ANSI/CAN/UL 12402-9:2022

JOINT CANADA-UNITED STATES NATIONAL ADOPTION

STANDARD FOR SAFETY

Personal Flotation Devices – Part 9: Test Methods

(ISO 12402-9:2011, MOD)

ANSI/UL 12402-9-2022

SCC FOREWORD

National Standard of Canada

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UL Standard for Safety for Personal Flotation Devices – Part 9: Test Methods, ANSI/CAN/UL 12402-9

First Edition, Dated December 31, 2015

Summary of Topics

This revision of ANSI/CAN/UL 12402-9 dated January 18, 2022 includes the following changes in requirements:

- ***Update to Add a Definition of Whitewater; 3.34DV***

- ***Corrections to Test Frame Dimensions; Figure 6DV***

- ***Updates to the Test Pan Dimensions; Figure 10DV***

- ***Self Righting Test Requirement Revisions, Table 6DV, 5.6.6.3ADV, and 5.6.6.3DDV.***

ANSI/CAN/UL 12402-9 is an adoption with binational deviations of ISO Standard for Personal Flotation Devices – Part 9: Test Methods, first edition of ISO 12402-9: 2006-09-01, and Amendment 1 dated 2011-04-01.

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 new and revised requirements are substantially in accordance with Proposal(s) on this subject dated June 11, 2021, September 3, 2021, and October 8, 2021.

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ANSI/CAN/UL 12402-9:2022

Standard for Personal Flotation Devices – Part 9: Test Methods

First Edition

December 31, 2015

This ANSI/CAN/UL 12402-9 consists of the First Edition including revisions through January 18, 2022.

The most recent designation of ANSI/UL 12402-9 as an American National Standard (ANSI) occurred on January 18, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface, and SCC Foreword.

This standard has been designated as a National Standard of Canada (NSC) on January 18, 2022.

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Preface (UL)

This is the First Edition of the ANSI/CAN/UL 12402-9, Standard for Personal Flotation Devices – Part 9: Test Methods, which is a National Adoption of the first edition of ISO 12402-9: 2006-09-01 and Amendment 1 dated 2011-04-01.

This Standard has been developed in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization.

This ANSI/CAN/UL12402-9 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of ANSI and SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

UL is accredited by the American National Standards Institute (ANSI) and the Standards Council of Canada (SCC) as a Standards Development Organization (SDO).

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

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.

To purchase UL Standards, visit the UL Standards Sales Site at http://www.shopulstandards.com/HowToOrder.aspx or call toll free 1-888-853-3503.

This Edition of the Standard has been formally approved by the UL Standards Technical Panel (STP) on Personal Flotation Devices, STP 1123.

This list represents the STP 1123 membership when the final text in this standard was balloted. Since that time, changes in the membership may have occurred.

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This Standard is intended to be used for conformity assessment.

The intended primary application of this standard is stated in its scope. It is important to note that it remains the responsibility of the user of the standard to judge its suitability for this particular application.

CETTE ADOPTION NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE

Reasons for Differences from ISO

National Differences from the ISO standard are being added in order to address regulatory and safety situations present in the US and Canada.

NATIONAL DIFFERENCES

There are six types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences. The National Differences in this standard were developed via a binational effort by the Canada / US 12402 Task Group.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are national differences from ISO requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the ISO or national requirement) is not available or the text has not been included in the ISO standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the ISO component standard.

DE – These are National Differences based on **editorial comments or corrections**. Some examples of editorial comments or corrections include replacing "lifejacket" with "PFD" or vice versa and correcting paragraph references.

DT – These are National Differences that are the result of pending changes that have been tentatively agreed internationally by ISO TC188/SC1 for the next edition of the standard and therefore are expected outcomes of the second edition of ISO 12402. These changes include both clarifications and substantive changes in requirements and that will be reviewed when the next edition of ISO 12402 is published.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base ISO text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base ISO text.

Modification / Modify - A modification is an altering of the existing base ISO text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base ISO text

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12402-9 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 162, *Protective clothing including hand and arm protection and lifejackets*, in collaboration with Technical Committee ISO/TC 188, *Small craft*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO 12402 consists of the following parts, under the general title *Personal flotation devices:*

– *Part 1: Lifejackets for seagoing ships – Safety requirements*

– *Part 2: Lifejackets, performance level 275 – Safety requirements*

– *Part 3: Lifejackets, performance level 150 – Safety requirements*

– *Part 4: Lifejackets, performance level 100 – Safety requirements*

– *Part 5: Buoyancy aids (level 50) – Safety requirements*

– *Part 6: Special purpose lifejackets and buoyancy aids – Safety requirements and additional test methods*

– *Part 7: Materials and components – Safety requirements and test methods*

– *Part 8: Accessories – Safety requirements and test methods*

– *Part 9: Test methods*

– *Part 10: Selection and application of personal flotation devices and other relevant devices*

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Introduction

ISO 12402 has been prepared to give guidance on the design and application of personal flotation devices (hereafter referred to as PFDs) for persons engaged in activities, whether in relation to their work or their leisure, in or near water. PFDs manufactured, selected, and maintained to this standard should give a reasonable assurance of safety from drowning to a person who is immersed in water.

Requirements for lifejackets on large, commercial seagoing ships are regulated by the International Maritime Organization (IMO) under the International Convention for the Safety of Life at Sea (SOLAS). ISO 12402-1 addresses lifejackets for seagoing ships.

ISO 12402 allows for the buoyancy of a PFD to be provided by a wide variety of materials or designs, some of which may require preparation before entering the water (e.g. inflation of chambers by gas from a cylinder or blown in orally). However, PFDs can be divided into the following two main classes:

– those which provide face up in-water support to the user regardless of physical conditions (lifejackets), and

– those which require the user to make swimming and other postural movements to position the user with the face out of the water (buoyancy aids).

Within these main two classes there are a number of levels of support, types of buoyancy, activation methods for inflatable devices, and auxiliary items (such as location aids), all of which will affect the user‘s probability of survival. Within the different types of buoyancy allowed, inflatable PFDs either provide full buoyancy without any user intervention other than arming (i.e. PFDs inflated by a fully automatic method) or require the user to initiate the inflation. Hybrid PFDs always provide some buoyancy but rely on the same methods as inflatable PFDs to achieve full buoyancy. With inherently buoyant PFDs, the user only needs to put the PFD on to achieve the performance of its class.

PFDs that do not require intervention (automatically operating PFDs) are suited to activities where persons are likely to enter the water unexpectedly; whereas PFDs requiring intervention (e.g. manually inflated PFDs) are only suitable for use if the user believes there will be sufficient time to produce full buoyancy, or help is close at hand. In every circumstance, the user should ensure that the operation of the PFD is suited to the specific application. The conformity of a PFD to this part of ISO 12402 does not imply that it is suitable for all circumstances. The relative amount of required inspection and maintenance is another factor of paramount importance in the choice and application of specific PFDs.

ISO 12402 is intended to serve as a guide to manufacturers, purchasers, and users of such safety equipment in ensuring that the equipment provides an effective standard of performance in use. Equally essential is the need for the designer to encourage the wearing of the equipment by making it comfortable and attractive for continuous wear on or near water, rather than for it to be stored in a locker for emergency use. Throwable devices and flotation cushions are not covered by this part of ISO 12402. The primary function of a PFD is to support the user in reasonable safety in the water. Within the two classes, alternative attributes make some PFDs better suited to some circumstances than others or make them easier to use and care for than others. Important alternatives allowed by ISO 12402 are the following:

– to provide higher levels of support (levels 100, 150, or 275) that generally float the user with greater water clearance, enabling the user’s efforts to be expended in recovery rather than avoiding waves; or to provide lighter or less bulky PFDs (levels 50 or 100);

– to provide the kinds of flotation (inherently buoyant foam, hybrid, and inflatable) that will accommodate the sometimes conflicting needs of reliability and durability, in-water performance, and continuous wear;

– to provide automatically operating (inherently buoyant or automatically inflated) PFDs that float users without any intervention on their part, except in initially donning the PFD (and regular inspection and rearming of inflatable types), or to provide user control of the inflatable PFD’s buoyancy by manual and oral operation; and

– to assist in detection (location aids) and recovery of the user.

PFDs provide various degrees of buoyancy in garments that are light in weight and only as bulky and restrictive as needed for their intended use. They will need to be secure when worn, in order to provide positive support in the water and to allow the user to swim or actively assist herself/himself or others. The PFD selected shall ensure that the user is supported with the mouth and nose clear of the water under the expected conditions of use and the user's ability to assist.

Under certain conditions (such as rough water and waves), the use of watertight and multilayer clothing, which provide (intentionally or otherwise) additional buoyancy, or the use of equipment with additional weight (such as tool belts) will likely alter the performance of the PFD. Users, owners and employers need to ensure that this is taken into account when selecting a PFD. Similarly, PFDs may not perform as well in extremes of temperature, although fully approved under this part of ISO 12402. PFDs may also be affected by other conditions of use, such as chemical exposure and welding, and may require additional protection to meet the specific requirements of use. If the user intends taking a PFD into such conditions, she/he has to be assured that the PFD will not be adversely affected. This part of ISO 12402 also allows a PFD to be an integral part of a safety harness designed to conform to ISO 12401, or an integral part of a garment with other uses, for example to provide thermal protection during immersion, in which case the complete assembly as used is required to conform to this part of ISO 12402.

In compiling the attributes required of a PFD, consideration has also been given to the potential length of service that the user might expect. Whilst a PFD needs to be of substantial construction and material, its potential length of service often depends on the conditions of use and storage, which are the responsibility of the owner, user and/or employer. Furthermore, whilst the performance tests included are believed to assess relevant aspects of performance in real-life use, they do not accurately simulate all conditions of this. For example, the fact that a device passes the self-righting tests in swimming attire, as described herein, does not guarantee that it will self-right an unconscious user wearing waterproof clothing; neither can it be expected to completely protect the airway of an unconscious person in rough water. Waterproof clothing can trap air and further impede the self-righting action of a lifejacket.

It is essential that owners, users and employers choose those PFDs that meet the correct standards for the circumstances in which they will be used. Manufacturers and those selling PFDs have to make clear to prospective purchasers the product properties, alternative choices and the limitations to normal use, prior to the purchase.

Similarly, those framing legislation regarding the use of these garments should consider carefully which class and performance levels are most appropriate for the foreseeable conditions of use, allowing for the higher risk circumstances. These higher risk circumstances should account for the highest probabilities of occurrence of accidental immersion and the expected consequences in such emergencies. More information on the selection and application is given in ISO 12402-10.

Personal flotation devices – Part 9: Test methods

1 Scope

This part of ISO 12402 specifies the test methods for personal flotation devices.

1DV DR *Addition to Clause 1 as follows:*

Where references are made to ISO 12402 standards, they shall be considered to be to UL 12402 with applicable Canadian / US National Differences where UL Standards exist. Where references are made to particular requirements within a part they shall include the associated DVs contained in that standard, as applicable.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 139:2005, *Textiles – Standard atmospheres for conditioning and testing*

ISO 2768-1, *General tolerances – Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

ISO 3386-1:1986, *Polymeric materials, cellular flexible – Determination of stress-strain characteristics in compression – Part 1: Low-density materials*

ISO 12401:2004, *Small craft – Deck safety harness and safety line for use on recreational craft – Safety requirements and test methods*

2DV.1 *DT Modification of Clause 2 by replacing normative reference ISO 12401 as follows:*

ISO 12401:2009, *Small craft – Deck safety harness and safety line for use on recreational craft – Safety requirements and test methods*

ISO 12402-1, *Personal flotation devices – Part 1: Lifejackets for seagoing ships – Safety requirements*

ISO 12402-2:2006, *Personal flotation devices – Part 2: Lifejackets, performance level 275 – Safety requirements*

ISO 12402-3:2006, *Personal flotation devices – Part 3: Lifejackets, performance level 150 – Safety requirements*

ISO 12402-4:2006, *Personal flotation devices – Part 4: Lifejackets, performance level 100 – Safety requirements*

ISO 12402-5:2006, *Personal flotation devices – Part 5: Buoyancy aids (level 50) – Safety requirements*

ISO 12402-6, *Personal flotation devices – Part 6: Special purpose lifejackets and buoyancy aids – Safety requirements and additional test methods*

ISO 12402-7:2006, *Personal flotation devices – Part 7: Materials and components – Safety requirements and test methods*

ISO 12402-8:2006, *Personal flotation devices – Part 8: Accessories – Safety requirements and test methods*

ISO 12402-10, *Personal flotation devices – Part 10: Selection and application of personal flotation devices and other relevant devices*

ASTM D471-98:1999, *Standard test method for rubber property – Effect of liquids*

International Convention for the Safety of Life of Sea (SOLAS), 1974, as amended, International Maritime Organization[1)]

2DV.2 DC *Modification of Clause 2 by adding the following normative reference:*

ANSI/UL 1191, 4th Edition, *Components for Personal Flotation Devices*

[1)] IMO is an institution with domicile in London issuing regulations which are then published as laws by the member states.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 **personal flotation device PFD** – garment or device which, when correctly worn and used in water, will provide the user with a specific amount of buoyancy which will increase the likelihood of survival

3.2 **inherently buoyant material** – material which is permanently less dense than water

3.3 **automatically operating PFD** – PFD in which buoyancy is provided by permanent means (inherently buoyant material) or by suitable means (gas inflation) effected by a system which automatically activates upon immersion and which, except for the inspection and rearming of inflatable types, when correctly donned requires no further action by the user

3.3DV.1 *DT Modification by deleting clause 3.3.*

3.4 **automatically inflating PFD** – PFD in which inflation is effected as a result of immersion without the user carrying out any action at the time of immersion

3.5 **manually inflated PFD** – PFD in which inflation is effected as a result of the user operating a mechanism

3.6 **orally inflated PFD** – PFD inflated by mouth to produce buoyancy

3.7 **PFD with secondary donning** – PFD for which additional donning or adjustment is needed to place the PFD in its functioning position from the position it is normally worn

NOTE Pouch-type devices are examples of the type of PFDs which usually require such additional positioning.

3.8 **vest-type PFD** – PFD covering the upper trunk of the user like a vest

3.9 **yoke-type PFD** – PFD in a style worn around the back of the neck and secured by a waist strap

3.10 **emergency light** – device which emits light so as to increase the chances of a user being located

3.11 **multi-chamber buoyancy system** – system that divides the buoyancy provided by an inflatable lifejacket into two or more separate compartments, such that if mechanical damage occurs to one, others can still operate and provide buoyancy so as to aid the user when immersed

3.11DV ***DT Modification by replacing the multi-chamber buoyancy system definition as follows:***

PFD with buoyancy to meet the applicable PFD performance requirement provided by multiple sources including, for example, devices with a combination of inherent buoyancy and inflatable chamber(s), or devices with two or more independent inflatable chambers that collectively provide the in-water performance conforming to the relevant part.

NOTE 1 This excludes supplemental inflation chambers.

3.12 **deck safety harness and safety line** – device that allows a user to be securely attached to a strong point on a vessel or on shore, so as to prevent him from falling into the water, or, if he does fall into the water, to prevent him from being separated from the vessel or shore

3.13 **buddy line** – length of cord which can be tied or otherwise fixed to another person or to that person's PFD or other objects, so as to keep a user in the vicinity of that person or object with a view to making location and thus rescue easier

3.14 **lifting loop** – device which facilitates manual recovery of a person from water

3.15 **sprayhood** – cover brought or placed in front of the airways of a user in order to reduce or eliminate the splashing of water from waves or the like onto the airways and thereby to promote the survival of the user in rough water conditions

3.16 **protective cover** – cover that is normally in place over the functional elements of a PFD in order to protect them from physical damage, or snagging on external objects

NOTE 1 The protective cover may be designed to provide additional properties, i.e. to make the PFDs suitable for use when the subject is exposed to additional hazards, e.g. significant abrasion, molten metal splash, flame and fire.

NOTE 2 The inflatable chamber of an inflatable PFD is an example of a functional element.

3.17 **overpressure relief valve** – valve which may be used in an inflatable system to avoid the likelihood of destruction caused by overpressure

3.18 **whistle** – device which, when blown by mouth, produces an audible sound which can aid in the location of the user

3.19 **hybrid-type PFD** – PFD of combined buoyancy types, i.e. inherent and inflatable

3.19DV D1 ***Modification by adding a note to the hybrid-type PFD definition as follows:***

NOTE – An inflatable PFD with minimal inherent buoyancy to meet the uninflated buoyancy test (see UL 12402-5, 5.3.1.2) is not considered a hybrid-type PFD.

3.20DV ***DT Modification by adding bunching definition to clause 3:***

bunching – curling or folding of internal buoyant material upon itself, from its original position, within the envelope

3.21DV ***DT Modification by adding sheltered waters definition to clause 3:***

sheltered waters – water with protection from significant breaking waves, current, or strong winds, where the possibility of being blown or carried away from shore or place of safety is minimal

3.22DV ***DT Modification by adding offshore definition to clause 3:***

offshore – water that is unprotected and influenced by a variety of threat conditions such as waves, tide, currents, or wind, which may be at sea or on inland waters

3.23DV ***DT Modification by adding primary inflation definition to clause 3:***

primary inflation – means of inflating an inflation chamber that meets the applicable PFD performance requirements and that requires the least amount of intervention by the user, generally according to the following order of precedence: automatic (easiest), manual (second), and oral (most difficult)

3.24DV ***DT Modification by adding secondary inflation definition to clause 3:***

secondary inflation – alternate method of inflation which is provided in case the primary system fails

3.25DV ***DT Modification by adding primary inflation chamber(s) definition to clause 3:***

primary inflation chamber(s) – inflation chamber(s) associated with the primary inflation system that alone meets the applicable PFD performance requirements and provides the greatest in-water performance and ease of use

3.26DV ***DT Modification by adding back-up inflation chamber definition to clause 3:***

back-up inflation chamber – inflation chamber(s) other than the primary chamber(s) that, when used alone or together, provides redundancy to float the wearer in case a primary inflation chamber fails to function

3.27DV ***DT Modification by adding supplemental inflation chamber definition to clause 3:***

supplemental inflation chamber – inflation chamber other than a primary or back-up chamber that is intended for deployment after stabilization in the water, and provides enhanced features such as splash protection, higher freeboard, improved head support, additional stability, location detection, etc.

3.28DV D2 ***Addition of definitions as follows:***

3.28.1DV somatotypes – four categories of human body types based on physical characteristics: endomorphy (En), mesomorphy (Me), ectomorphy (Ec), and central (Ce).

a) endomorph (En) – body type having a more rounded appearance with limited muscle definition, normal bone structure, higher body fat, and typically the waist and thigh areas carry a larger percentage of body mass than the upper chest area

b) mesomorph (Me) – body type having well defined muscles, large bone structure, and low body fat with broad shoulders tapering to a defined narrower waist

c) ectomorph (Ec) – lean body type with low muscle mass, light bone structure, and low body fat with a linear physique

d) central somatotype – body type having no dominant endomorph, mesomorph, or ectomorph characteristics

3.29DV D2 ***Modification by adding primary closure definition to clause 3:***

primary closure – one or more 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

3.30DV D2 ***Modification by adding secondary closure definition to clause 3:***

secondary closure – closure or closures not meeting the definition of a primary closure

3.31DV D2 ***Modification by adding structural component definition to clause 3:***

structural parts, materials, and component – parts, materials, or components that are integral to the device and that are essential for its correct function and performance

3.32DV D2 ***Modification by adding design inflation range definition to clause 3:***

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

3.33DV D2 ***Modification by adding user category definitions to clause 3:***

3.33DV.1 user categories – four categories of user types based on weight.

a) Adult PFD – PFD intended for users with a mass greater than 40 kg

b) Youth PFD – PFD intended for users with a mass greater than 25 kg and less than or equal to 40 kg

c) Child PFD – PFD intended for users with a mass greater than 15 kg and less than or equal to 25 kg

d) Infant PFD – PFD intended for users with a mass less than or equal to 15 kg

3.34DV D1 ***Modification by adding Reference Test Device (RTD) definition to clause 3:***

Reference Test Device (RTD)

A calibrated test apparatus with known in-water performance for comparison of a candidate PFD, used in the RTD testing method.

a) Adult RTD – USCG Model 63, used in the RTD testing method for a level 100 lifejacket intended for use by persons over 40 kg

b) Child RTD – USCG Model 67, used in the RTD testing method for a level 100 lifejacket intended for use by persons between 15 and 40 kg

c) Infant RTD (Lifejacket) – SOLAS Infant RTD, used in the RTD testing for a level 100 or 150 lifejacket intended for use by persons under 15 kg

d) Infant RTD (Buoyancy Aid) – USCG Model CKS-2, used in the RTD testing for a level 70 buoyancy aid intended for use by persons under 15 kg

4 Classification of personal flotation devices

An overview of this classification is given in Annex A for information.

5 Test methods

5.1 General

Unless otherwise specified, a new sample of the PFD to be tested may be used for each of the tests.

A combination of PFD and accessories in accordance with ISO 12402-8 shall not impair the performance of either item. This shall be proved during the test required for both PFD and accessories. If necessary, the test sequence shall be arranged accordingly.

The human subject performance tests shall be witnessed by a test panel of at least 2 experts familiar with testing and the products specified in the relevant parts of ISO 12402.

The human subject performance tests shall be carried out under the direction of a test house's test panel that is experienced in these specific test procedures. These tests shall be observed by at least 2

experienced observers from the panel and repeated with 3 experienced observers from the panel if there is any question about the performance observed. An observer is to be qualified by having expertise in observing (or conducting under the supervision of a qualified observer) the specific test on at least 3 occasions.

NOTE 1 Specific test means, for instance, that experience with stability testing would not qualify for self-righting testing or that experience with self-righting testing of inherently buoyant PFDs would not qualify as experience with similar testing of inflatable PFDs.

NOTE 2 It is recommended that the test panel have at least one member of the test house regularly participating in experience exchanges and round robin tests.

5.2 Sampling and conditioning

5.2.1 Sampling

At least one sample of each size of the device to be tested shall be provided, if not specified otherwise in the part of ISO 12402.

5.2.2 Conditioning

Prior to testing, the samples shall be conditioned for (24 ± 0,1) h under the appropriate standard atmosphere as defined in ISO 139 according to the specific fabric used for the PFD.

If spelled out to be tested under wet conditions, the sample shall be soaked for at least 5 min in fresh water, or as specified by the test procedure itself.

5.2DVDV D2 ***Modification by replacing the first paragraph of clause 5.2.2 as follows :***

Conditioning prior to testing

The samples used for the mechanical properties tests shall be conditioned for (24 ±0,1) h under the appropriate standard atmosphere as defined in ISO 139 according to the specific fabric used for the PFD.

5.3 Criteria for passing and failure

All required samples shall pass all tests specified in 5.5 for the entire device to meet the requirements of the relevant parts of ISO 12402. Due to the high variability between human subjects and the difficulty in assessing some subjective measures, for tests according to 5.6 a test subject may be disqualified if demonstrated not to perform in accordance with this standard when tested in a reference vest as described in Annex B, C or D. When a reference vest is used, the test report shall state the model of reference vest(s). Whenever a subject is disqualified from this test, another two subjects with similar weight, height and anatomic build shall be subjected to the same test and before the same test panel. If these additional tests are still not clearly passed in accordance with this standard and the part of ISO 12402 applicable to the performance level of device, the device shall be deemed to have failed.

5.3DV DE *Modification by deleting clause 5.3*.

5.4 Magnetic properties testing

Place a direct-reading magnetic compass in an undisturbed magnetic area (i.e. an area in which magnetic items and d.c. electrical cables are not continually moved or switched). Check the compass to ensure that it has negligible pivot friction. This can be done by deflecting the compass card 10° by means of a magnet and then removing the deflecting force, when the card should return to within 0,5° of its original position.

Present the metal components (with any hooks closed) individually to the compass on an approximately east-to-west line, to a position where the nearest point of the component is (300 ± 10) mm horizontally from the center of the compass. Lightly tap the compass to eliminate the effect of friction. Record the angle, in degrees, of any deflection of the compass from its position before the metal components were brought near the compass.

5.5 Mechanical properties tests

5.5.1 General

The material properties tests shall be conducted in accordance with Table 1 or Table 2 on device(s) of the size that has been determined to represent the weakest construction. When different device sizes have substantially the same construction, any representative size may be tested.

Table 1
Mechanical properties tests for inherently buoyant PFDs

Applicable tests	Applicable samples					
	A[a]	B[b]	C[c]	D[d]	E[d]	F[d]
5.5.3 Rotating shock bin test method	X	X	X	X	X	X
5.5.4 Temperature cycling test	X	X	X	X	X	X
5.5.2.3.2 Horizontal load test		X[e]				
5.5.2.3.3 Vertical load test		X[e]				
5.5.2.4 Lifting loop test		X[e]				
5.5.2.5 Buddy line test		X[e]				
5.5.7 Over-pressure test						
5.5.9 Measurement of buoyancy of the whole device	X					
5.5.10 Inflation test						
5.5.11 Test of the resistance to inadvertent inflation						
5.5.12 Test of the resistance to burning	X					

[a] For each size.

[b] For adult devices, this sample may be the smallest size. For child devices, the sample may be the smallest size.

[c] For adult devices, this sample may be the largest size. For child devices, the sample may be the largest size.

[d] When substantially the same construction is used in adult and child devices, any size may be tested.

[e] An alternative sample subjected to 5.5.4 of the smallest size may be substituted for this test.

Table 1DV D2 *Modification of Table 1 by replacing with Table 1DV:*

Table 1DV
Mechanical properties tests for inherently buoyant PFDs

Applicable tests	Applicable samples		
	A[a]	B[b]	C[c]
5.5.4.3DV Resistance to temperature extremes			X
5.5.2.3.2 Horizontal load test	X[e]		
5.5.2.3.3 Vertical load test	X[e]		
5.5.2.4 Lifting loop test	X[e]		
5.5.2.5 Buddy line test	X[e]		
5.5.2.6DV Collar handles test			X[e]
5.5.2.7DV Holding down device test			X[e]
5.5.2.8DV Body strap hardware secureness test[f]			
5.5.2.9DV Secondary closure attachment-strength test[f]			
5.5.9 Measurement of buoyancy of the whole device	X		
5.5.12 Test of the resistance to burning		X	

[a] For each size.
[b] This sample shall be the smallest size.
[c] This sample shall be the largest size.
[d] When substantially the same construction is used in adult and child devices, any size may be tested.
[e] An alternate sample subjected to 5.5.4 of the same size may be substituted for this test.
[f] Not tested on a device and does not require the temperature test.

Table 2
Mechanical properties tests for inflatable PFDs

Applicable tests	Applicable samples			
	A[a]	B[b]	C[c]	D[d]
5.5.3 Rotating shock bin test method	X	X	X	X
5.5.4 Temperature cycling test	X	X	X	X
5.5.2.3.2 Horizontal load test		X[e]		
5.5.2.3.3 Vertical load test		X[e]		
5.5.2.4 Lifting loop test		X[e]		
5.5.2.5 Buddy line test		X[e]		
5.5.7 Over-pressure test			X	
5.5.9 Measurement of buoyancy of the whole device	X			
5.5.10 Inflation test		X		
5.5.11 Test of the resistance to inadvertent inflation	X			
5.5.12 Test of the resistance to burning			X	

[a] For each size.
[b] For adult devices, this sample may be the smallest size. For child devices, the sample may be the smallest size.
[c] For adult devices, this sample may be the largest size. For child devices, the sample may be the largest size.
[d] When substantially the same construction is used in adult and child devices, any size may be tested.
[e] An alternative sample subjected to 5.5.4 of the smallest size may be substituted for this test.

Table 2DV D2 *Modification of Table 2 by replacing with the following Table 2DV*

Table 2DV
Mechanical properties tests for inflatable PFDs

Applicable tests	Applicable samples				
	A[a]	B[b]	C[c]	D[d]	E[d]
5.5.3 Rotating shock bin test method	X	X	X	X	
5.5.4 Temperature cycling test	X	X	X	X	
5.5.2.3.2 Horizontal load test		X[e]			
5.5.2.3.3 Vertical load test		X[e]			
5.5.2.4 Lifting loop test		X[e]			
5.5.2.5 Buddy line test		X[e]			
5.5.2.6DV Collar handles test				X[e]	
5.5.2.7DV Holding down device test				X[e]	
5.5.2.8DV Body strap hardware secureness test[f]					
5.5.2.9DV Secondary closure attachment-strength test[f]					
5.5.2.10DV Strength of attachment test for inflatable PFDs		X[e]			
5.5.7 Over-pressure test			X		
5.5.9 Measurement of buoyancy of the whole device	X				
5.5.10 Inflation test		X[e]			
5.5.11 Test of the resistance to inadvertent inflation	X				
5.5.12 Test of the resistance to burning			X		
5.5.13DV Puncture Resistance test					X

[a] For each size.
[b] This sample shall be the smallest size.
[c] This sample shall be the largest size.
[d] When substantially the same construction is used in adult and child devices, any size may be tested.
[e] An alternate sample subjected to 5.5.3 and 5.5.4 of the same size may be substituted for this test.
[f] Not tested on a device and does not require the temperature test.

5.5.2 Horizontal and vertical load tests

5.5.2.1 Principles

The PFD shall be subject to tension via its integral structure, such as waist belt or harness arrangement, by means of a specified load. The tests shall be carried out in the following order and be applied to the same PFD sample:

horizontal load test wet;

vertical load test wet.

NOTE Test houses may use other test arrangements as described in 5.5.2.3, i.e. by means of a hydraulic jig, if the load maintained and the same accuracy of results can be achieved.

5.5.2.2 Apparatus

The apparatus consists of a horizontally suspended upper cylinder, of diameter (50 ± 5) mm for PFD user masses less than 40 kg, or of diameter (125 ± 10) mm for PFD user masses of 40 kg and above, to which the PFD is fitted. The length of the test cylinder shall be sufficient to accommodate the full width of the portion of the PFD under test.

For the horizontal load test shown in Figure 2 and Figure 4, an additional lower test cylinder of similar size to the upper cylinder shall be placed in the PFD in the position indicated. The axes of the upper and lower cylinders shall be regarded as the datum positions A1-A2 and B1-B2, respectively, shown in Figure 2 and Figure 4.

For the horizontal load test shown in Figure 2 and Figure 4, a pre-load is required. The total pre-load shall be (20 ± 2) N.

For the vertical load tests shown in Figure 3 and Figure 5, the lower apparatus shall have the dimensions as indicated in Figure 6 and Figure 7. The diameter of the tube shown in Figure 7 shall be (50 ± 5) mm for PFD user masses less than 40 kg and (125 ± 10) mm for user masses of 40 kg and above.

5.5.2.2DV DE *Modification by replacing paragraphs 2 through 4 of clause 5.5.2.2 as follows:*

For the horizontal load test shown in Figure 2 and Figure 4, an additional lower test cylinder of similar size to the upper cylinder shall be placed in the PFD in the position indicated. The axes of the upper and lower cylinders shall be regarded as the datum positions A1-A2 and B1-B2, respectively, shown in Figure 2 and Figure 4.

For the horizontal load test shown in Figure 2 and Figure 4, a pre-load is required. The total pre-load shall be (20 ± 2) N.

For the vertical load tests shown in Figure 3DV and Figure 5DV, the apparatus shall have the dimensions as indicated in Figure 6DV.

The dummy or test form may be modified to prevent the device from slipping off of the neck projection, if needed for a valid test.

For all load tests, any load from the test fixtures applied to the device shall be included in the test load.

5.5.2.3 Procedure

5.5.2.3.1 General

The webbing or movable part of the assembly shall be marked at each point of adjustment prior to application of each test load. This includes tie tapes, draw cords, and lacing, as well as webbing-hardware adjustments.

A different sample is acceptable to test each configuration. Except for hardware closures on buoyancy aids, the tests shall be repeated on each closure independently. For buoyancy aids, all closures shall be fastened and adjusted to the mid-range to approximate even loading.