ANSI/CAN/UL 12402-9:2024

JOINT CANADA-UNITED STATES NATIONAL ADOPTION

STANDARD FOR SAFETY

Personal Flotation Devices – Part 9: Test Methods

(ISO 12402-9:2011, MOD)

ANSI/UL 12402-9-2024

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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 November 19, 2024 includes the following changes:

– Vinyl dipped PFD's and Resistance to temperature extremes: 5.5.4.3DV;

– Inflation test: 5.5.10.2.3DV.1;

– Correction of an error in Figure 3DV;

– Addition of clarification on the pressure for the 3m jump test: Table 9DV;

– Proposed revision to Rotating Shock Bin Test: 5.5.3.3DV.

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 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 June 21, 2024 and September 25, 2024.

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ANSI/UL 12402-9-2024

DECEMBER 31, 2015
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ANSI/CAN/UL 12402-9:2024

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 November 19, 2024.

The most recent designation of ANSI/UL 12402-9 as an American National Standard (ANSI) occurred on November 19, 2024. 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 November 19, 2024.

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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.

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This list represents the TC 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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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.

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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.

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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
>
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Foreword

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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

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– 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.

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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*

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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 *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

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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

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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

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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

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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

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