs

31 Construction	65
31.1 General	65
31.2 Materials	66
31.3 Oral inflation systems	66
31.4 Actuation and rearming of manual, manual-auto, and automatic inflation systems ...	67
31.5 Means for verification of mechanism operation	68
31.6 Inflation medium and cylinders	68
31.7 Indicators	68
31.8 Window material	69
32 Performance	70
32.1 General	70
32.2 Use characteristics test – automatic, manual-auto, and manual inflation systems ...	71
32.3 Automatic operability test– automatic and manual-auto inflation systems	88
32.4 Conditioning test – cylinder seal indicating cylinders	89
32.5 Manual operability test – manual and manual-auto inflation systems	89
32.6 Operability test – oral systems	90
32.7 Discharge test – automatic, manual-auto, and manual inflation systems	90
32.8 Parallel and perpendicular strength of attachment – automatic, manual-auto, manual, oral inflation systems, and over-pressure relief valve systems	92
32.9 Humid atmosphere test – automatic and manual-auto inflation systems	92
32.10 System durability test – automatic, manual, and manual-auto inflation systems ...	95
32.11 Operability test – over-pressure relief valves	95
32.12 Pull test – automatic, manual-automatic and manual inflation systems, and cylinder seal indicating cylinders	95
32.13 Piercing test – cylinders	95
33 Marking	102

POLYMERIC COATINGS

34 Performance	103
34.1 General	103
34.2 Flexibility	104
34.3 Blocking	104
35 Marking	106

KNITTED FABRIC LAMINATED TO FOAM FLOTATION MATERIAL

36 Performance	106
37 Marking	109

INTRODUCTION

1 Scope

1.1 These requirements cover components intended for use in the manufacturer of personal flotation devices. Compliance with these requirements does not indicate that the product is intended for use as a component of an end product without further investigation. The requirements shall be applied to other components if found to be appropriate.

1.2 The components addressed in this Standard are intended for use in personal flotation devices which comply with the requirements of Underwriters Laboratories Inc., and the United States Coast Guard Subparts of Chapter I, Title 46, Code of Federal Regulations. These include:

a) USCG Subparts 160.002, 160.047, 160.048, 160.049, 160.050, 160.052, 160.053, 160.055, 160.060, 160.064, 160.076, 160.077, 160.150, 160.155, and 160.176.

b) The requirements for:

- 1) Marine Buoyant Devices, UL 1123;
- 2) Buoyant Cushions, UL 1175;
- 3) Buoyant Vests, UL 1177;
- 4) Hybrid Personal Flotation Devices, UL 1517; and
- 5) Fully Inflatable Recreational Personal Flotation Devices, UL 1180.

1.3 These requirements also cover personal flotation device components intended to meet the requirements of the United States Coast Guard Subparts of Chapter I, Title 46, Code of Federal Regulations. These include USCG Subparts 164.019 and 164.023.

1.4 The components addressed in this Standard are not prohibited from being used on devices that comply with other regulations and requirements (other than those tabulated in 1.2) when the component meets the intent of the requirements of Underwriters Laboratories Inc. and the United States Coast Guard.

2 General

2.1 Units of measurement

2.1.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

2.2 Use codes

2.2.1 One or more use codes shall be assigned to each PFD component to show the PFD Type(s) for which it is intended. See Table 2.1.

Table 2.1
Use codes

Use code	Type of PFD for which it is intended
1	I – Inherently Buoyant Adult or Child sizes
1F	I – Fully Inflatables
2	II – Inherently Buoyant Adult or Child sizes
2A	II – Inherently Buoyant Adult sizes only
2C	II – Inherently Buoyant Child sizes only
2F	II – Fully Inflatables
3	III – Inherently Buoyant Adult or Child sizes
3A	III – Inherently Buoyant Adult sizes only
3C	III – Inherently Buoyant Child sizes only
3F	III – Fully Inflatables
4	IV – Any Styles
4B	IV – Any ring buoy
4BC	IV – Buoyant Cushions
4H	IV – Horseshoe buoys
4RB	IV – Recreational ring buoys
5	V – Any styles except Hybrids or work vests
5H	V – Hybrids
5SB	V – Recreational sailboard devices
5R	V – Any recreational style Type V; except Hybrids
5WV	V – Workvest
6	This Use Code is reserved for unique, limited or restricted categories for devices not covered in this Table. When used, the intended application for this Use Code shall be specifically described.

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2.3 Material

2.3.1 Polymeric material shall comply with the regrind requirements specified in the Standard for Polymeric Materials – Fabricated Parts, UL 746D, and is to be determined the same when it is of the same generic type, the same kind and amount of resin, filler, stabilizers or reinforcement as demonstrated by the applicable identification tests.

2.4 Color

2.4.1 When a textile or polymeric product is furnished in a range of colors, samples of each are to be provided for evaluation. Where various colors are evaluated by representative sample(s) of a range of colors, only the representative sample(s) are required to be evaluated.

Table 2.2
Sample conditioning

Exposure	Method
Standard Conditioning SC	Except for textile products (i.e., fabric, webbing, thread, tie tape), the applicable number of samples specified in each section are to be conditioned at $23 \pm 2^\circ\text{C}$ ($73 \pm 4^\circ\text{F}$) and 50 ± 5 percent relative humidity for not less than 24 hours prior to the tests. For textile products, the samples are to be conditioned at $21 \pm 2^\circ\text{C}$ ($70 \pm 4^\circ\text{F}$) and 65 ± 5 percent relative humidity for not less than 24 hours. A different temperature and relative humidity that provides equivalent conditioning is not prohibited from being used.
Natural Accelerated Weathering Nt ₇₅ Nt ₁₃₈	Where Nt ₇₅ or Nt ₁₃₈ exposure is specified, samples are to be exposed to natural weathering of 75 or 138 MJ/m ² of UV radiation below 385 nm, respectively in South Florida (approximately 3 or 6 months) beginning between May 21 and July 21. Unless otherwise specified specimens are to be mounted with the face side (the side normally exposed to sunlight in service) toward the light, open backing, 45° angle, facing south. Condition samples to Standard Conditioning after exposure.
Sunshine Carbon Arc Accelerated Weathering CA ₁₀₀ CA ₃₀₀	Unless otherwise specified, specimens are to be mounted with the face side (the side normally exposed to sunlight in service) toward the light so that the exposed area of each specimen is perpendicular to the light source rays. Condition samples to Standard Conditions after exposure. Where CA ₁₀₀ or CA ₃₀₀ exposure is specified, samples are to be exposed to 100 or 300 hours of light and water exposure, respectively in accordance with Cycle 1 (102 minutes of light/18 minutes of light and water) of the Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials, ASTM G152. The lower arcs are to be No. 15 copper clad carbon. The black panel temperature is to be $68 \pm 5^\circ\text{C}$ ($155 \pm 10^\circ\text{F}$) per Federal Standard 191A, Method 5804. The arcs are to be replaced and the corex D glass cleaned every 24 hours.
Xenon Accelerated Weathering Xe ₅₀₀ Xe ₇₅₀ Xe ₁₃₈₀	Unless otherwise specified, specimens are to be mounted with the face side (the side normally exposed to sunlight in service) toward the light so that the exposed area of each specimen is perpendicular to the light source rays. Condition samples to Standard Conditions after exposure. Where Xe ₅₀₀ or Xe ₇₅₀ or Xe ₁₃₈₀ exposure is specified, samples are to be exposed to 500 or 750 or 1380 KJ/ (m ² · nm) ^{a,b,c} @ 340 nm of Xenon accelerated weathering conditions, respectively in accordance with the following specifications: Irradiance: 0.55 W/m ² at 340 nm Filters: Daylight filters per ISO 4892-2 (if published, or substitute applicable ASTM) Black Panel Temp.: $63 \pm 2^\circ\text{C}$ ($145 \pm 4^\circ\text{F}$) Dry Bulb Temp.: $42 \pm 2^\circ\text{C}$ ($108 \pm 4^\circ\text{F}$) Relative Humidity (light only): 50% Initial Water Temp. ^d : $20 \pm 5^\circ\text{C}$ ($68 \pm 10^\circ\text{F}$) Test Cycle: 102 minutes of light / 18 minutes of light and water spray / 24 minutes dark and water spray
^a 500 KJ/ (m ² · nm) is approximately [0.55 W/(m ² · nm)] · [3600 sec/hr · KJ/ 1000J] · [300 hr machine cycling · 83.3 percent light cycle].	

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Table 2.2 Continued on Next Page

Table 2.2 Continued

Exposure	Method
^b 750 KJ/ (m ² · nm) is approximately [0.55 W/(m ² · nm)] · [3600 sec/hr · KJ/ 1000J] · [450 hr machine cycling · 83.3 percent light cycle].	
^c 1380 KJ/ (m ² · nm) is approximately [0.55 W/(m ² · nm)] · [3600 sec/hr · KJ/ 1000J] · [835 hr machine cycling · 83.3 percent light cycle].	
^d Temperature of source water measured at inlet of test chamber.	

3 Definitions

3.1 For the purpose of this standard, the following definitions apply.

3.2 **COURSE** – In knitted fabrics, the series of successive loops lying crosswise in the fabric, that is, lying at right angles to a line passing through the open throat to the closed end of the loops.

3.3 **CYLINDER SEAL INDICATOR** – A visual display on an inflation system which provides information regarding the status of the seal on an installed cylinder.

3.4 **DESIGN INFLATION RANGE** – The range of buoyancy and pressure, as specified by the manufacturer, to which a compartment is capable of being inflated to provide the intended in-water performance.

3.5 **FILLING** (also referred to as Weft) – In woven fabrics, yarn running from selvage to selvage at right angles to the warp (for knitted fabric see Wale).

3.6 **FILL RATIO** – For inflation medium containers, the weight of the gas charge (in grams) divided by the volume of the inflation medium container (in milliliters).

3.7 **FULL INFLATION** – A chamber or chambers inflated to any value within the design inflation range.

3.8 **INFLATABLE COMPARTMENT** – A container that is inflated by a gas or other medium through an automatic, manual-auto, manual, or oral inflation system.

3.9 **INFLATION SYSTEM** – A means of inflating one or more compartments to make the device buoyant or more buoyant on demand, either actively or passively of the wearer's action, based on its type as follows:

a) **AUTOMATIC INFLATION SYSTEM** – A system that activates to inflate one or more compartments upon immersion in water without any action by the user (a passive system), and which has no provision for manually actuated inflation.

b) **MANUAL-AUTO INFLATION SYSTEM** – A system that activates to inflate one or more compartments upon immersion in water without any action by the user (a passive system), and which also has provision for being activated by a single deliberate user action, such as by the pulling of a lanyard.

c) **MANUAL INFLATION SYSTEM** – A system that inflates one or more compartments when activated by a single deliberate user action, such as by the pulling of a lanyard, and which has no provision for automatically actuated inflation.

d) **ORAL INFLATION SYSTEM** – A means for a user to blow air into a compartment by mouth.

3.10 INITIAL JAW SEPARATION – The distance between the bottom of the top clamp and the top of the bottom clamp of a tensile test machine prior to testing.

3.11 LOT NUMBER – A marking assigned to each group of materials or component produced which incorporates a means of identifying the year and quarter of manufacture (unless provided elsewhere), and provides a means of identifying the production of a particular factory, when a manufacturer produces at more than one factory.

3.12 MULTI-POINT STATUS INDICATOR – A status indicator which utilizes two or more independent visual display points to communicate inflation system readiness.

3.13 SELVAGE – The uncut edge portion of a fabric.

3.14 SERVICEABILITY – The ease with which the inflation system mechanism is properly rearmed. Use Code 1F inflation systems have the most stringent serviceability requirements, with Use Code 2F and 3F systems having correspondingly less stringent requirements.

3.15 SERVICEABLE – Capable of continued use (i.e. exhibits no signs of functional deterioration, deformation of hardware, indicators not functional, oral inflation tube blocked or detached, and manual inflator trigger detached).

3.16 SINGLE-POINT STATUS INDICATOR – A status indicator which combines all system checks into a single visual display point to communicate inflation system readiness.

3.17 STATUS INDICATOR – The part or parts of an inflation system which provide user feedback to assist in keeping an inflatable PFD in an armed and ready condition. Use Code 1F inflation systems have the most stringent status indicator user recognition requirements, with Use Code 2F and 3F systems having correspondingly less stringent requirements.

3.18 WALE – In knitted fabrics, a column of loops in successive courses. The column is parallel to the loop axes.

3.19 WARP – In a woven fabric, the yarn running lengthwise, parallel to the selvage (for knitted fabrics see Course).

THREAD

4 Construction

4.1 Thread shall not contain cotton or be monofilament.

5 Performance

5.1 Thread shall comply with the requirements specified in Table 5.1 and United States Coast Guard Subpart 164.023 of Chapter 1, Title 46, Code of Federal Regulations – Thread for Personal Flotation Devices.

Table 5.1
Thread

Table 5.1 revised February 19, 2010

Tests	Exposure ^a	Test methods	Number of samples ^b	Sample size ^c inch (mm)	Use Codes ^d	Compliance criteria pounds-force (N)
Single Strand Breaking Strength	1. SC 2a. Xe ₅₀₀ or CA ₁₀₀ 2b. Xe ₇₅₀ or CA ₃₀₀ or Nt ₇₅₀	ASTM D204-93	5 for each separate exposure	36 (914)	All except 4B and 4H	Exposure 1 Average ≥ 5.7 (25)
					4B and 4H	Exposure 1 Average ≥ 36 (160)
					All except 1F, 2F, 3F and 5H	Exposure 2a Average ≥ 60 percent of exposure 1 strength, or Exposure 2b Average ≥ 40 percent of exposure 1 strength
					All except 4B and 4H	Exposure 2a or 2b Average ≥ 5.1 (23)
					1F, 2F, 3F and 5H	Exposure 2b Average ≥ 40 percent of exposure 1 strength
Loop Breaking Strength	SC	See 5.2	5 (each consisting of two pieces)	14 (356)	All except 4B and 4H	Average ≥ 10 (44)
					4B and 4H	Average ≥ 60 (267)
^a See Table 2.2 for conditioning details. ^b Color dependent. See 2.4. ^c Minimum 150 linear yards (140 m) for both lightest and darkest. ^d See Table 2.1 for an explanation of Use Code designations.						

5.2 For the loop breaking strength test, the test machine described in the Standard Methods of Testing Sewn Threads, ASTM-93 is to be used. Both ends of one piece are to be secured in one clamp of the testing machine so that the length of the loop equals one-half the total length between the jaws. One end

of the second piece is to be passed through the loop formed by the first, and both ends of the second piece are to be secured in the other clamp of the machine. The clamps are to be separated at a rate of 12 ± 0.5 inches per minute (305 ± 12.7 mm per minute).

6 Marking

6.1 Each spool of thread and each shipping label shall be permanently and clearly marked with the following information in a color which contrasts with the color of the surface on which the marking is to be applied:

- a) The manufacturer's name, tradename, or symbol;
- b) The style (model) number of the thread;
- c) The size of the thread, unless a unique style (model) number is provided for each size;
- d) The lot number of the thread; and
- e) Use Code(s).

FABRIC

7 Construction

7.1 Fabric used as drainage material in a structural application (for example, when removed, the device does not function as intended) shall comply with all of the applicable fabric requirements for the specific PFD for which it is intended.

8 Performance

8.1 General

8.1.1 Fabric shall comply with the acceptance criteria specified in Table 8.1 when subjected to the tests in this Section.

8.1.2 Separate samples are to be used for each different conditioning exposure.

8.2 Yarn slippage – woven fabric only

8.2.1 The warp samples specified in Table 8.1 are to be cut with the long dimension parallel to the warp yarns and filling samples are to be cut with the long dimension parallel to the filling yarns. No two warp samples are to contain the same warp yarns and no two filling samples are to contain the same filling yarns. No sample is to include selvage.

8.2.2 The narrow end of the sample is to be inserted approximately 1/4 inch (6.35 mm) into the nine-hole chuck illustrated in Figure 8.1 and centered. A nine-needle bit is to be aligned with the holes in the chuck so that the smooth side of the needles faces the 1/4 inch (6.35 mm) edge of the sample. The needles are to be forced through the fabric past the scarf joint so that the fabric lays against the blade of the needles.

8.2.3 The tensile machine is to be a Constant-Rate-of-Traverse (CRT) or Constant-Rate-of-Extension (CRE). The tensile machine is to be equipped with clamps having front jaws 1 x 1 inches (25.4 mm x 25.4 mm) and back jaws 1 x 1.5 inches (25.4 mm x 38.1 mm) or wider. The nine-hole chuck is to be centered and clamped in the upper jaws of the machine so the sample hangs lengthwise. The holes in the chuck are to be perpendicular to the direction of pull. The fabric is to be clamped to the lower jaws of the machine. Separation between the holes in the chuck and the top of the jaws is to be 2.5 inches (63.5 mm). The yarns are to be parallel to the direction of pull. The jaws are then to be separated at a rate of 12 ± 0.5 inches (305 ± 12.7 mm) per minute. The maximum force required to cause rupture is to be recorded.

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8.3 Openness of weave

8.3.1 The openness of weave, see Table 8.1, is to be determined using a full width sample at least 1 yard (0.9 m) long. Five separate measurements are to be taken across the width of the roll. For each measurement a 1 inch square (645 mm²) is to be marked on the fabric. No measurement is to be within 1 inch (25.4 mm) of the selvage edge.

8.3.2 In the area of the marked fabric material, the size of each opening is to be measured using an optical comparator with a magnification sufficient to determine the size of each opening (i.e. 5X). Openings on the edge of a 1 inch square are to be counted as one whole opening only when more than 1/2 of the opening is inside the marked square. The openness of the weave is to be calculated as follows:

$$O_w = 100 \sum_{i=1}^N \frac{T_A}{N \times 1 \text{ inch}^2}$$

In which:

O_w = Openness of Weave

N = Number of 1 inch squares

T_A = Total Area of all opening (inch²)

Table 8.1
Fabric

Tests	Exposure ^a	Number of samples ^b	Sample size ^c inch (mm)	Use Codes ^d	Compliance criteria pounds-force N)
Breaking Load (Woven fabrics only) per ASTM D5034-90 (G-E or G-T)	1. SC 2a. Xe ₅₀₀ 2b. Xe ₇₅₀ or Nt ₇₅ 3. 70 hours immersion in ASTM Ref. Fuel B. 4. 70 hours immersion in IRM 902 (Calumet Oil No. 2). 5. 70 hours immersion in 0.5 percent per volume AATCC 2003 Standard Reference Liquid Detergent, by volume, in no greater than "1" hardness water.	5 warp and 5 fill for each separate exposure ^e	4 x 6 (102 x 152) ^e	2, 3, 4BC and 5R	Exposure 1 Average ≥ 70 (311) in each direction
				1, 1F, 2F, 3F, 4, 4B, 4H, 4RB, 5, 5H, and 5WV	Exposure 1 Average ≥ 90 (400) in each direction
				2, 3, 4BC and 5R	Exposure 2a Average ≥ 40 (178) in each direction, or Exposure 2b

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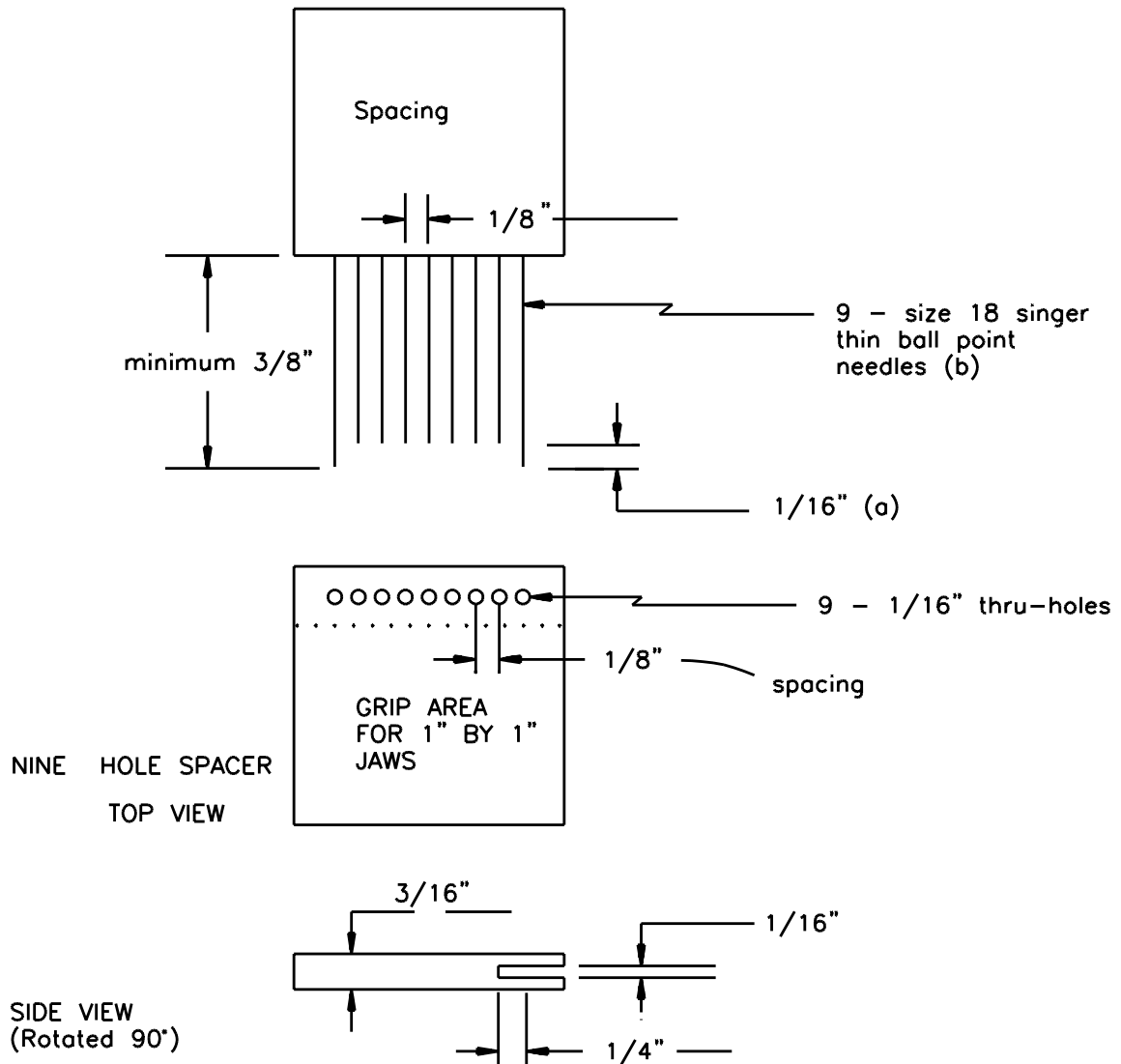
Table 8.1 Continued

Tests	Exposure ^a	Number of samples ^b	Sample size ^c inch (mm)	Use Codes ^d	Compliance criteria pounds-force N)
					Average ≥ 25 (111) in each direction
				1, 1F, 2F, 3F, 4, 4B, 4H, 4RB, 5, 5H and 5WV	Exposure 2a Average ≥ 60 (267) in each direction, or Exposure 2b Average ≥ 40 (178) in each direction
				3, 4, 4BC, and 5R	Exposure 3 through 5 Average ≥ 70 (311)
				1, 1F, 2F, 3F, 4, 4B, 4H, 4RB, 5, 5H and 5WV	Exposure 3 through 5 Average ≥ 90 (400) Average ≥ 60 percent of exposure 1 strength
Ball Burst (knitted fabrics only) per ASTM D3787	Same as Breaking Load (Woven fabrics)	10 for each separate exposure	5 x 5 (127 x 127)	All	Exposure 1, and 3 – 5 Average ≥ 130 (578)
				2, 3, 4BC, and 5R	Exposure 2a Average ≥ 130 (578), or Exposure 2b Average ≥ 46 (205)
				1, 1F, 2F, 3F, 4, 4B, 4H, 4RB, 5, 5H, and 5WV	Exposure 2a Average ≥ 130 (578), or Exposure 2b Average ≥ 74 (329)
Tearing Strength (woven fabrics only) per FTMS 191a, Method 5134	SC	5 warp and 5 fill ^f	3 x 8 (76 x 203)	2, 3, 4BC, and 5R	Average ≥ 6.0 (26.7) in each direction
				1, 1F, 2F, 3F, 4, 4B, 4H, 4RB, 5, 5H, and 5WV	Average ≥ 8.5 (37.8) in each direction
Yarn Slippage (Woven Fabric only) per nine needle apparatus test (See 8.2)	SC	5 warp and 5 fill	4 x 6 (102 x 152)	All	Average ≥ 50 (220) in each direction
Openness of Weave ^g (See 8.3)	SC	5	1 linear yard Full width	All	Shall not exceed 20 percent.
Adhesion Strength ^f per FED-STD 601 Method 8211 or FED-STD 191A Method 5950	SC	2 warp and 2 fill	2 x 8 (51 x 203) or 3 x 8 (76 x 203)	All	Shall be at least 4 pounds per inch (18).
^a See Table 2.2 for conditioning details. ^b Color dependent. See 2.4. ^c Minimum 5 linear yards (4.5 m) for both lightest and darkest colors. ^d See Table 2.1 for an explanation of Use Code designations.					

Table 8.1 Continued

Tests	Exposure ^a	Number of samples ^b	Sample size ^c inch (mm)	Use Codes ^d	Compliance criteria pounds-force N)
^e Sample requirements determined based on exposure facilities, number of fabric colors needing to be evaluated, and sample requirements for accelerated weathering correlation of natural weathering results. ^f Applies only to coated fabric with a coating of 5.5 oz/yd ² or more and where the base fabric or scrim does not comply with the applicable strength requirements when fabric is uncoated. ^g Applies to external cover fabrics only. Does not apply to gusset, lining, or drainage fabric.					

Figure 8.1
Nine needle apparatus



SM443

Notes:

(a) This spacing is optional. All needles are able to extend the same distance.

(b) The needles used have a conventional cylindrical profile (not U-bladed) and standard scarf. The grooves of the needles all face in the same direction perpendicular to the plane formed by the nine needles.

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9 Marking

9.1 Each shipping label shall be clearly and permanently marked in a color which contrasts with a color of the surface on which the marking is applied, with the following:

- a) Recognized company name, or tradename, or symbol;
- b) Style designation;
- c) Lot number; and
- d) One or more of the Use Code(s) specified for the product.

WEBBING AND TIE TAPE

10 Construction

10.1 Webbing shall be nominally 3/4 inch (19 mm) wide or wider for Use Codes 2C and 3C, nominally 2 inches (50.8 mm) wide or wider for Use Codes 4RB and 4B, and nominally 1 inch (25.4 mm) wide or wider for all other Use Codes.

10.2 Tie tape shall be nominally 1 inch (25.4 mm) wide or wider for Use Codes 1 and 1F and nominally 3/4 inch (19 mm) wide or wider for all other Use Codes.

11 Performance

11.1 General

11.1.1 Webbing and tie tape shall comply with the acceptance criteria specified in Tables 11.1 and 11.2, respectively, when subjected to the tests therein.

11.2 Friction

11.2.1 Three samples each consisting of one 10 inch (254 mm) long piece and two 5 inch (127 mm) long pieces as specified in Table 11.2, are to be used. Each 10 inch sample is to be centered between the two 5 inch samples to form a 90 degree cross. A 35 pound (16 kg) dead weight is to be placed on the intersection of the three pieces. A metal guide is then to be placed on top of this assembly. At the point of contact, the cross sectional area of the weight is to be approximately 1 square inch (645.2 mm²). The guide is constructed to:

- a) Hold the 5 inch (127 mm) pieces rigidly in place 2 inches (51 mm) on each side of the intersection; and
- b) Maintain the dead load weight directly over the intersection during the test. A force gauge is to be clamped to an end of the 10 inch (254 mm) piece.

The force required to initiate slippage of the 10 inch (254 mm) piece between the two 5 inch (127 mm) pieces under the 35 pound (16 kg) load is to be recorded.

11.3 Flexibility

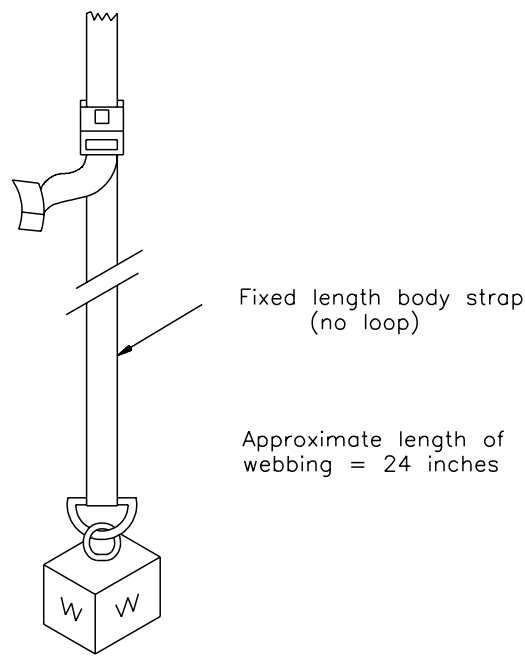
11.3.1 Each sample specified in Table 11.2, as applicable, is to be secured between two, 1/2 inch (12.7 mm) wide metal bars so that the cut edges of the sample are flush with the bottom edge of the bars to form a loop around the bars at a 90 degree angle to the bars. During this set-up, the sample is not to be creased. The sample is to be positioned vertically and left to hang for 1 minute. The distance from the bottom of the bars to the interior of the bottom of the loop (i.e., the loop length) is to be measured and recorded. The procedure is then to be repeated by taking the webbing out and turning it over. The values, both before and after being turned over are to be used in calculating the average.

11.4 Strength/slippage

11.4.1 A straight line pull on the webbing in combination with a piece of PFD hardware is to be performed. Each sample is to consist of two 24 inch (610 mm) lengths of the webbing and a friction adjusting PFD hardware, such as a buckle, that meets the requirements for the application and Use Codes. Other pieces of hardware, such as a snap hook/Dee rings or slide adjusters are able to be used to extend the conditions of compliance of the webbing.

11.4.2 The lengths of webbing are to be connected to opposite sides of the hardware according to the routing method recommended by the hardware manufacturer (see Figure 11.1). One length of the webbing is to be attached to a hoist and the other is to be attached to a weight in accordance with Table 11.1. A 10 ± 2 pound (4.5 ± 0.9 kg) pre-load is to be applied and the webbing is to be marked at the bottom of the adjustable end of the hardware to allow for measurement of slippage after the test. The remainder of the applicable load specified in Table 11.1 is to be applied for the required duration. The load is then to be removed and the webbing remarked at the bottom of the hardware. The distance between the marks is to be measured to the nearest 1/32 inch (0.8 mm) to determine the extent of slippage.

Figure 11.1
Fixed straight-length method



SM445

11.5 Torsional stiffness

11.5.1 Three samples are to be used.

11.5.2 The samples specified in Table 11.2 are to be laid flat on a hard surface, straight, and not under tension. One end of the sample is to be marked as the reference end. Marks are to be placed on the sample 1-1/4 inches (32 mm) and 36 inches (0.9 m) from the reference end.

11.5.3 The reference end of the sample is to be held in a clamping surface by taking the end of the strip at the reference end and folding it over until the end is even with the mark drawn 1-1/4 inches (32 mm) from the reference end. The reference end is then to be placed in a fabric clamp in accordance with the Test Methods for Breaking Load and Elongation of Textile Fabrics, ASTM D5034-90, centered and perpendicular to the clamp bars.

11.5.4 The end opposite the reference end is to be placed in a clamp. The clamping surface area is 1/2 x 4-1/2 inches (12.7 x 114.3 mm) and the jaws are not padded. The end of the strip is to be placed in the jaws of the clamp so that the 36 inch (0.9 m) mark is even with the outside bottom edge of the larger jaw of the clamp. The distance between the fabric clamp and the upper jaw is to be 34-3/4 inches (882 mm).

11.5.5 The clamp is then to be mounted so that the sample hangs freely down with the clamps parallel to each other.

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11.5.6 The fabric clamp is then to be rotated five complete turns in the clockwise direction and released. The sample is allowed to unwind (counterclockwise), allowed to pass the point of zero twists, and allowed to continue in the counterclockwise direction until it stops winding in the direction momentarily. The time from which the sample was released until the counterclockwise twisting motion first pauses is to be recorded. The clamp is to be returned to its initial position. For tie-tape material that has a unsymmetrical weave, the procedure is then to be repeated with the sample rotated counterclockwise.

Table 11.1
Webbing

Tests	Exposure ^a	Number of samples ^b	Sample size inch (mm)	Use codes ^c	Compliance criteria pounds-force (N)
Breaking Strength per FED-STD 191A Method 4108	1. SC 2a. Xe ₅₀₀ or CA ₁₀₀ 2b. Xe ₇₅₀ or CA ₃₀₀ or Nt ₇₅ 2c. Xe ₁₃₈₀ or Nt ₁₃₈	5 for each separate exposure	48 (1.2 m)	1, 1F, 2F, 3F, 5, 5WV and 5H	Exposures 1 and 2a Average ≥ 400 (1776)
				2, 3 4BC, and 5R	Exposures 1 and 2a Average ≥ 200 (888)
				2C and 3C	Exposures 1 and 2a Average ≥ 115 (511)
				All	Exposures 2a Change in width ≤ 5 percent
				All except 1F, 2F, 3F, 4, 4B, 4H, 4RB, and 5H.	Exposure 2a Average ≥ 60 percent of the exposure 1 strength, or Exposure 2b Average ≥ 40 percent of the exposure 1 strength.
				1F, 2F, 3F, and 5H.	Exposure 2b Average ≥ 40 percent of exposure 1 strength
				4, 4B, 4H, and 4RB	Exposures 1 and 2a Average ≥ 750 lbs (3330 N) per inch of width or Average = 1500 lbs (6670 N) whichever is less Exposure 2a Average ≥ 60 percent of the exposure 1 strength for all widths and colors Exposure 2c Average ≥ 80 percent of the exposure 1 strength for all widths less than 2 inches for all colors except black Exposure 1 Average ≥ 750 lbs (3330 N) per inch of width or Average = 1500 lbs (6670 N) whichever is less Exposure 2a

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Table 11.1 Continued on Next Page

Table 11.1 Continued

Tests	Exposure ^a	Number of samples ^b	Sample size inch (mm)	Use codes ^c	Compliance criteria pounds-force (N)
					Average ≥ 80 percent of the exposure 1 strength for all widths and colors Exposure 2c Average ≥ 80 percent of the exposure 1 strength for all widths less than 2 inches for all colors except black
Strength/Slippage (See 11.4.1 and 11.4.2)	1. SC 2. Xe ₅₀₀ or CA ₁₀₀ 3. 2 minute water soak	5	24 (610)	1, 1F, and 5	Exposures 1 – 3 Slippage ≤1 inch (25 mm) for 10 minutes at 360 (1600)
				2, 3, 4H, and 5R	Exposures 1 – 3 Slippage ≤1 inch (25 mm) for 10 minutes at 150 (666)
				2C and 3C	Exposures 1 – 3 Slippage ≤1 inch (25 mm) for 10 minutes at 115 (511)
				2F, 3F, 5WV, and 5H	Exposures 1 – 3 Slippage ≤1 inch (25 mm) for 10 minutes at 225 (999)

^a See Table 2.2 for conditioning details.
^b Color dependent. See 2.4 (i.e. based on the diffuse reflectance number in FED-STD 595B).
^c See Table 2.1 for an explanation of Use Code designations.
^d Minimum total of 80 linear yards (73 meters) for test program.

Table 11.2
Tie tape

Tests	Exposure ^a	Test method	Number of samples	Sample size ^b inch (mm)	Use codes ^c	Compliance criteria pounds-force (N)
Breaking Load	1. SC 2a. Xe ₅₀₀ or CA ₁₀₀ 2b. Xe ₇₅₀ or CA ₃₀₀ or Nt ₇₅	FED-STD 191A Method 4108;	10 ^{b,c}	54 (1.3 m)	2, 3, and 5R	Exposure 1 Average ≥ 120 (533)
					1, 1F, 2F, 3F, 5 and 5H	Exposure 1 Average ≥ 200 (888)
					All except 1F, 2F, 3F and 5H	Exposure 2a Average ≥ 60 percent of exposure 1 strength, or Exposure 2b Average ≥ 40 percent of exposure 1 strength
					1F, 2F, 3F and 5H	Exposure 2b Average ≥ 40 percent of exposure 1 strength

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Table 11.2 Continued on Next Page



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Table 11.2 Continued

Tests	Exposure ^a	Test method	Number of samples	Sample size ^b inch (mm)	Use codes ^c	Compliance criteria pounds-force (N)
Flexibility	SC	See 11.3.1	3 for each separate test	10 (254)	All	Average ≥ 1.5 inches (38 mm)
Friction	SC	See 11.2.1		3 pieces 10 (254) or 6 pieces 5 (127)	All	Average ≥ 18 (80)
Torsional Stiffness	SC	See 11.5.1 – 11.5.6		40 (1.0 m)	All	Average ≥ 5 seconds
^a See Table 2.2 for conditioning details.						
^b Color dependent. See 2.4.						
^c See Table 2.1 for an explanation of Use Code designations.						

12 Marking

12.1 Each shipping label shall be permanently and clearly marked in a color which contrasts with the color of the surface on which the marking is applied with the following:

- a) Manufacturer's name, tradename, or symbol;
- b) The product's style designation;
- c) The width of the product in inches;
- d) Lot number; and
- e) Use Code(s).

LACING

13 Construction

13.1 Lacing shall be nominally 1/8 inch (3.2 mm) in diameter or nominally 1/4 inch (6.35 mm) wide.

14 Performance

14.1 General

14.1.1 Lacing shall comply with the acceptance criteria specified in Table 14.1 when subjected to the tests therein.

14.2 Untieability

14.2.1 The samples specified in Table 14.1 are to be given to test subjects who are to be instructed to "tie the lacing into a square knot and pull the knot snug." The subjects are then to be instructed to "untie the square knot as quickly as possible." The time to untie the square knot is to be recorded.

Table 14.1
Lacing

Tests	Exposure ^a	Test method	Number of samples ^b	Sample size ^c inch (mm)	Use codes ^d	Compliance criteria pounds-force (N)
Ultimate Breaking Strength	1. SC 2a. Xe ₅₀₀ or CA ₁₀₀ 2b. Xe ₇₅₀ or CA ₃₀₀ or Nt ₇₅	FED-STD 191A Method 4108; except separation 12 ±0.5 inch per minute	5 for each separate conditioning	54 (1.4 m)	2, 2F, 3, 3F, 5, 5H and 5R	Exposure 1 and 2a or 2b Average ≥ 120 (533)
					2, 3, and 5R	Exposure 2a Average ≥ 60 percent of exposure 1 strength, or Exposure 2b Average ≥ 40 percent of exposure 1 strength
					2F, 3F, 5, and 5H	Exposure 2b Average ≥ 40 percent of exposure 1 strength
Untieability	1. Tied and Untied at Standard Conditioning 2. Tied and Untied after 1 Minute Water Soak 3. Tied after Standard Conditioning and Untied after 1 minute Water Soak	See 14.2.1	2	36 (914)	All	Each of the five test subjects shall be able to untie the square knot within 1 minute following exposures 1– 3
^a See Table 2.2 for conditioning details. ^b Color dependent. See 2.4. ^c Minimum of 50 linear yards (45.5 m) ^d See Table 2.1 for an explanation of Use Code designations.						

15 Marking

15.1 Each shipping label used for the smallest carton shipped shall be clearly and permanently marked in a contrasting color with the following:

- a) Manufacturer's name, tradename, or symbol;
- b) The product's style designation;
- c) The width or diameter of the product in inches;
- d) Lot number; and
- e) Use Code(s).

ZIPPERS

16 Construction

16.1 A right-handed zipper shall not be used in a PFD. The handedness of the zipper is determined by which hand holds the separable pin when closing (i.e., initiating) a zipper.

16.2 A thong hole shall be provided on the zipper pull.

16.3 A zipper pull shall be at least 15/16 inches (24 mm) long. Projections (i.e., raised material) on the end of the zipper pull shall be provided to make the zipper pull easier to grasp.

16.4 When the pin is properly seated for closing the zipper, the retainer of a zipper shall engage with the separable pin and the slider shall engage the chain without undue difficulty.

16.5 The slider of the zipper shall be of the automatic locking type.

16.6 For the purpose of these requirements the Definitions of Terms Relating to Zippers, ASTM D2050-87(1992) apply.

17 Performance

17.1 General

17.1.1 Zippers shall comply with the acceptance criteria specified in Table 17.1 when subjected to the tests therein.

17.2 Operability force test

17.2.1 For each set of six samples (see Table 17.1), three are to be used to determine the force required to open the zipper, and three are to be used to determine the force required to close the zipper. Samples for opening force are to be closed for conditioning. Samples for closing force are to be open (separated) for conditioning. Tests are to be conducted on the slider and on the moveable retainer, when provided.

Table 17.1
Zippers

Tests	Exposure ^a	Test method	Number of samples ^{b,c}	Sample size inch (mm)	Use codes ^d	Compliance criteria pounds-force (N)
Operability Force	1. SC	ASTM D2062-93 See 17.2.1.	Six for each separate exposure	6 (152)	2, 3, and 5	Exposures 1, 3 – 7, and 2a or 2b Open and Close Force ≤ 15 (67)
	2a. Xe ₅₀₀ or CA ₁₀₀ 2b. Xe ₇₅₀ or CA ₃₀₀ or Nt ₇₅ 3. 70 hours immersion in ASTM Ref. Fuel B ^g 4. 70 hours immersion in IRM 902 (Calumet Oil No.2) ^g 5. 70 hours immersion in Perchloroethylene ^g 6. 70 hours immersion in 0.5 percent per volume AATCC 2003 Standard Reference Liquid Detergent, by volume, in no greater than "1" hardness water ^g 7. 720 hours of salt spray as specified in ASTM B117-94 ^e				2F, 3F and 5H	Exposures 1 – 7, except 2a Open and Close Force ≤ 15 (67)

Table 17.1 Continued

Tests	Exposure ^a	Test method	Number of samples ^{b,c}	Sample size inch (mm)	Use codes ^d	Compliance criteria pounds-force (N)
Crosswise Strength	Same samples as Operability Force	ASTM D2061-93 except for top of zipper (including slider) and bottom of zipper (for moveable retainer) See 17.3.2	The samples used in the Operability Force Tests.	6 (152)	2, 2F, 3, 3F, 5 and 5H	Exposures 1 – 7, except 2b Average ≥ 50 (222) for the top (including slider) and the chain (crosswise). Average ≥ 30 (133) for the separating unit (crosswise).
					2, 2F, 3, 3F, 5 and 5H	Exposures 2a – 7, except 2b Average ≥ 60 percent of exposure 1 strength
					2F, 3F, and 5H	Exposure 2b Average ≥ 40 percent of exposure 1 strength
Resistance to Pull-Off of Slider Pull	SC	ASTM D2061-93	3	6 (152)	2, 2F, 3, 3F, 5, and 5H.	The pull-and-slider zipper assembly shall not dislodge when subjected to a force of 40 (177).
Resistance to Twist of Pull and Slider	SC	ASTM D2061-93	4 (2 for each direction)	6 (152)	2, 2F, 3, 3F, 5, and 5H.	The pull and slider shall resist a force of 7 lbf-in (0.79 N·m) torsional stress without significant deformation or rupture.
Holding Strength of Slider Lock	SC	ASTM D2061-93	3	6 (152)	2, 2F, 3, 3F, 5, and 5H.	The locking mechanism shall remain locked when subjected to a force of 5 (22) and the slider shall be operable following the test .
^a See Table 2.2 and 17.2.1 for conditioning details. ^b Color dependent. See 2.4 ^c Minimum of 75 (6 inch) zippers for both the lightest and darkest colors. ^d See Table 2.1 for an explanation of the Use Code designations ^e Applies to zippers employing metallic parts; except certified AISI 300 or 400 series stainless steel or equivalent corrosion resistant metals. ^f Mount each of 3 samples vertically so the top of sample 1, the center of chain of sample 2, and the bottom of sample 3 are in the same plane as the horizontal centerline of the source of radiation. The outer side of the samples is to face the arcs. See 17.2.1. ^g Samples are to be blotted dry to remove surface moisture and are to rest for 30 minutes at ambient room temperature prior to the operability force and strength tests.						

17.3 Crosswise strength test

17.3.1 The same samples subjected to the operability force test are to be used. The zippers are to be closed for these tests.

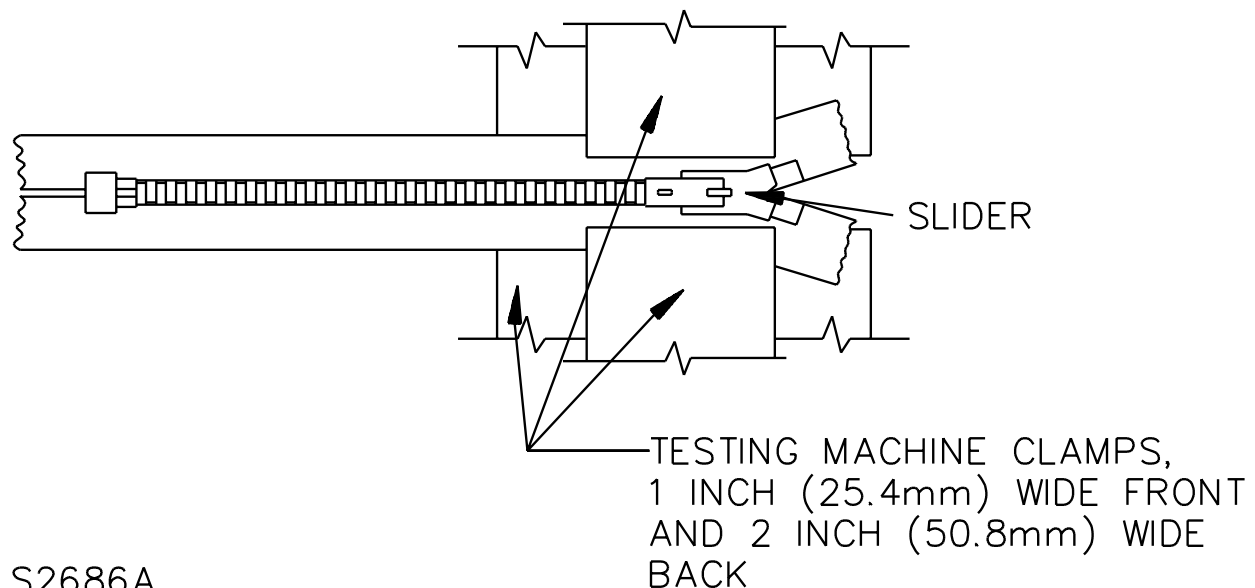
17.3.2 The following tests are to be conducted in accordance with the Methods for Strength Tests for Zippers, ASTM D2061-93:

- a) For the chain (crosswise); and
- b) For a separating unit (crosswise), or for a bottom stop holding (crosswise).

17.3.3 The test described in 17.3.4 is to be conducted for the test at the top of the zipper including slider, and for the test at the bottom of the zipper when a moveable retainer (second slider) is used.

17.3.4 The apparatus used for the strength test at the top of the zipper including the slider, and for the test at the bottom of the zipper when a moveable retainer (second slider) is used, is to be as described in the Test Methods for Strength Tests for Zippers, ASTM D2061-93. The tapes of each zipper are to be mounted in the clamps of the tension machine as illustrated in Figure 17.1 with the edges of the jaws parallel to, and approximately 1/8 inch (3 mm) from the sides of the slider. The slides are to be positioned so that the exposed end of the slider is aligned with the sides of the front jaws as illustrated in Figure 17.1. The load is to be applied until the slider comes apart, until the tape breaks or until some other kind of malfunction occurs. The maximum load to obtain rupture is to be recorded.

Figure 17.1
Crosswise strength test top (including slider)



18 Marking

18.1 Each shipping label shall be permanently and clearly marked with the following in a color that contrasts with the color of the surface on which the marking is applied:

- a) Manufacturer's name, tradename, or symbol;
- b) Model number;
- c) Lot number; and
- d) Use Code(s).

18.2 Each zipper slider or pull shall be marked with the manufacturer's name, tradename, or symbol.

HARDWARE

19 Webbing Closures and Adjusters

19.1 General

19.1.1 Closures and adjusters, such as buckles, slide adjusters, snaphooks, Dee rings, and hook and eye clasps shall comply with the compliance criteria specified in Table 19.2 when subjected to the tests therein.

19.2 Construction

19.2.1 A closure or adjuster shall be constructed to accommodate webbing in one of the following nominal widths: 3/4, 1, 1-1/4, 1-1/2, or 2 inches (19, 25, 32, 38, or 51 mm).

19.2.2 For Use Codes, 1, 2, 3, 1F, 2F, 3F, 2C, and 3C, the primary webbing closure hardware shall have a quick and positive lock mechanism.

19.3 Performance

19.3.1 Ultimate breaking strength

19.3.1.1 Each assembly is to consist of the conditioned sample with two lengths of 6 inches (152.4 mm) of unconditioned Type II webbing with specifications in accordance with Table 19.1 attached as they are for use.

19.3.1.2 The tester used is to be a constant-rate-of-extension Tensile Test machine as described in the Specification for Tensile Testing Machines for Textiles, ASTM D76-93 with a rate-of-extension of 12 ± 0.5 inch (305 ± 12.7 mm) per minute. The front and back jaws of the clamps are to be at least as wide as the webbing being used on the samples. The gage length shall be $2 + 1/4, -0$ inches (51 +6.3, -0 mm) longer than the length of the sample being tested.

19.3.1.3 The sample is to be mounted in the tensile machine by securing each length of webbing in opposite clamps so that the sample is centered between the clamps both vertically and horizontally. For the end of the sample in which friction adjustment of the webbing is possible, only the end of that piece of webbing which results in the binding of the webbing to the hardware when under load is to be secured to the clamps. The clamps are to be separated until breakage, disengagement, webbing slippage in excess of 3 inches (76.2 mm) or similar condition occurs. The maximum value (breaking load) to result in failure is to be recorded.

Table 19.1
Webbing specifications for breaking strength test

Type I webbing: 840 denier polypropylene					
Width (inches)					
	3/4	1	1-1/4	1-1/2	2
Ends (±2)	58	84	106	125	168
Binders (±2)	10	13	16	20	26
Picks (±2)	18	20	20	20	20
Weight (±0.2 lbs/100 yds)	2.0	3.0	3.7	4.5	5.8
Type II webbing: 1680 denier polypropylene for warp and binders. 840 denier polypropylene for picks.					
Width (inches)					
	3/4	1	1-1/4	1-1/2	2
Ends (±2)	45	60	70	80	110
Binders (±2)	10	13	16	20	25
Picks (±2)	24	24	24	24	24
Weight (±0.2 lbs/100 yds)	3.5	4.0	5.25	8.25	8.75

19.3.2 Strength/slippage

19.3.2.1 A straight line pull on the PFD hardware in combination with webbing is to be performed. This test is to be conducted with both Type I and II webbing; except for the highest percent loss conditioning identified in the Ultimate Breaking Strength Test for which only unconditioned Type II webbing is to be used. Each sample is to consist of two 24 inch (610 mm) lengths of webbing and the PFD hardware. Other webbings are able to be used to extend the conditions of compliance of the hardware.

19.3.2.2 The lengths of webbing are to be connected to opposite sides of the hardware according to the routing method recommended by the hardware manufacturer (see Figure 19.1). One length of the webbing is to be attached to a hoist and the other is to be attached to a weight in accordance with Table 19.2. A 10 ±2 pound (4.5 ±0.9 kg) pre-load is to be applied and the webbing is to be marked at the bottom of the adjustable end of the hardware to allow for measurement of slippage after the test. The remainder of the applicable load specified in Table 19.2 is to be applied for the required duration. The load is then to be removed and the webbing remarked at the bottom of the hardware. The distance between the marks is to be measured to the nearest 1/32 inch (0.8 mm) to determine the extent of slippage.

Table 19.2
Webbing closures and adjusters

Tests	Exposure ^a	Test method	Number of samples ^{b,c}	Use code ^d	Compliance criteria pounds-force (N)
Ultimate Breaking Strength	1. SC 2a. Xe ₅₀₀ or CA ₁₀₀ ^g 2b. Xe ₇₅₀ or CA ₃₀₀ or Nt ₇₅ ^g 3. 70 hours immersion in ASTM Ref. Fuel B ^e 4. 70 hours immersion in IRM 902 (Calumet Oil No. 2) ^e 5. 70 hours immersion in Perchloroethylene ^e 6. 70 hours immersion in 0.5 percent per volume AATCC 2003 Standard Reference Liquid Detergent, by volume, in no greater than "1" hardness water ^e 7. 70 ±2°C (158 ±40F) for 7 days ^e . 8. -30 ±2°C (-22 ±40F) for 24 hours. ⁱ 9. 720 hours of Salt Spray as specified in ASTM B117-94. ^f 10. Fatigue ^j	19.3.1.1 – 19.3.1.3	5 for each separate conditioning	1, 1F, and 5	Exposures 1 – 10, except 2b Minimum ≥ 360 (1600)
				2F, 3F, 5WV, and 5H	Exposures 1 – 10, except 2b Minimum ≥ 225 (1000)
				2, 3, 4H, and 5R	Exposure 1 Minimum ≥ 200 (888)
				2C and 3C	Exposures 1 – 10, except 2b Minimum ≥ 115 (511)
				2, 3, 4H, and 5R	Exposures 2a – 10, except 2b Minimum ≥ 150 (666)
				All except 1F, 2F, 3F, and 5H	Exposure 2a Average ≥ 60 percent of exposure 1, or Exposure 2b Average ≥ 40 percent of exposure 1.
				All	Exposures 3 – 10 Average ≥ 60 percent of exposure 1.
				1F, 2F, 3F, and 5H	Exposure 2b Average ≥ 40 percent of exposure 1.
Strength/Slippage	1. SC 2. 2 minute water soak ^k 3. Highest percent loss conditioning from the Ultimate Breaking Strength Test ^h	19.3.2.1 and 19.3.2.2	5 for each separate exposure each for webbing Type I and II. See Table 19.1 for webbing types.		Exposures 1 – 3 Shall support without breaking, distorting, or slipping more than 1 inch (25.4 mm) for the following weights for 10 minutes using the fixed-straight-length body strap method. The load is to be doubled for the closed-loop assembly method:
				1, 1F, and 5	360 (1600)
				2F, 3F, 5WV, and 5H	225 (1000)
				2, 3, 4H, and 5R	150 (666)

Table 19.2 Continued

Tests	Exposure ^a	Test method	Number of samples ^{b,c}	Use code ^d	Compliance criteria pounds-force (N)
				2C and 3C	115 (511)
Inadvertent Release Test (Dual-tab closures only)	SC	19.3.3.1 and 19.3.3.2	5	1, 1F, 2, 2F, 2C, 3, 3F, 3C, 4H, 5, 5WV, 5H, and 5R	Each sample shall support for 5 minutes without breaking, disengagement, or similar condition, a load of at least 1/2 the minimum breaking strength specified for exposure 1 in the Ultimate Breaking Strength Test using webbing Type II.

^a See Table 2.2 for conditioning details.

^b Color dependent. See 2.4.

^c For polymeric hardware, a minimum of 75 hardware/webbing Type II assemblies and 10 hardware/webbing Type I assemblies (including 5 extra). For metal hardware, 30 hardware/webbing Type II assemblies.

^d See Table 2.1 for an explanation of Use Code designations

^e Samples are to be blotted dry to remove surface moisture and are to rest for 30 minutes at ambient room temperature prior to the strength test.

^f Metallic hardware only. Not applicable to certified AISI 300 or 400 series stainless steel or equivalent corrosion resistant materials.

^g Each sample is to be routed with webbing. Mount each sample vertically, unbuckled, so the center of the sample is in the same plane as the horizontal centerline of the source of normal radiation. The outside face of the samples is to face the arcs. Replace webbing before testing.

^h The conditioning (1 – 10) that results in the highest loss in breaking strength for the average of 5 samples, when compared to the corresponding strength of the same group of 5 samples from Standard Conditioning.

ⁱ Immediately following removal from the cold chamber, the samples are to be dropped using different orientations onto a concrete floor five times from a height of 6 feet (1.8 m). Each sample is then to be manually operated five times and then examined for signs of cracking. The samples are then to be returned to the cold chamber for 15 minutes. The samples are then to be individually removed and subjected to the Ultimate Breaking Strength Test and Strength/Slippage Test.

^j Each flexible or moveable tab of polymeric part is to be mechanically operated 5000 cycles at a rate of 40 to 60 cycles per minute. The tab is to be completely engaged/disengaged. Also, for hardware which is designed to separate into two parts (i.e., buckles), the parts are to be completely engaged/disengaged. In addition, the samples are to be manually operated 5 times prior to the Ultimate Breaking Strength Test and Strength/Slippage Test.

^k The webbing which is used for the applicable tests in 19.3.1 is to be soaked in fresh water for 2 minutes prior to the Strength/Slippage Test.

19.3.3 Inadvertent release test – dual-tab closures

19.3.3.1 With one tab depressed, the samples shall comply with the compliance criteria specified in Table 19.2.

19.3.3.2 The Type II webbing assembly and test method are to be as described for the Fixed Length Body Strap test method specified in 19.3.2.1 (see Figure 19.1); except one tab is to be depressed. A 5 ± 1 pound pre-load is to be applied to each closure so that when the release tab is depressed it does not slip back into the locked position. The remaining load is then to be applied.

19.4 Marking

19.4.1 Each shipping carton label for all devices shall be permanently and clearly marked in a color which contrasts with the color of the surface on which the markings are applied with the following:

- a) Manufacturer's name, tradename, or symbol;
- b) Model number;
- c) Lot Number; and
- d) Use Code(s).

19.4.2 Each singular polymeric hardware device (i.e., one physical piece such as a slide) shall be permanently marked with the following:

- a) Manufacturer's name, tradename, or symbol; and
- b) Model number.