



# UL 1180

## STANDARD FOR SAFETY

### Fully Inflatable Recreational Personal Flotation Devices

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UL Standard for Safety for Fully Inflatable Recreational Personal Flotation Devices, UL 1180

Second Edition, Dated February 13, 2009

### **Summary of Topics**

***This revision to ANSI/UL 1180 dated May 27, 2021 includes the removal of Low Mark requirements for Type III Inflatables; [24.4](#), [24.5](#) and [SA6.4.2](#)***

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.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated March 26, 2021.

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ANSI/UL 1180-2021

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## UL 1180

### Standard for Fully Inflatable Recreational Personal Flotation Devices

First Edition – May, 1995

#### Second Edition

February 13, 2009

This ANSI/UL Standard for Safety consists of the Second Edition including revisions through May 27, 2021.

The most recent designation of ANSI/UL 1180 as an American National Standard (ANSI) occurred on May 27, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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 <https://csds.ul.com>.

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## INTRODUCTION

### 1 Scope

1.1 These requirements cover adult recreational wearable devices having at least one buoyancy compartment that relies upon inflation by gas or other medium to provide flotation to the wearer, for use by individuals at least 16 years of age and weighing 80 pounds (36.3 kg) or more.

1.2 These requirements cover devices intended for general boating activities where impacts with the water or other objects (i. e. those which occur during water skiing, white water paddling, personal watercraft use, and parasailing) are not likely.

1.3 These requirements cover rearming kits for the devices covered by this Standard.

1.4 Several levels of performance are set out by this standard to meet the needs of various boating activities, locations, and water conditions. The performance levels are designated by performance type.

1.5 *Deleted*

### 2 References

2.1 The following alpha-numeric list of Standards related to the American Society for Testing and Materials (ASTM) is provided for reference purposes:

- a) Method for Salt Spray (Fog, Testing), ASTM B117-94.
- b) Method for Rubber Property – Effect of Liquids, ASTM D471-79(R1991).
- c) Methods of Testing Coated Fabrics, ASTM D751-89.
- d) Method for Gas Transmission Rate of Plastic Film and Sheeting, ASTM D1434-82(R1992).
- e) Method for Failure in Sewn Seams in Woven Fabrics, ASTM D1683-90a.
- f) Practice for Operating Light Exposure Apparatus (Carbon-Arc Type) With or Without Water for Exposure of Nonmetallic Materials, ASTM G23-93.

### 3 Units of Measurement

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

### 4 Definitions

4.1 For the purpose of this standard the following definitions apply.

4.2 CLOSURE, PRIMARY – A primary closure is considered to be a means of securing the device onto the body so that the device can be expected to function substantially in the intended manner without the use of any other means of fastening the device onto the body.

4.3 CLOSURE, SECONDARY – A secondary closure is considered to be a closure that meets the following:

- a) Does not result in the device being donned as intended if it is the only closure that is closed on the device; and

b) Is not usually required to be closed in order for the device to substantially comply with the requirements in this standard.

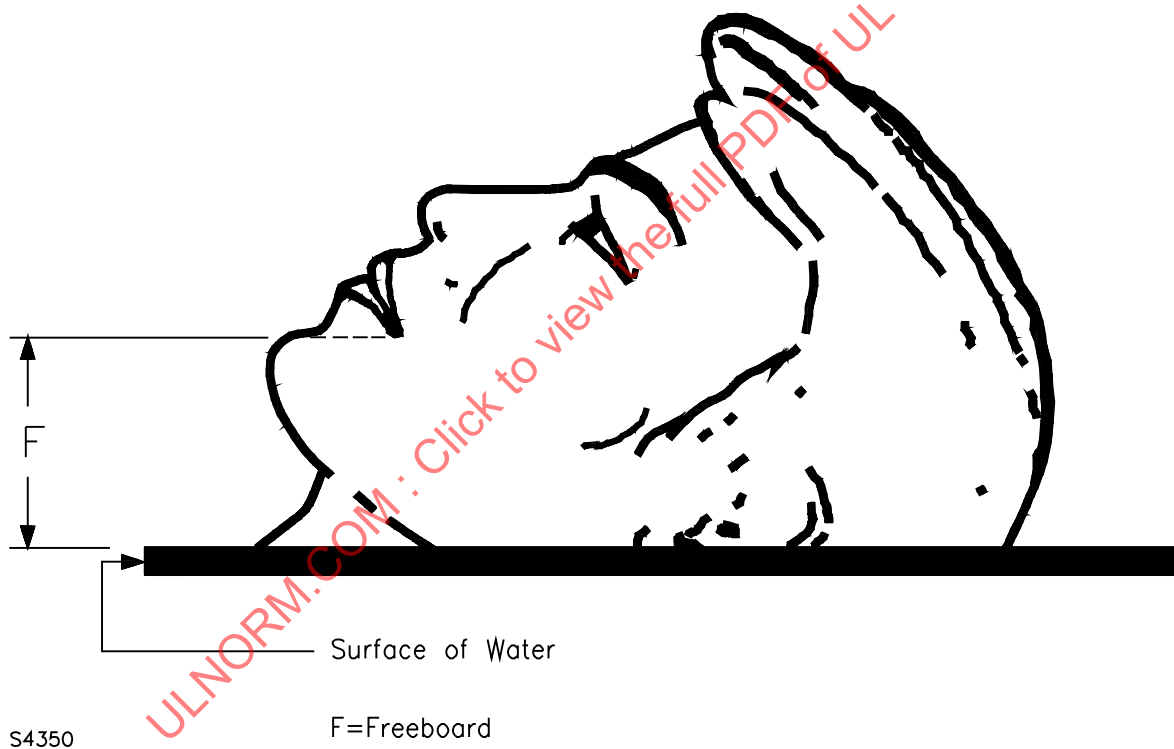
4.4 DESIGN INFLATION RANGE – The range of buoyancy and pressure, as specified by the manufacturer, to which a compartment may be inflated to provide the intended in-water performance.

4.5 FACE PLANE ANGLE – The angle, relative to the surface of the water, of the plane formed by the most forward part of the forehead and chin of a wearer floating in the attitude of static balance. A positive angle is achieved when a user's forehead is higher than their chin.

4.6 FREEBOARD – A distance measured perpendicularly from the surface of the water to the lowest point where the wearer's respiration may be impeded, typically to the corner of the mouth. See [Figure 4.1](#).

Figure 4.1

Freeboard



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

4.8 FUNCTIONAL RESIDUAL CAPACITY (FRC) – The amount of lung volume that a person has remaining at the bottom of the normal breathing cycle when at rest.

4.9 H.E.L.P. (HEAT ESCAPE LESSENING POSTURE) POSITION – A position recommended by the United States Coast Guard and the American Red Cross to lessen the rate of body heat loss in cold water. In the H.E.L.P. Position, test participants have their knees drawn up toward their chests, their faces forward and out of the water, their upper arms held at their sides, and their lower arms folded across their chests.

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

4.11 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, dependent 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) but 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.

4.12 JACKET – A device having sleeves.

4.13 LOCK STITCH – A stitch that will not unravel when a force is applied to any of the threads forming the stitch, such as the stitch designated as Type 301 in Federal Standard No. 751a (November 21, 1983).

4.14 LOT NUMBER – A marking assigned to each group of PFD's produced which incorporates a means for the user to identify the year and quarter of manufacture of the device (unless provided elsewhere). If a manufacturer produces PFDs at more than one factory, the lot number shall also provide a means of identifying the device as the product of a particular factory, although this information may be coded.

4.15 PERFORMANCE TYPE – The classification of the level and redundancy of assistance provided to the wearer based on the device's in-water flotation characteristics, number of compartments, and need for second stage donning as follows:

a) Type I devices have at least two flotation compartments, turn the largest percentage of participants face up, support the wearer's head such that the mouth is well clear of the water, and do not require second stage donning.

b) Type II devices have at least one flotation compartment, turn most test participants face up, support the wearer's head such that the mouth is well clear of the water, and do not require second stage donning.

c) Type III devices have at least one flotation compartment, turn many test participants face up, and support the wearer's head such that the mouth is well clear of the water, but may require second stage donning to achieve this in-water performance.

4.16 REFERENCE VEST – Stearns Manufacturing Company Model 1150, 30 – 52 inches (762 – 1321 mm) adult, inflatable PFD or equivalent. The vest utilizes a single 35 lbf (156.9 N) buoyancy chamber, built in sailing harness design with nylon chestbelt and shoulder harness, and a stainless steel front chest closure.

4.17 SECOND-STAGE DONNING – Additional donning or adjustment that is required to place the device in its functioning position from the position in which it is normally worn.

4.18 SERVICEABILITY – The ease with which the inflation system mechanism can be 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.

4.19 SERVICEABLE – Acceptable for continued use (e.g. exhibits no signs of functional deterioration such as deformation of hardware, a rip or tear, a loose seam, indicators not functional, oral inflation tube blocked or detached, manual inflator trigger detached, or the like).

4.20 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.

4.21 STRUCTURAL SEAM – A seam that serves a functional purpose, as distinguished from a decorative purpose.

4.22 TORSO ANGLE – The angle between a vertical line and a line passing through the shoulder and hip. A positive angle is achieved when a test participant's hips are forward with respect to their shoulders.

4.23 TURNING TIME – The time required for a device to turn a face-down wearer to a position in which the wearer's respiration is not impeded.

4.24 UNINFLATED – A device with the chamber(s) deflated and in the packed condition.

4.25 UNIVERSAL SIZE – A size of device constructed to fit, as a minimum, persons in the 5th through 95th percentile of the adult U.S. population, as reported by the National Center for Health Statistics, with respect to height and girth. The universal size includes the chest size range of 30 – 52 inches (80– 130 cm).

4.26 USCG APPROVAL TYPE – A classification assigned based on a device's performance, serviceability, and status indicators.

4.27 VEST – A device that covers the shoulders but has no sleeves. A yoke-style device is considered to be a vest.

4.28 WHITE WATER PADDLING – Any activity with a vessel on Class II and above rapids as determined by the six-class "International Scale of River Difficulty"<sup>4.28</sup>. This definition applies only to those sections of the river with such rapids, and not the entire river.

\* American Whitewater, PO Box 1540, Cullowhee, NC 28723; 1-866-BOAT-4-AW; <http://www.americanwhitewater.org/>; [info@amwhitewater.org](mailto:info@amwhitewater.org).

## CONSTRUCTION

### 5 Inflatable Devices

5.1 The construction and assembly of an inflatable device shall be judged with respect to its intended use as well as the requirements in this standard.

### 6 Components and Materials

6.1 A component of a device covered by this standard shall:

- a) Comply with the requirements for the component in the Standard for Components for Personal Flotation Devices, UL 1191; and
- b) Comply with any USCG requirements for the component.

6.2 Unless its function is such that failure of the component will not affect the ability of the device to meet the requirements of this standard, a nonmetallic component of an inflatable device which is permanently covered shall retain at least 60 percent of its as-received strength after being subjected to 100 hours of light and water exposure in accordance with Method I of the Standard Practice for Operating Light Exposure Apparatus (Carbon-Arc Type) With or Without Water for Exposure of Nonmetallic Materials, ASTM G23-93, using apparatus designated Type E. 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 5804-90. The arcs are to be replaced and the corex D glass cleaned every 24 hours.

6.3 Unless its function is such that failure of the component will not affect the ability of the device to meet the requirements of this standard, a nonmetallic component of an inflatable device which may be exposed to sun light when in service shall retain at least 40 percent of its as-received strength after being subjected to 300 hours of light and water exposure in accordance with Method I of the Standard Practice for Operating Light Exposure Apparatus (Carbon-Arc Type) With or Without Water for Exposure of Nonmetallic Materials, ASTM G23-93, using apparatus designated Type E as specified in [6.2](#).

6.4 Inflation chamber compartment material shall retain at least 90 percent of its strength and the rate of transmission of  $\text{CO}_2$  gas through the material shall not be increased by more than ten percent after being subjected to the mildew resistance test specified in Federal Test Method, Standard 191, Method 5762-78, when untreated cotton is used as the control specimen.

6.5 Unless it is expendable, or if failure of the component will not affect the ability of the device to meet the requirements of this standard, a metallic component of an inflatable device shall have salt water and salt air corrosion characteristics equal or superior to 410 stainless steel, or perform its intended function and have no visible pitting or other damage on any surface after 720 hours of salt spray testing in accordance with ASTM B117-94.

*Exception: An expendable component need not be of corrosion-resistant material, provided that the component is provided with a durable zinc or cadmium plating, or is equivalently protected against corrosion.*

6.6 Metals shall be used in combinations that are galvanically compatible.

*Exception: Where galvanic compatibility cannot be provided, an expendable component may be utilized as a sacrificial anode.*

6.7 An exposed edge or projection of a component shall not be sufficiently sharp to damage the material of an inflatable compartment or constitute a risk of injury to persons during intended use. Referee measurements necessary to determine compliance with this requirement are to be those described in the Standard for Tests for Sharpness of Edges on Equipment, UL 1439.

6.8 Material used in the manufacture of a device shall be new.

## 7 Sizing and Arrangement

7.1 An inflatable device shall not be constructed for persons weighing less than 80 lbs (36 kg).

7.2 Type II and Type III performance inflatable devices shall be constructed to fit chest sizes over a marked range of at least 2 inches (51 mm). Type I performance devices shall be constructed to fit chest

sizes over a marked range of at least the universal chest size range. In addition, all devices shall fit users having chest sizes 1.5 inches (38 mm) above and below the marked chest size range.

7.3 Hardware shall be arranged and attached to facilitate operation.

7.4 For devices which do not require second stage donning, oral and manual inflation systems shall be located and arranged to be operated by either hand of the wearer in a single deliberate action. Moving an unsecured flap, or the like, to gain access to the actuation means is not to be considered a deliberate action. For an oral inflation system, this requirement applies to the device in any intended condition of inflation, except the uninflated, packed condition. In this regard, the term "operated" refers only to the action of bringing the inflation tube to the mouth (not to the process of oral inflation). For devices which require second stage donning, manual inflation systems shall be located and arranged to be operated by either hand of the wearer in a single deliberate action with the device in the donned, packed condition, and oral and manual inflation systems shall be located and arranged to be operated by either hand of the wearer in a single deliberate action after second stage donning has been completed.

7.5 The construction and assembly of an inflatable device shall be designed to minimize the likelihood of inflation compartments, and other device components whose positioning within the device are critical to the performance of the device, from becoming bunched, knotted, tangled, dislocated, or otherwise rendered inoperative.

7.6 The construction and assembly of an inflatable device shall be designed to minimize the likelihood of inflation compartments being abraded or otherwise damaged by adjacent components such as the inflation system.

7.7 The arrangement of an inflatable device shall acceptably reduce the likelihood of snagging, such as by providing means to secure the free ends of body straps and the like.

## 8 Inflatable Compartments

8.1 A Type I performance device shall have at least two inflatable compartments.

8.2 Type II and Type III performance devices shall have at least one inflatable compartment.

## 9 Over-Pressure-Relief Valves

9.1 Over-pressure-relief valves may only be provided on one compartment of a multi-compartmented device. If provided, an over-pressure-relief valve shall be located and arranged to reduce the likelihood of the valve becoming blocked or otherwise rendered ineffective.

## 10 Inflation Systems

10.1 An inflatable device shall be provided with inflation systems in accordance with [10.2](#) – [10.7](#), as applicable.

10.2 A Type I performance device shall have a Use Code 1F automatic or manual-auto inflator on one compartment which shall be mounted such that its status indicator is viewable before and after donning the device. A second compartment shall have a Use Code 3F or 6F manual, or Use Code 1F, 2F, or 6F manual-auto inflator mounted so the status indicator(s) are accessible for checking prior to donning the device.

10.3 A Type II performance device shall have a Use Code 1F or 2F manual-auto inflator or both a Use Code 1F automatic inflator and a Use Code 3F or 6F manual inflator. The manual-auto inflator and

automatic inflator shall be mounted on the PFD so the status indicator(s) can be viewed before and after donning the device. The manual inflator shall be mounted on the PFD so the indicator(s) can be easily accessed for checking prior to donning the device.

10.4 A Type III performance device shall have at least one Use Code 3F manual inflator or one Use Code 1F or 2F manual-auto inflator on one compartment which shall be mounted on the PFD such that its indicator(s) can be viewed before and after donning the device.

10.5 A Type V device shall use an inflation system that complies with the appropriate supplement to the standard, or the following .

a) For those Type V PFDs provided with at least one 6F manual or manual-automatic inflator, the cylinder shall be easily accessed for checking its status prior to donning the PFD. The devices shall be marked as Type V PFDs, APPROVED ONLY WHEN WORN and incorporate educational material into the Owners Manual, Think Safe pamphlet, and approval label on the risk of not checking the indicators and cylinder cap prior to each use; or

b) For those Type V PFDs provided with at least one non-convertible Use Code 6F manual-auto inflator, the cylinder shall be easily accessed for checking its status prior to donning the PFD. These devices shall be marked as Type V PFD, APPROVED ONLY WHEN WORN and meet the following requirements:

1) Incorporate educational material on the risk of premature inflation in the "THINK SAFE" pamphlet, and the "Owner's Manual" with the PFD.

2) Include a label that states DO NOT ALTER THIS PFD. Contact [insert Manufacturer and phone] for adjustment/replacement if dissatisfied with performance of the inflator".

10.6 All inflatable devices shall be provided with both an oral inflator and either an manual-auto or manual inflator for each compartment whose presence is required for the device to meet the in-water performance requirements of this standard.

*Exception: Type I performance devices may be provided with only automatic and oral inflators on one compartment (see [10.2](#)).*

10.7 Where a device has one or more redundant compartments which are not required to be inflated to achieve the in-water performance requirements, then the redundant compartment(s) may be fitted with an oral inflation system only. (For Type I performance devices this applies to compartments in excess of two.)

10.8 Inflation systems shall be located in a manner which permits servicing equivalent in ease to that performed in the Standard for Components for Personal Flotation Devices, UL 1191.

10.9 Window material used as a non-load bearing component for viewing the indicator(s) of the inflation system, shall comply with the requirements of the Standard for Components for Personal Flotation Devices, UL 1191, Window Material.

## 11 Deflation Systems

11.1 An inflatable compartment shall be provided with means to be deflated, which may be integral with or separate from any inflation system provided for the compartment. The deflation means shall be located and arranged to:

a) Be easily operated by either hand without the use of tools;

b) Reduce the likelihood of unintentional operation;

- c) Self-seal after operation and permit reinflation of the compartment; and
- d) Not be lockable in an open position.

## 12 Closure, Adjustment, and Attachment Means

12.1 An inflatable device shall incorporate strapping or other means of adjustment that provides a secure fit (as tight as possible without causing discomfort, or as tight a fit as is consistent with the intended use).

12.2 The cut ends of a body strap, tie tape, belt loop, or the like shall be turned under and stitched or the equivalent, to prevent raveling. Synthetic materials may be heat sealed in lieu of being turned under.

12.3 The free end of a body strap shall be provided with means to reduce the likelihood of unintentional disengagement from the hardware, such as a tab formed by box-x stitching two 1-1/2 inch (40 mm) turn-unders.

12.4 Body straps shall be permanently attached to the device using box-x stitching covering a minimum area of 0.3125 sq. inch per inch (7.9 sq. mm per mm) of webbing width or the equivalent, such as two bar-tack stitches bracketing the same minimum area and providing equal or greater strength. Equivalent performance is to be determined based on peel and shear strength test results.

12.5 Where body straps are held in their intended positions using belt loops or belt tunnels, the opening width of the loop or tunnel nearest the free end of the body strap shall not be more than 3/4 inch (19 mm) greater than the width of the body strap webbing, or shall be sized so as not to permit the unsecured end of the primary closure to pass through the opening.

*Exception No. 1: Devices may have larger belt loop and belt tunnel openings provided they successfully meet the Use Characteristics Tests Sections [16](#) – [27](#) with the body straps free of the belt loops and/or tunnels.*

*Exception No. 2: This requirement does not apply to sliding belt loops provided to stow excess strap lengths while the device is worn.*

12.6 The width of the opening in a closure such as a buckle or dee ring shall be not more than 1/8 inch (3 mm) greater than the width of the associated webbing, as measured at the line of contact.

12.7 Drawstrings shall be positively secured to the device using means other than a knot alone. Drawstrings shall also:

- a) Be not less than 1 inch (25 mm) wide; or
- b) Have a positive closing mechanism; or
- c) Comply with the tieability requirements for tie tapes as specified in the standard for Components For Personal Flotation Devices, UL 1191.

12.8 For devices where the inflatable chambers may be displaced if worn by users having a chest size greater than those for which the device is intended, body straps shall have no more than 3 inches (76 mm) of remaining adjustment when measured:

- a) On the largest test participant successfully tested in accordance with the Use Characteristics Tests in Sections [16](#) – [27](#); or
- b) With the device placed over a cylinder having an outer circumference equal to the maximum chest size for which the device is intended.

12.9 An inflatable device shall not provide means intended to fasten the device to a boat.

*Exception No. 1: This requirement does not apply to harness assemblies, or the like, intended to be attached to harness lines during activities such as board-sailing or hiking out on a sailboat, and that have been investigated and found to be acceptable for the application.*

*Exception No. 2: This requirement does not apply to a means that is rendered inoperative when subjected to the Miscellaneous Fastener Strength Test, Section [33](#).*

*Exception No. 3: This requirement does not apply to a device provided with an owner's manual containing the text specified in [B15.4](#).*

### 13 Seams and Stitching

13.1 A lock stitch shall be used for a structural seam formed by sewing. Also, see Seam Strength Test, Section [35](#).

13.2 Monofilament thread shall not be used for making structural seams.

13.3 Thread and fabric combinations shall be compatible.

13.4 A structural seam shall have at least 1/2 inch (12.7 mm) of seam allowance or have equivalent mechanical characteristics. The equivalency of the mechanical characteristics is to be determined by the Seam Breaking Strength Test – Overedge Stitch evaluation in the Standard for Marine Buoyant Devices, UL 1123, except that the candidate stitch is to be compared to a 1/2 inch (12.7 mm), ssA-1 seam produced with size E thread meeting the requirements of Federal Standard V-T-295E(1985) or V-T-285F(1991), at 9 stitches per inch (.35 stitches/mm).

13.5 Window material attachments to the PFD shall have minimum seam strength (sewn or welded) of 53 N (12 pounds) for a 1-inch grip, in an as received condition, using the test method in Section [35](#), Seam Strength Test.

### 14 Buddy Line

14.1 A buddy line installed on a PFD shall comply with the requirements specified in [14.2](#), Section [44](#), Pull Test, and Section [55](#), Buddy Line Identification.

14.2 The buddy line shall be a minimum of 600 mm (24 inches) long and shall be attached so that risk of the buddy line snagging is reduced. Means of stowage shall be provided to secure the buddy line to the PFD, so that it is not a snag hazard.

## PERFORMANCE

### GENERAL

### 15 Selection and Preparation of Test Samples

15.1 Representative samples of an inflatable device shall be subjected to the applicable Use Characteristics Tests described in Sections [17](#) – [27](#), and the Physical Properties Test in Sections [28](#) – [31](#), [33](#), [36](#) – [41](#), and [43](#). Components or material specimens are to be used for the Physical Properties Tests specified in [32.1](#), Sections [34](#), [35](#), and [42](#).

15.2 A device having an optional or detachable feature, such as a harness assembly, which may adversely effect performance of the device shall be tested both with and without the optional or detachable feature in place.

15.3 For tests involving inflation of sample compartments to specific pressures, the inflation systems provided on the device may be modified to permit external pressurization, measurement of pressure, and the like.

15.4 If one or more compartments experience significant dimensional changes between the minimum and maximum pressure values of the design inflation range, the Use Characteristics Tests specified in Sections 22 – 27 are to be repeated with the inflation compartment(s) inflated to a sufficient number of buoyancy/pressure values within the design inflation range to demonstrate compliance with these requirements over the entire design pressure range.

## USE CHARACTERISTICS TESTS

### 16 Test Participants

16.1 For the Use Characteristics Tests described in Section 17 – 27, human test participants as specified in Table 16.1 are to be employed. A test participant shall not be familiar with the particular device under test, but may be familiar with PFDs in general. Prior to testing, test participants are to be given a video orientation which covers the following topics:

- a) The general purpose of an inflatable PFD.
- b) General information regarding inflation medium containers.
- c) General demonstration of reference vest donning.
- d) The general principal and method of manual inflation.
- e) The general principal and method of automatic inflation.

**Table 16.1**  
**Test subject selection**

Chest size adjustment range of device, inches (mm)	Number of test participants
6 (150) or less	6
More than 6 but not more than 12 (300)	12
More than 12 (300)	18

NOTES

1. Test participants selected are to be of varying height and weight so as to represent endomorphic, mesomorphic, and Ectomorphic anatomic builds. The chest sizes of the test participants are to be within the Intended chest size range of the device; except that one subject shall have a chest size  $1 \pm 0.5$  inch ( $25 \pm 13$  mm) larger than the marked maximum size, and one test participant shall have a chest size  $1 \pm 0.5$  inch smaller than the marked minimum size.
2. Test participants may be any combination of males and females, provided that at least one male and one female is used. Participants shall have basic swimming skills (e.g. be capable of treading water for 1 minute).

**Table 16.1 Continued on Next Page**