UL 1123

STANDARD FOR SAFETY

Marine Buoyant Devices

UL Standard for Safety for Marine Buoyant Devices, UL 1123

Seventh Edition, Dated October 1, 2008

Summary of Topics

This revision of ANSI/UL 1123 dated July 9, 2025 includes a change in requirements to the AATCC Test Method; 31.3.2.2.

Text that has been changed in any manner or impacted by ULSE'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 May 23, 2025.

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Standard for Marine Buoyant Devices

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The most recent designation of ANSI/UL 1123 as an American National Standard (ANSI) occurred on July 9, 2025. 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 ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover Type II, Type III, and Type IV marine buoyant devices, including vests, jackets, horseshoe buoys and ring buoys, with or without lifelines, intended for recreational use, and those Type V devices described in the Supplements, in accordance with the applicable regulations of the United States Coast Guard (USCG).

1.2 The buoyant devices covered by these requirements are intended for USCG approval under 46 CFR 160.064.

2 General

2.1 The buoyancy of devices covered by these requirements is provided by inherently buoyant material and is not dependent upon loose or granulated materials, gas compartments, or inflation.

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

2.3 Devices for which the intended use is indicated as "General Purpose Vest," "Boating Vest," or the like, shall be considered to include "Skiing" unless this is specifically excluded in the marking provided with the device. Statements such as "Hiking" are not considered general use statements.

3 Glossary

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

3.2 ADULT DEVICE – A device intended for use by persons weighing more than 90 pounds (41 kg).

3.3 BUOYANT DEVICES – The following defines the device types covered by these requirements:

a)Type II – A device intended to turn some unconscious persons from a face down position in the water to a position where the wearer's respiration is not impeded.

b)Type III – A device intended to support a conscious person in the water in an upright position. This type of device is not required to turn an unconscious person in the water from a face-down position to a position where the wearer's respiration is not impeded.

c)Type IV – A device intended to be thrown to and grasped by a person in the water. This device does not provide means for adjustment or close fitting to the body.

3.3.1 BUNCHING – The curling or folding of internal buoyant material upon itself, from its original position, within the envelope.

3.4 CANDIDATE DEVICE – The device being investigated.

3.5 CHILD DEVICE – A device intended for use by persons weighing not less than 30 pounds (14 kg) but not more than 50 pounds (23 kg).

3.6 CLOSURE SYSTEM– A combination of a closure and a corresponding means of adjustment.

a) Primary – A component or group of components in series that provide a single circumferential path around the wearer to support the prescribed body tensile load when adjusted to any position.

b) Secondary – A closure provided in addition to a primary closure that is intended to be closed to provide proper fit and performance of the device but when used on the device by itself, does not make the device appear to be donned as intended.

3.7 DEVICE – Any marine buoyant device.

3.8 DOGBONE – A piece of loop-shaped metal designed for attachment to a hiking harness.

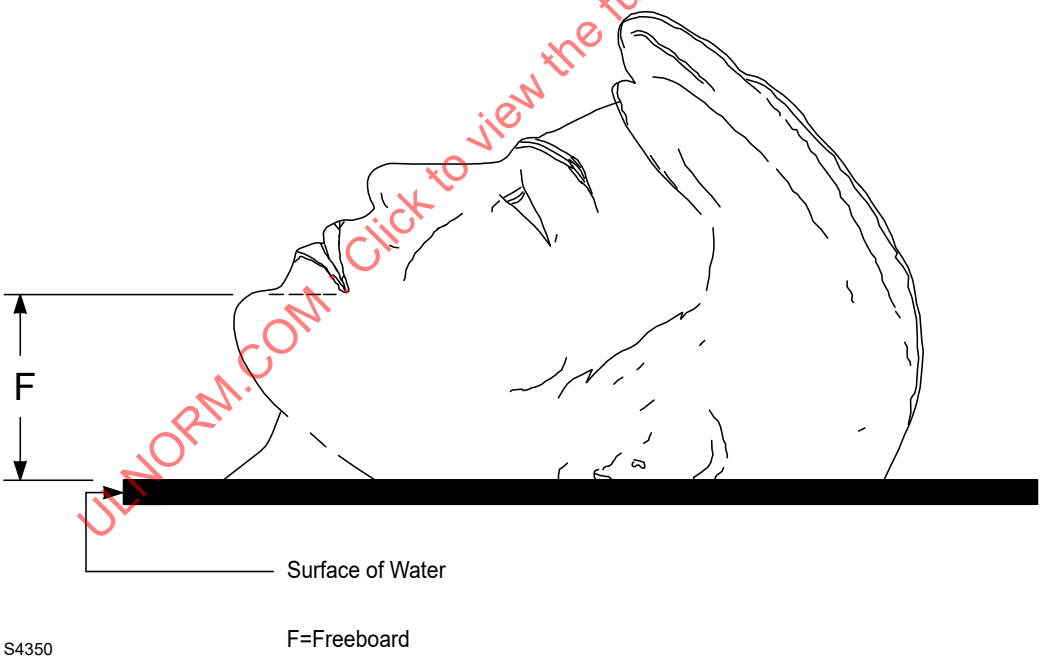
3.9 FACE PLANE ANGLE – The angle, relative to the surface of the water, of the plane formed by the most forward part of the forehead and chin of a wearer floating in the attitude of static balance in which respiration is least likely to be impeded.

3.10 FOAM – Closed-cell foamed polymeric material.

3.11 FREEBOARD – A distance measured perpendicularly from the surface of the water to the lowest point where the wearer's respiration is able to be impeded, typically to the corner of the mouth. See Figure 3.1.

Figure 3.1

Freeboard



3.12 INFANT DEVICE – A device intended for use by persons weighing less than 30 pounds (14 kg).

3.13 INFANT/CHILD DEVICE – A device intended for use by persons weighing less than 50 pounds (23 kg).

3.14 INSERT – A quantity of buoyant material that has been cut or formed for insertion into a buoyant device.

3.15 JACKET – A buoyant device having sleeves.

3.16 LOCK TYPE STITCH – A stitch that will not unravel when a force is applied in the direction of the seam on any of the threads forming the stitch.

3.17 OVERSIZE DEVICE – An adult device intended for specified chest ranges of not less than 38 inches (0.97 m) at the minimum to at least 60 inches (1.52 m) at the maximum.

3.17.1 PLAIN SURFACE TEXTILE FABRIC – Any textile fabric which does not have an intentionally raised fiber or yarn surface such as pile, nap, or tuft, but shall include those fabrics that have fancy woven, knitted or flock-printed surfaces (See 16 CFR 1610).

3.17.2 RAISED SURFACE TEXTILE FABRIC – Any textile fabric with an intentionally raised fiber or yarn surface, such as a pile, including flocked pile, nap, or tufting (See 16 CFR 1610).

3.18 REFERENCE VESTS – The standard USCG vests: Model AK-1 (Adult), Model CKM-1 (Youth), and Model CKS-2 (Child Small and Infant).

3.19 SEAM – A joint consisting of a sequence of series of stitches uniting two or more pieces of material.

3.20 SERVICEABLE – Acceptable for continued intended use. Exhibits no signs of functional deterioration.

3.21 SPECIAL PURPOSE – A buoyant device intended for one or more specific purposes, such as sailing, skiing, or similar activities in addition to general use.

3.22 STRUCTURAL SEAM – A seam that serves a functional purpose in the end product as distinguished from a decorative function.

3.23 *Deleted*

3.24 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.

3.25 UNIVERSAL SIZE DEVICE – An adult device intended for use by persons in the 30 – 52 inch (0.8 – 1.3 m) chest sizes.

3.26 VEST – A sleeveless buoyant device.

3.27 YOUTH-ADULT DEVICE – A device intended for use by persons weighing more than 75 pounds (34 kg) and that meets the performance and minimum requirements of both youth and adult devices within the size range specified on the device.

3.28 YOUTH DEVICE – A device intended for use by persons weighing not less than 50 pounds (23 kg) but not more than 90 pounds (41 kg).

3.29 YOUTH LARGE – / ADULT XXS DEVICE– A device intended for use by persons weighing at least 75 pounds (34 kg) but not more than 125 pounds (57 kg). It shall be designed for chest sizes no larger than 33 inches(914 mm) and shall meet the minimum performance requirements for both youth and adult devices within the size specified on the device.

CONSTRUCTION

4 General

4.1 The construction and assembly of a device shall be judged according to its intended application and use as well as according to these requirements.

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

a) Comply with the applicable requirements for the component in the Standard for Components for Personal Flotation Devices, UL 1191 (see Table 4.1); or

b) If not covered by specific requirements in UL 1191, be acceptable when investigated with respect to the application. In addition, if the United States Coast Guard has specific requirements for the component, it shall comply with those requirements.

Table 4.1
Component requirements

Component	Application	Applicable Sections in UL 1191[a] or USCG Requirements
Body Straps	Primary closure	Webbing
	Secondary closure	Tie Tape and Reinforcing Tape
Drawstrings	Secondary closure	Tie Tape and Reinforcing Tape
Fabric	Wearable device	Fabrics for Wearable Devices
	Throwable device	Fabrics for Buoyant Cushions
Foam	Buoyant material[b]	Closed-Cell Foamed Polymeric Material
Hardware	Primary closure	Hardware
Kapok	Buoyant material	46 CFR 164.003
Lacing	Any	Lacing
Polymeric film	Kapok or fibrous glass enclosure	Plastic Film for Kapok or Fibrous Glass Enclosures
Retroreflective fabric or tape	Any	46 CFR 164.018
Survivor locating light	Any	46 CFR 161.012
Thread	Structural seam	Thread
Tie Tape	Secondary closure	Tie Tape and Reinforcing Tape
Polymeric coating	Any	Vinyl-Dip Coatings
Zipper	Primary closure	Zippers

NOTE – Not applicable to nonfunctional (decorative) components.

[a] The Standard for Components for Personal Flotation Devices, UL 1191.

[b] Material relied upon for compliance with the requirements of the Buoyancy Test, Section 20.

4.3 Adhesive shall be an all-purpose, waterproof type, acceptable for use with the materials being bonded. See requirements for glued joints in 32.5.

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

4.5 A device intended to be worn shall:

a) Be as comfortable, nonrestrictive of motion and vision, and as nonbulky for the wearer as practicable, consistent with intended use;

b) Be such that the intended method of donning the device is obvious to an untrained person;

c) Incorporate strapping or other means of adjustment that provides a snug fit (as tight as possible without causing discomfort). See Donning Test, Section 15, Flotation Stability Test, Section 16, and Water Entry Test, Section 17;

d) *Deleted*

e) Incorporate at least one primary closure.

4.6 Unless a PFD is reversible, under reduced lighting conditions a candidate device shall be obvious to the wearer as to which is the inside and outside of the device. This may be accomplished by pockets, belts, distinctively different (tactile) fabrics, logos and the like. Logos as a sole means are not acceptable.

4.7 A device shall not incorporate means obviously intended for fastening or securing the device to a boat, nor shall instructions accompanying the device indicate such intent.

Exception No. 1: A Type V device for which the intended use includes fastening or securing the device to the boat, such as in hiking, need not comply with this requirement.

Exception No. 2: A device incorporating a D-ring, tab, or other construction feature that is not intended to secure the device to the boat need not comply with this requirement, if:

a) The feature is rendered inoperative when subjected to the Pull Test, Section 26, or

b) The marking label information complies with the requirements of the Optional Texts, Section 39.

Exception No. 3: A Type IV buoyant cushion may be provided with hook and loop touch fasteners, or the equivalent, on the cushion's bottom surface only provided the cushion complies with the requirements specified in the Release Test, Section 28.

4.8 Drawstrings shall comply with at least one of the following:

a) Be at least 1 inch (25.4 mm) wide;

b) Have a positive closing mechanism; or

c) When tied into a square knot, be able to be untied within 1 minute by the number of test subjects selected as specified in Table 16.1.

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

4.9 An infant device shall:

a) Have a means of closure that is constructed to reduce the risk of the wearer's undoing the closure; and

b) Incorporate means for removing the wearer from the water without the necessity of grasping the wearer.

4.10 An infant device shall be a Type II device.

4.11 A child and an infant device shall be provided with crotch straps; however, equivalent means will be investigated.

4.12 An infant, child, or youth device shall not be constructed with single point release buckles.

4.13 A youth device shall be constructed for chest sizes no larger than 32 inches (813 mm). If a device is marked with the chest size, the chest size marking shall not exceed 29 inches (737 mm). The maximum chest size shall be measured using 12.2 (a) or (b) in that specific order.

4.14 A child device shall be constructed for chest sizes no larger than 25 inches (625 mm).

4.15 A device shall have provision for drainage of entrapped water including water entrapped between the device and the wearer. See Water Retention Test, Section 21, and Water Emergence Test, Section 18.

4.16 If chest size marking is required, the chest size shall be expressed as a range and each range shall encompass a minimum of 2 inches (50.8 mm), for example, 30 – 32 inches (762 – 813 mm).

4.17 Uncoated 70 denier fabric shall:

a) Have 3/4 inch (19.1 mm) seams; or

b) Incorporate two rows of lockstitch, or the equivalent.

4.18 The ratio of the weight of a cushion to its total volume, as determined from the finished product, shall be not less than 4.0 pounds per cubic foot (65 kg/m^3).

4.19 The spacing between parallel grab strap inner edges of a cushion shall be 4-1/4 ±1/2 inches (108 ±12.7 mm) from the centerline of the cushion to the inside edge of the grab strap.

4.20 The cut ends of woven or braided components and construction features shall be turned under and stitched, or the equivalent, so as not to ravel. With the exception of fabric, synthetic materials such as webbing and lacing may be heat-sealed in lieu of being turned under.

4.21 A wearable device having side adjustments shall be provided with at least one positive means to maintain the front flotation pads in their intended positions.

4.22 A zipper used to close the envelope of a horseshoe buoy shall be disabled (in the closed position) by one of the methods below:

a) Detachment of zipper tab from zipper crown or bail with the zipper slider and/or zipper chain either heat or chemical welded. If zipper chain is welded, the weld should be directly behind the zipper slide;

b) Detachment of zipper tab from zipper crown or bail with the zipper slider placed inside a pocket that fully covers the body of the zipper slide such that the pocket is tight fitting around the zipper body and extends beyond the body by at least 1/4 inch; or

c) Complete removal of the zipper slider and securement of the zipper chain/stops as defined in (a) or (b).

5 Material

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

5.2 A fibrous buoyant material shall be completely encased in polymeric film.

5.3 Only inherently buoyant materials shall be used as the prime buoyant means in a device.

5.4 A device shall be constructed to reduce the likelihood of bunching of internal buoyant materials.

5.5 Foam used as buoyant material in a device intended to be worn shall have a V factor of 85 or more as determined in accordance with the Standard for Components for Personal Flotation Devices, UL 1191. Also, see 20.2.

Exception No. 1: Foam used in a jacket or suit to comply with the requirement of 20.2 may have a V factor of 80 or more provided that at least 85 percent of the regulatory minimum buoyancy for the device as specified in Table 20.1 is supplied by foam having a V factor of 85 or more and when the foam is not layered.

Exception No. 2: This requirement does not apply to foam that is not relied upon for compliance with the requirement of 20.2, provided that the device complies with the requirements of the Flotation Stability Test, Section 16, both with and without the foam in place.

5.6 For a wearable device, the V factor (as determined in accordance with the Standard for Components for Personal Flotation Devices, UL 1191) of foam forward of the body axis (see Figure 16.1) shall be not more than 2 points less than the V factor of foam aft of the body axis.

Exception: A device that complies with the requirement of 19.2.1 need not comply with this requirement.

5.7 Foam used as buoyant material in a buoyant cushion shall have a C factor of 94 or more as determined in accordance with the Standard for Components for Personal Flotation Devices, UL 1191.

6 Hardware

6.1 The width of the opening in the hardware through which webbing is routed, provided with a device, such as buckles, dee rings, and the like, shall not exceed the width of the associated webbing by more than 1/8 inch (3.2 mm) as measured at the line of contact.

6.2 The hardware used shall be so attached to the device that it will be retained in its intended position yet not to be so tight that the operation of the hardware is restricted.

6.3 Hardware used to secure a wearable device to the body shall have a quick and positive lock mechanism.

6.4 All buckles provided on a device with multiple buckle closures shall be operated in a similar manner, i.e., all buckles shall have center release mechanisms, or all buckles shall have side release mechanisms.

6.5 An exposed edge or projection of a component shall not be sufficiently sharp to damage material, body straps, etc., 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 Test for Sharpness of Edges on Equipment, UL 1439.

7 Body Straps

7.1 General

7.1.1 The free end of a body strap shall be provided with a t-tab or an equivalent means, such that the strap does not disengage from the hardware. See the Body Strap Hardware Secureness Test, Section 25.

7.1.2 A tab shall be formed by turning under 1-1/2 inches (40 mm) of material twice and stitching 3/4 inch (19 mm) from the end of the folds with bar tack stitching, rivets, or other equivalent means. Other constructions will be subjected to an investigation to determine acceptability which will include the Body Strap Hardware Secureness Test, Section 25.

7.1.3 Body straps shall be prevented from becoming disengaged from the device either by means of belt loop constructions intended for that purpose or by an equivalent means that will attach at least one end of the body strap to the device.

7.2 Devices for personal water craft, water skiing, or similar towed uses

7.2.1 At least three front closures (at least two of which shall be primary encircling body straps) shall be provided on all devices which are marked "Water Skiing Vest," or the equivalent, as indicated by the intended use statement. See PFD Markings, Section 36.

Exception No. 1: A device with features, such as integral legs, that prevent dislodging of the device during water drops is not required to comply with this requirement.

Exception No. 2: A device with 2 encircling body straps that does not separate in front, such as a pullover vest with a centered front flotation pad, shall meet the intent of the requirement of having the third non-encircling body strap.

7.2.2 Devices which do not meet the construction requirements in 7.2.1 shall be marked to indicate that the devices are not approved for the corresponding uses as specified in PFD Markings, Section 36.

7.3 Buddy line

7.3.1 A buddy line installed on a PFD shall comply with the requirements specified in 7.3.2, 26.2, 26.3, and 36.2.6.

7.3.2 The buddy line shall be a minimum of 600 mm (24 inches) long. Means for stowage shall be provided to secure the free end of the buddy line to the PFD, so that it is not a snag hazard.

8 Belt Loops

8.1 The belt loops shall be constructed so that the primary closure does not come out of the loop if the belt loops are being used to prevent the body strap from becoming disengaged from the device.

9 Tie Tapes

9.1 Tie tapes shall remain in the original tied position during the Flotation Stability Test, Section 16; and Water Entry Test, Section 17.

10 Thread

10.1 Monofilament and non-synthetic thread shall not be used for structural applications.

10.2 Thread and fabric combinations shall be compatible. Cotton threads shall be used only with cotton fabrics; synthetic threads may be used with all fabrics.

11 Seams and Stitching

11.1 A lock-type stitch, such as type 301, Federal Standard 751a, shall be used for joining structural seams. The stitch density shall be 7 – 12 stitches per inch.

Exception: Except for closing seams, an overedge stitch constructed in accordance with 500 series requirements in Federal Standard 751a may be used in lieu of the lock stitch type 301 if the 500 series stitch complies with the requirements described in 31.3.1.1 – 31.3.3.1.

12 Primary Closures

12.1 For adult devices the extended finished length of each body strap shall not allow an excess strap length of more than 3 inches (76 mm)) for a device with separable front flotation pads; and 10 inches (254 mm) for a device with non-separable front flotation pad(s), when measured using the method in 12.2.

12.2 The excess strap length is measured from the end of the buckle to the stop on the T-tab when using one of the methods in the following order:

a) With the device placed over a cylinder having an outer circumference equal to the maximum chest size for which the device is intended and adjusted to a snug fit; or

b) On the largest test participant successfully tested in accordance with the Performance Tests specified in Sections 15 – 18.

13 Coatings

13.1 Polymeric coatings shall be applied smoothly and evenly and shall be free of visible blemishes. This shall not preclude the stressed areas from having a greater thickness than unstressed areas.

13.2 A pocket comparator with a minimum magnifying power of 6X shall be used to determine the thickness of the dipped coating. One slash shall be made at each of the following locations for vests, or at seven high stress locations for other type devices:

a) At the top of one armhole;

b) At the bottom of one armhole;

c) On the left side of the neck edge;

d) On the right side of the neck edge;

e) On the left front panel near the lower center front;

f) On the right front panel near the lower center front; and

g) On the lower edge at the center back.

Three readings shall be taken at each location and the average of the three readings shall be considered the minimum thickness for that location.

PERFORMANCE

14 General

14.1 Except as otherwise indicated, fully representative sample(s) of a device shall be subjected to the applicable tests specified in Sections 15 – 34.

14.2 A device having optional features shall be tested both during use and not during use of the optional feature.

14.3 Where human test subjects are employed in the testing of a device, adequate precautions shall be taken to reduce the risk of injury to the subjects at all times.

15 Donning Test

15.1 Donning and complete adjustment to a fit , for each subject [see 4.5(c)] shall be accomplished by at least one of the following:

a) Donning and complete adjustment of the device within 60 seconds;

b) If donning and complete adjustment is not accomplished within 60 seconds, the subject shall be instructed to “stop” at 60 seconds. The donned device shall then comply with the applicable requirements of Sections 16 – 18. In addition, the device donned to a complete fit, not timed, shall comply with the applicable requirements of 16 – 18; or

c) Donning and complete adjustment of the device, with the donning instructions provided on the device, within 60 seconds.

15.2 Human test subjects as specified in Table 16.1 are to be used for this test. All size adjustments are to be at the halfway point when the device is given to a subject for donning.

Exception: When the device is donned and no additional size adjustments are required, the test subject shall remove the device, loosen the side adjustments beyond the halfway point, and restart the donning test.

15.3 For subjects ages 12 or younger, the donning and adjustment attempts specified in 15.1 may be performed with the assistance of an adult.

15.4 For youth devices, at least 2 subjects are required to successfully don the device in accordance with 15.1 without adult assistance.

15.5 The candidate device is to be given to the subject, or assisting adult, where applicable, at pool side with the instruction "Please don as quickly as possible and adjust to fit snugly, and say "finished" once donning is complete." The donning attempt then is to be timed.

15.6 *Deleted*

15.7 If donning and adjustment of the candidate device on a subject is not achieved within 1 minute after the instruction specified in 15.5 has been given, the test is to be repeated by the subject with the reference vest. If the reference vest also is not donned and adjusted within 1 minute, the subject is to be disqualified and replaced.

16 Flotation Stability Test

16.1 General

16.1.1 Human test subjects as specified in Table 16.1 are to be used for these tests.

Table 16.1
Test subject selection

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

NOTE –

1. Test participants selected are to be of varying height and weight so as to represent endomorphic, mesomorphic, and ectomorphic anatomic builds. For an adult device, the chest sizes of the subjects are to be within the intended chest size range of the device; except that one subject shall have a chest size 1 ±0.5 inch (25 ±13 mm) larger than the marked maximum size, and one subject shall have a chest size 1 ±0.5 inch (25 ±13 mm) smaller than the marked minimum size.

2. Should an adult test participant having a chest size 1 ±0.5 inch (25 ±13 mm) smaller than the marked minimum size be unavailable, a test participant having the required chest size and a weight of 80 lbs (36.4 kg) or more may be used to demonstrate acceptable performance of the device. However, should the candidate device perform unacceptably on such a participant, it shall not constitute failure of the device to comply with the requirements of this Standard, and another participant shall be selected.

3. For a youth, child, or infant device, the weights of the subjects are to be within the intended weight range ±1 lb (0.5 kg) of the device and, for a device that indicates a chest size, the chest sizes are to be within the intended chest size range ±1 in (25 mm).

4. A youth test participant may be used to satisfy specific anthropomorphic characteristics for weight, chest size, or girth of an adult-size device. When testing an adult-size device, when the youth is less than 13 years of age, his or her test results may be excluded for Donning, Sections 15, SA4, or SB7; or In-Water Removal Sections SB9, or SC9 due to the participant's inherent limitations in dexterity, strength, and maturity. For an adult-size device, where the results for a youth test participant are excluded, a substitute test participant shall be used for the excluded tests. The substitute participant shall have anthropomorphic characteristics within the candidate device's specified range, that are similar to, but not necessarily identical to the excluded participant.

[a] For a youth, child, or infant device, six subjects are to be used. For a combined infant/child device (less than 50 pounds), nine subjects are to be used. For a combined child/youth device (30 – 90 pounds), twelve subjects are to be used.

[b] May be any combination of males and females, provided that at least one male and one female are used.

16.1.2 For these tests, the device is to be donned over a swimsuit; except that, if the attire customary to the designated purpose of the device may have an adverse effect on the test results, the tests are to be repeated with at least one subject wearing such attire.

16.1.3 The tests for Type II devices are to be conducted with the test subject wearing the reference vest, and then repeated wearing the candidate device.

16.1.4 The pads of a candidate Type II device shall not dislodge, the internal buoyant materials shall not bunch, and tie tapes shall remain in the original tied position during the tests specified in 16.2.1 – 16.3.7.

16.1.5 During the conduct of the Flotation Stability Test (16.4.1 – 16.4.9) and the Water Entry Test, Section 17, a Type III shall comply with the following:

a) The internal buoyant material shall not become dislodged to the extent that prevents the device to comply.

b) The internal buoyant material shall remain in a position which produces a body list angle of less than 30 degrees. If an angle of 30 degrees or more is measured and the internal buoyant material has noticeably shifted, the subject is to be instructed to remain in the water and attempt to correct

the position of the internal buoyant material by adjusting the device. The in-water correction shall be such that the internal buoyant material is secured in place without the need for repeated adjustment or physical restraint by the subject. The body list angle following such correction shall be less than 30 degrees.

c) *Deleted*

d) The internal buoyant materials shall not bunch.

16.1.6 A youth or adult Type II or Type III candidate device is to be tested in accordance with the Water Emergence Test, Section 18, if subjects have difficulty emerging from the pool during the in-water flotation stability tests due to excess water retained by the device. A device need not comply with the Water Retention Test, Section 21, if it complies with the Water Emergence Test, Section 18, for all subjects specified in Table 16.1.

16.1.7 *Deleted*

16.2 Type II turning test

16.2.1 A youth and an adult Type II candidate device are to be tested as specified in 16.2.4. The device shall comply with the following:

a) The corrected average turning time (see 16.2.2) for the group of test subjects shall not exceed that for the reference vest by more than 2 seconds; and

b) The total number of turns for the group of test subjects shall not be less than the number of turns obtained by using the reference vest.

16.2.2 The corrected average turning time (see 16.2.1 and 16.2.3) is to be computed based on the following:

$$A_C = \frac{A_t}{T_t / T_{total}}$$

in which:

A_c *is the corrected average turning time;*

A_t *is the average turning time for tests resulting in a turn;*

T_t *is the number of tests resulting in a turn; and*

T_{total} *is total number of tests performed.*

16.2.3 A child and an infant Type II candidate device are to be tested as specified in 16.2.4. The device shall comply with the following:

a) The corrected average turning time (see 16.2.2) for the group of test subjects shall not exceed that for the reference vest by more than 1 second;

b) The total number of turns for the group of test subjects shall be not less than the number of turns obtained by using the reference vest; and

c) Water shall not funnel or be cupped into the face of a test subject as a result of the turning moment.

16.2.4 The following are the test methods for conducting the Type II turning test specified in 16.2.1 and 16.2.3:

a) For a youth and adult Type II candidate device the subject is to don the device and enter the water[a]. The subject then is to take at least three breast strokes and then, face down in the water, relax completely while exhaling slowly. The subject is to remain limp in this position long enough so that the final stabilized attitude of static balance can be determined. The turning time is to be recorded. The subject then is to repeat the test two additional times.

b) For a child Type II candidate device, the device is to be fastened in the intended manner on the subject. The subject is to gently push-off from the side of the pool, take a single breast stroke, and then face down in the water relax and exhale slowly. The turning time is to be recorded. The test then is to be repeated two additional times. As an alternative, the device is to be fastened in the intended manner on the subject, who then is to be placed in a face down (mouth above the water) position in the water and released. The turning time is to be recorded. The subject then is to repeat the test two additional times.

c) For an infant Type II candidate device, the device is to be fastened in the intended manner on the subject, who then is to be placed in a face down (mouth above the water) position in the water and released. To prevent the test subject from inhaling water during the test it is permissible to gently blow air into the child's face immediately prior to the release. The turning time is to be recorded. The test is to be repeated two additional times.

[a] The Donning Test, Section 15, and Water Entry Test, Section 17, may be conducted at this point. In addition, if an examination of the candidate device indicates that it may have a tendency to permit movement of the buoyant material from the position it was in when the device was donned to a position toward the sides or back of a subject, at least one test subject is to enter the water by diving so that the subject strikes the water in a prone position.

16.3 Type II freeboard, head support, face plane angle, and chin support test

16.3.1 A youth and adult Type II candidate device shall comply with the following when tested as specified in 16.3.3 – 16.3.7:

a) The average freeboard of the group of test subjects shall be not less than that of the reference vest by more than 1/4 inch (6.4 mm);

b) Each individual freeboard measurement of the group of test subjects shall be no less than 1 inch (25.4 mm);

c) The average value of the lowest marks that can be viewed on a vertical scale (see 16.3.3) by the group of test subjects shall be not greater than that for the reference vest by more than 3 inches (76 mm), or the average face plane angle for the group of test subjects shall be not less than that for the reference vest by more than 5 degrees, providing vision to the scale is not obscured by the candidate device to a degree greater than by the reference vest; and

d) The number of test subjects provided with chin support (see 16.3.7) shall be not less than that for the reference vest.

16.3.2 An infant and child Type II candidate device shall comply with the following when tested as specified in 16.3.3 – 16.3.7:

a) The average freeboard of the group of test subjects shall be not less than that of the reference vest by more than 1/4 inch (6.4 mm);

b) Each individual freeboard measurement of the group of test subjects shall be no less than 1 inch (25.4 mm);

c) The average distance of the ear canal above the surface of the water for the group of test subjects shall be not less than that for the reference vest by more than 1/4 inch (6.4 mm);

d) The average face plane angle for the group of test subjects shall be not less than that for the reference vest by more than 5 degrees and vision to the scale shall not be obscured by the candidate device to a degree greater than by the reference vest;

e) The head support shall cradle the subject's head in a stable manner to limit lateral rotation and tilting from side to side of the head; and

f) The number of test subjects provided with chin support (see 16.3.7) shall be not less than that for the reference vest.

16.3.3 The subjects used during the test specified in 16.2.1 – 16.2.4 are to be used for this test while still in the water. Starting from a vertical upright position (see 16.3.7), each subject is to attain a relaxed, face-up position of static balance. The subject then is to be positioned in line with a vertical scale mounted at the side of the pool, so that the subject's feet are closest to the scale and eyes are 20 feet (6.1 m) from the scale. The vertical scale is to be not less than 12 feet (3.6 m) high and is to be marked in 3-inch (75-mm) increments so that the increment at the level of the surface of the water is equal to zero and the increment 12 feet above the level of the surface of the water is equal to 144.

16.3.4 While in the position of static balance specified in 16.3.3, the subject is to be instructed to "relax and breathe normally." The freeboard, face plane angle, and distance of the ear canal from the surface of the water is to be measured (see 16.3.5) while the subject is at the lowest level attained during the normal breathing cycle. The lowest mark on the scale that can be seen by the subject without movement of the head from the relaxed position then is to be identified (see 16.3.6). The subject then is to attempt to touch the chin to the chest (see 16.3.7).

16.3.5 For the purpose of calculating the average ear-canal distance above the water, if the ear canal is below the surface of the water, the distance is to be measured and recorded as a negative value.

16.3.6 For the purpose of calculating the average lowest-viewable-mark height, the value for a subject that can see below the zero mark is to be zero and the value for a subject that cannot view below the 12-foot (3.6-m) mark is to be 144.

16.3.7 A subject is to be considered as having chin support if:

a) The device is in direct contact with the jawline while the subject is in either the vertical upright or relaxed face-up position, or

b) The device prevents the subject from touching the chin to the chest while the subject is in the relaxed face-up position of static balance.

16.4 Type III device test

16.4.1 A Type III Device:

a) Shall maintain each subject in an attitude of relaxed static balance (such as an upright or backward position) so that the subject's respiration is not impeded at any time, and

b) Shall not have a tendency to turn a subject face-down from the position of relaxed static balance in the water.

See 16.4.4 and 16.4.9. In addition, a youth and adult device shall not have a shoulder gap of more than 6 inches (152.4 mm), following 3 self-induced bobbing actions in the water (see 16.4.5) when any part of the front buoyant material, including the portion of the shoulders forward of the ears constructed of foam

and/or fabric laminated foam, is shifted upward on the wearer above the lowest corner of the mouth or when vision of the wearer is obstructed by the ridden up device. The gap shall be measured at the shoulder with the greatest apparent gap. Also, the device in the ridden-up condition shall not have a tendency to turn a subject face-down from the position of relaxed static balance in the water and shall comply with the requirements specified in 16.4.2 and 16.4.3 following the bobbing actions. The use of crotch straps is not acceptable to achieve compliance with the ride-up requirements.

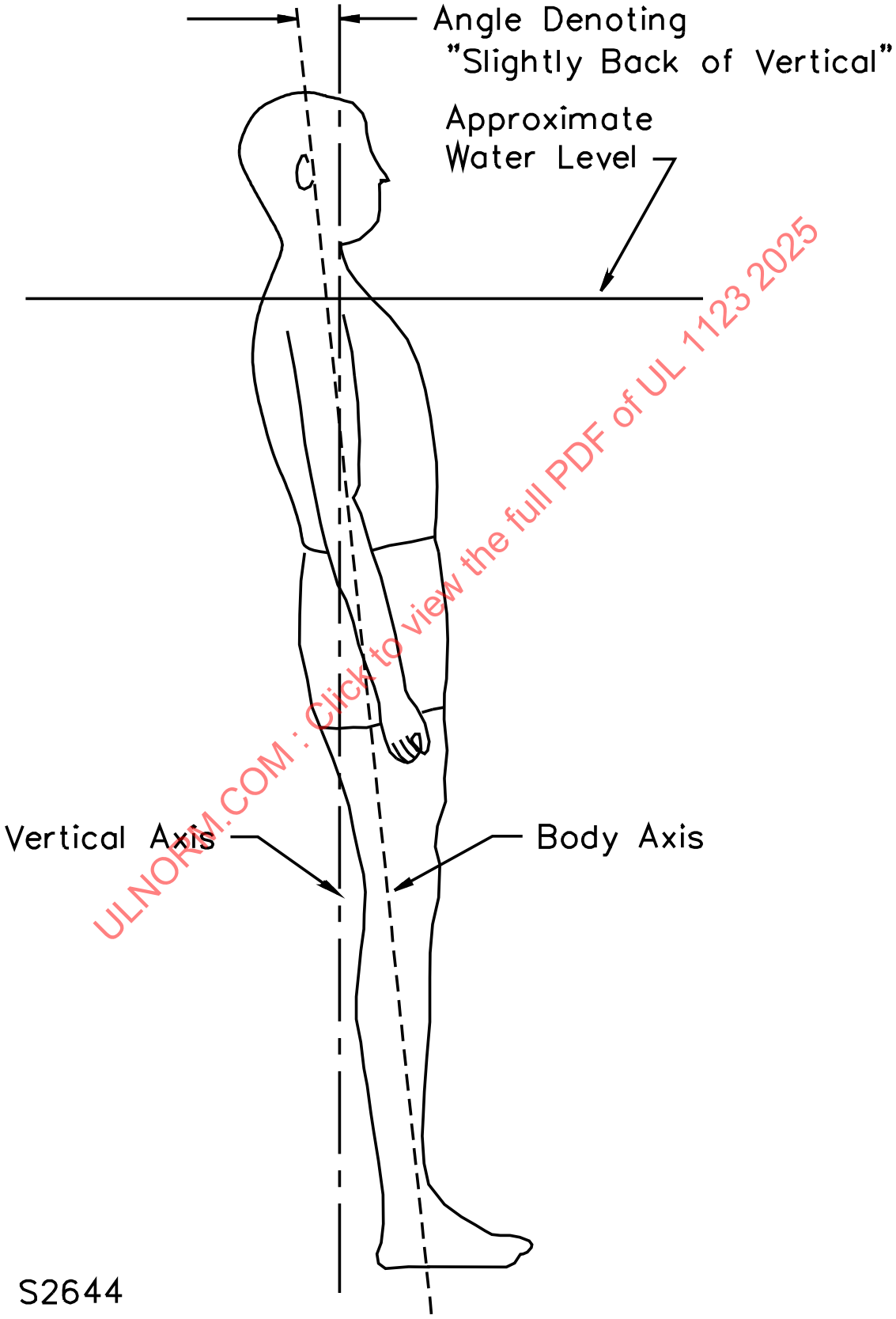
Exception No. 1: The shoulder gap requirements do not apply to float coat or wetsuit style PFDs.

Exception No. 2: For pear-shaped individuals only (i.e., stomach is larger than chest), a device need not comply with the shoulder gap requirements. See SAFE CHOICE PLACARD. For the purposes of this exception, a compressed chest size measurement is taken, similar to a snug fitting PFD.

16.4.2 A Type III device shall permit each subject to attain at least a slightly backward of vertical position, see Figure 16.1, when starting from a face-down position in the water.

Figure 16.1

Starting position – Type III flotation test



16.4.3 The average freeboard of a Type III device at static balance for the group of test subjects shall be not less than 2 inches (50.8 mm). In no case shall the freeboard measured on an individual test subject be less than 1 inch (25.4 mm). The subject is to be instructed to "relax and breathe normally" during measurement of the freeboard.

16.4.4 Each subject is to don the device and enter the water[a]. The subject then is to assume an upright, slightly back of vertical position in the water, keeping the head and torso in the same plane, while holding the arms at the sides. Refer to Figure 16.1 for an illustration of the starting position. A straight rod with an inclinometer attached may be used to establish the starting position. The subject is to maintain this position until motion (forward or backward of vertical) is induced by the device. Then, the subject is to allow the arms, legs, torso, and head to assume their naturally relaxed positions so that the head falls in the direction of induced motion. If motion is not induced, the subject is to allow the head to fall backwards and then the subject is to allow the arms, legs, and torso to assume their naturally relaxed positions. After the subject attains an attitude of relaxed static balance, the freeboard of the subject is to be measured while the subject is at the lowest level attained during the normal breathing cycle.

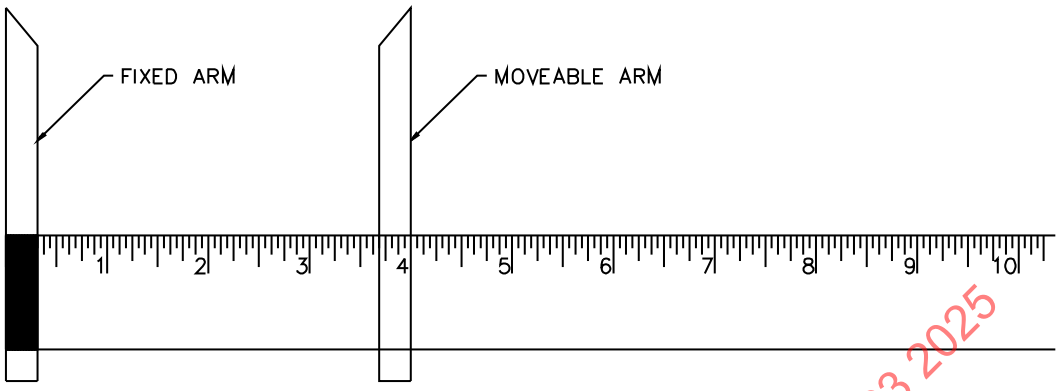
[a] The Donning Test, Section 15, and Water Entry Test, Section 17, may be conducted at this point. In addition, if an examination of the candidate device indicates that it may have a tendency to permit movement of the buoyant material from the position it was in when the device was donned to a position toward the sides or back of a subject, at least one test subject is to enter the water by diving so that the subject strikes the water in a prone position.

16.4.5 For an adult and youth Type III device, the subjects are to perform 3 bobbing motions in the water while in a vertical position to induce ride-up. See 16.4.1. Prior to the bobbing actions and while in the water, the subjects are to be instructed to "readjust the device to a comfortably snug fit." Immature, young subjects with limited manual dexterity may be assisted when readjusting the device to a comfortably snug fit. The bobbing motions are then to be generated by stretching the arms straight out from the sides at the water's surface with the palms facing downward. While in this position, the subjects are to push down on the water with their hands in an open, flat orientation. While pushing down on top of the water, the subjects are to fully inhale and rise above the water's surface. After reaching the upward peak, the subjects are to bring their hands together over the head and fully exhale while sinking into the water. The head must go under the water's surface to be counted. This motion is to be repeated three total times. Subjects weighing 50 – 90 pounds (22 – 41 kg) may be assisted in performing the bobs.

16.4.6 Immediately following the last bobbing motion specified in 16.4.5, the shoulder with the greatest apparent gap is to be measured by inserting the measuring device illustrated in Figure 16.2 between the top of the shoulder and the inside uppermost portion of the PFD above the right shoulder and applying only enough pressure to take up existing slack. The test subject is to be oriented vertically in the water during this measurement. The hands are to be held together and located at approximately the mid-abdomen during the measurement. Following the shoulder gap measurement, the candidate device is to be tested in accordance with 16.4.2 and 16.4.3. See 16.4.1.

Figure 16.2

Shoulder gap measuring instrument



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16.4.7 The subject then is to attain a face-down position in the water. The device shall permit the subject to turn in not more than 5 seconds from the face-down position to a position in which respiration is not impeded.

16.4.8 If, during these tests, a subject is not maintained in an upright or backward face-up position, the subject is to repeat the test using a reference vest. If the reference vest does not maintain the subject in an upright or backward face-up position, the test is to be repeated with another subject of the same anatomic build.

16.4.9 If during the tests described in 16.4.4 and 16.4.8 the candidate device does not comply with these requirements with one subject from the group, an additional 18 subjects as specified in Table 16.1 may be used. If the device performs acceptably (see 16.4.1 – 16.4.3) while being worn by each of the 18 subjects, the device is acceptable.

16.5 Pocket flotation stability test

16.5.1 When a device employs more than 150 square inches (967 cm^2) of total pocket area on the front when measured in accordance with 16.5.6, pockets of the device are to be filled with the nonbuoyant material (i.e., weights) determined in accordance with 16.5.4. Pockets on the rear of the device are to be filled once with buoyant material (i.e. closed cell foam flotation material) determined in accordance with 16.5.5 and once with nonbuoyant material.

16.5.2 For Type II devices, the device with the front pockets filled with nonbuoyant material shall comply with the requirements:

a) In Section 16.2, with rear pockets filled with buoyant material; and

b) In Section 16.3, with the rear pockets filled once with nonbuoyant material and once with buoyant material.

16.5.3 For Type III devices, with the pockets filled, the device shall comply with one of the following:

a) For front and rear pockets, the subject's freeboard shall not be reduced to below water's surface when measured at the bottom of the subject's normal breathing cycle with the subject in the starting

position and in the achieved position of static balance. Also, the device shall maintain the subject in an upright or back of vertical position.

b) For front pockets, when the use of the nonbuoyant items no longer permits the device to provide adequate freeboard or does not maintain the subject in an upright or back of vertical position in the water, the test is to be repeated as follows. The backward tilting of the head described as follows shall maintain the subject in an upright or back of vertical position and the average freeboard at static balance shall not be less than 1 inch (25.4 mm). The subject is to be instructed to breathe normally during measurement of the freeboard.

1) The subject is to assume an upright, slightly back of vertical position in the water, while holding the arms at the sides. The subject is to relax the neck to allow the head to tilt backward so that it is behind the plane of the body axis. The subject then is to allow the arms, legs, and torso to assume a natural relaxed position, until motion is induced by the device.

2) After the subject attains an attitude of static balance, the freeboard of the subject is to be measured while the subject is at the lowest level attained during the normal breathing cycle.

c) For front pockets, when, even with the head tilted backward, the device does not maintain the subject with a freeboard of 1 inch (25.4 mm) or more in an upright or back of vertical position, the test is to be repeated as follows. The freeboard at static balance shall not be less than 1 inch (25.4 mm).

1) The subject is to assume an upright slightly back of vertical position and then is to assume a posture in the water where breathing is not impaired. This posture may be attained by arching of the back and tilting of the head, or the like.

2) After the subject attains an attitude of static balance, the freeboard of the subject is to be measured while the subject is at the lowest level attained during the normal breathing cycle. The subject is to be instructed to breathe normally during measurement of the freeboard.

The device does not comply with the requirement when any action other than the posturing specified in (a) – (c) is needed to maintain the specified minimum freeboard.

16.5.4 To determine the maximum capacity of each front pocket, rigid rectangular prisms (to represent ammunition boxes) are to be placed in the pockets and each pocket is to be filled with as many prisms as it is able to hold. Nonbuoyant items with in-water weight equivalent to the ammunition boxes are then to be used for the swim test specified in 16.5.1. The dimensions for the prisms and the weight for the nonbuoyant items are to be as follows:

a) For lower or middle pockets on the front of a device the prism is to measure 4-1/4 by 3 by 1 inches (114 mm by 76 mm by 25 mm). Each nonbuoyant item, representing 1 box of ammunition, is to have an in-water weight (i.e. weight under two inches of fresh water) of 250 ±5 grams (7.7 ±0.1 ounces).

b) For upper pockets the prism is to measure 1-1/4 by 1-1/2 by 2-1/2 inches (32 mm by 38 mm by 64 mm). Each nonbuoyant item, representing 1 box of ammunition, is to have an in-water weight (i.e. weight under two inches of fresh water) of 140 ±5 grams (4.5 ±0.1 ounces).

16.5.5 To determine the maximum capacity of each back pocket, rigid rectangular prisms are to be placed in the pockets. The prisms are to measure 4-1/4 by 3 by 1 inches (114 by 76 by 25 mm), and each pocket is to be filled with as many prisms as it is able to hold. Closed cell foam buoyant material with a density of no more than 4 lb/ft^3 (64.1 kg/m^3) and a volume equal to the rigid prisms are then to be used for the swim test specified in 16.5.1.

16.5.6 The area (A) of each pocket is to be determined by the following equations:

a) For flat pockets:

$$A = h \times w$$

where:

h is the height of the pocket, and

w is the width of the pocket. See Figure 16.3.

b) For pouch type pockets or pockets with gussets:

$$A = (h + g_b) \times (w + g_m)$$

in which:

h is the height of the outer surface of the pocket,

w is the width of the outer surface of the pocket,

g_b is the depth at the bottom gusset, and

g_m is the depth at the middle side gusset. See Figure 16.4.

c) The total area (AT) is the sum of all pocket areas:

$$AT = A1 + A2 + ...An$$