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Personal flotation devices —

Part 8: Accessories — Safety requirements and test methods

Équipements individuels de flottabilité —

Partie 8: Accessoires — Exigences de sécurité et méthodes d'essai

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 188, *Small craft*, Subcommittee SC 1, *Personal safety equipment*.

This second edition cancels and replaces the first edition (ISO 12402-8:2006), which has been technically revised. It also incorporates the Amendment ISO 12402-8:2006/Amd. 1:2011.

The main changes compared to the previous edition are as follows:

a) amendment of terms and definitions (Clause 3);

b) amendment of specifications and test methods (Clause 5);

c) addition of multi -chamber buoyancy;

d) addition of lifting loop;

e) amendment of emergency position-indicating lights (Clause 5.10);

f) amendment of Annex A “Classification of personal flotation devices”;

g) addition of PFDs with PLDs;

h) the marking with the number of the standard has been deleted.

A list of all parts in the ISO 12402 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

ISO 12402 (all parts):2020 deals with personal floatation devices (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 International Standard give a reasonable assurance of safety from drowning to a person who is immersed in water. ISO 12402 (all parts):2020 does not include the following:

— requirements for lifejackets on seagoing ships, which are regulated by the International Maritime Organization (IMO)[1)] under the International Convention for the Safety of Life at Sea (SOLAS);

— throwable devices and flotation cushions.

ISO 12402 (all parts):2020 allows for the buoyancy of a PFD to be provided by a variety of materials or designs, some of which can require preparation before entering the water (e.g. inflation of chambers by gas from a cylinder or blown in orally). 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), which all 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, if automatic operation would result in entrapment, or if 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 the ISO 12402 series:2020 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 (all parts):2020 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. 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 provided by ISO 12402 (all parts):2020 are the following:

— to provide higher levels of support (levels 100, 150, or 275) that generally float the user with greater water clearance, when required for increasingly severe conditions; 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 accommodate the sometimes conflicting needs of reliability and durability, in-water performance, and continuous wear;

1) The International Maritime Organization (IMO) is an institution with domicile in London issuing regulations which are then published as laws by its Member States.

— 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 need to be secure when worn, in order to provide positive support in the water and to allow users to swim or actively assist themselves or others. The PFD selected ensures 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) can alter the performance of the PFD. Users, owners and employers need to ensure that this is taken into account when selecting a PFD. Similarly, it is possible that PFDs do not perform as well in extremes of temperature, although meeting ISO 12402 (all parts):2020 requirements. PFDs can also be affected by other conditions of use, such as chemical exposure and welding, and can require additional protection to meet the specific requirements of use. Taking a PFD into such conditions necessitates the assurance that the PFD will not be adversely affected. ISO 12402 (all parts):2020 also allows a PFD to be an integral part of a safety harness designed to conform to ISO 12401:2009, 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 expected to conform to ISO 12402 (all parts):2020.

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 use. 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 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 impair 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.

The characteristics of the product properties, alternative choices and the limitations to normal use are to be explained to potential buyers by manufacturers and distributors of PFDs prior to purchase.

Similarly, it is advised that regulators regarding the use of these garments 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 expected consequences. Requirements and recommendations for the correct selection and application of PFDs are given in ISO 12402-10:2020.

Personal flotation devices —

Part 8:
Accessories — Safety requirements and test methods

1 Scope

This document specifies the safety requirements and test methods for accessories used for personal flotation devices (PFDs).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 9150:1988, *Protective clothing — Determination of behaviour of materials on impact of small splashes of molten metal*

ISO 12401:2009, *Small craft — Deck safety harness and safety line — Safety requirements and test methods*

ISO 12402-2:2020, *Personal flotation devices — Part 2: Lifejackets, performance level 275 — Safety requirements*

ISO 12402-3:2020, *Personal flotation devices — Part 3: Lifejackets, performance level 150 — Safety requirements*

ISO 12402-4:2020, *Personal flotation devices — Part 4: Lifejackets, performance level 100 — Safety requirements*

ISO 12402-5:2020, *Personal flotation devices — Part 5: Buoyancy aids (level 50) — Safety requirements*

ISO 12402-6:2020, *Personal flotation devices — Part 6: Special application lifejackets and buoyancy aids — Safety requirements and additional test methods*

ISO 12402-7:2020, *Personal flotation devices — Part 7: Materials and components — Safety requirements and test methods*

ISO 12402-9:2020, *Personal flotation devices — Part 9: Evaluation*

IMO Resolution A.689 (17), *Recommendation on Testing of Live-Saving Appliances, as amended through Resolution MSC 81(70)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
personal flotation device
PFD
garment or device which, when correctly worn and used in water, provides the user with a specific amount of buoyancy which increases the likelihood of survival

3.2
emergency position-indicating light
device which emits light so as to increase the chances of a user being located

3.3
multi-chamber buoyancy system
PFD with buoyancy to meet the applicable *PFD* (3.1) performance requirement provided by two or more independent chambers

Note 1 to entry: This excludes supplemental inflation chambers.

3.4
deck safety harness
device that allows a user to be securely attached to a strong point on a vessel or on shore, preventing a fall into the water or, if falling occurs, preventing separation from the vessel or shore

3.5
buddy line
length of cord which can be tied or otherwise fixed to another person or to that person's *PFD* (3.1) 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

3.6
lifting loop
device which facilitates manual recovery of a person from water

3.7
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 promoting the survival of the user in rough water conditions

3.8
protective cover
cover that is normally in place over the functional elements of a *PFD* (3.1) in order to protect them from physical damage, or snagging on external objects

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

Note 2 to entry: The inflatable chamber of an inflatable PFD is an example of a functional element.

3.9
whistle
device which, when blown by mouth, produces an audible sound which can aid in the location of the user

3.10
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 a place of safety is minimal

3.11
offshore
water that is unprotected and influenced by threat conditions such as waves, tide, currents, or wind, at sea or on inland waters

3.12
primary means of inflation
means of inflating an inflation chamber that meets the applicable *PFD* (3.1) 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)

3.13
primary chamber
inflation chamber associated with the *primary means of inflation* (3.12) that alone meets the applicable *PFD* (3.1) performance requirements

3.14
back-up chamber
inflation chamber other than the *primary chamber(s)* (3.13) or *supplemental chamber* (3.15) that, when used alone, provides performance in case the primary chamber fails to function

3.15
supplemental chamber
inflation chamber other than a *primary chamber* (3.13) or *back-up chamber* (3.14) that is intended for deployment after stabilization in the water, and provides enhanced performance such as higher freeboard, improved head support, additional stability, splash protection, location, detection

3.16
personal locator device
PLD
device that aids the (electronic) detection and location of people in distress and emergency situations

3.17
oral inflation
inflation resulting from the user blowing air into the *PFD* (3.1) by mouth

4 Classification of PFDs

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

5 Specifications and test methods

5.1 General

5.1.1 When accessories complying with this document are attached to, or included with, PFDs conforming to ISO 12402-2:2020 to ISO 12402-6:2020, both the accessory and the PFD shall remain in conformity with the relevant standards when tested according to ISO 12402-9:2020.

5.1.2 Any integral combination or claimed permissible or usable combination shall conform to the relevant standards for each individual item, and as a combined assembly for each permissible combination. Only then can the combination be stated and marked as complying with the relevant part of ISO 12402. Whilst it is not required that the combination be donned or doffed in a single operation, each component shall satisfy its required tests when in combination and when separated, unless it is of permanently integral construction. Pass-fail-criteria shall be as specified in the relevant standard.

Where no test is specified, the requirements shall be verified by visual inspection.

NOTE Suits and the combination of a lifejacket and a safety harness are examples of combinations.

5.2 Whistles

5.2.1 Whistles shall be non-metallic and robust in construction, free from all burrs, and shall not rely on any moving part for the production of sound.

5.2.2 Three specimens shall be tested by being blown as hard as possible by a subject of between 20 years and 30 years of age and free from all known impairments to pulmonary function, in an outside and open area during calm clear weather. The sound generated shall be shown at least at an instant to have exceeded 100 dB(A) measured at a distance of (5 ± 0,1) m directly in front of the whistle. The predominant frequency shall be (2 ± 1) kHz and shall be multi-tone.

NOTE Multi-tone means that the whistle has two chambers which emit different primary frequencies.

5.2.3 The whistle shall also be shown to be capable of producing sound in air immediately following immersion in fresh water. The procedure in 5.2.2 shall be repeated immediately after the whistle has been removed from immersion in fresh water.

5.2.4 The whistle shall be attached to a cord or line of a length sufficient to permit its use, which shall in turn be attached securely to the lifejacket or buoyancy aid. The attachment and the cord of the whistle shall be loaded vertically with a static load of (200 ± 10) N for 60 s without any damage or separation of the whistle from the PFD.

5.2.5 The whistle shall be stowed on the device in such a way that the performance of the lifejacket is not affected, but so that it can be removed for use with either hand of the user, and can be stowed by the user. The stowage of the whistle shall be verified when the lifejacket is tested according to ISO 12402-9:2020, 5.6.

5.3 Deck safety harness and safety lines

Deck safety harnesses and safety lines to be used for lifejackets shall comply with ISO 12401:2009.

5.4 Buddy lines

5.4.1 A buddy line shall be made from synthetic cord or webbing and shall have a minimum length of 1 500 mm. The line shall have, attached securely to the free end, a releasable means for attachment to another person or object, such as a loop, a snap hook, or a wooden or plastic toggle. The other end of the line shall be attached securely to the retention system of the PFD.

5.4.2 The buddy line shall be readily accessible to at least one of the user's hands as confirmed during device testing.

5.4.3 The attachment means and line shall be stowed in such a way that they do not create a hazard or affect the normal operation of the PFD. The stowage of the buddy line shall be verified when the lifejacket is tested according to ISO 12402-9:2020, 5.6. Weathering testing is not required when the buddy line is normally stowed inside a pocket.

5.4.4 If hardware is provided as an attachment means, it shall not have sharp edges. The assembly shall float. The hardware of the buddy line shall either not be broken or, if broken, not expose sharp edges after testing in accordance with ISO 12402-9:2020, 5.5.6.

5.4.5 A buddy line of the length provided by the manufacturer shall be tested, as indicated for a PFD, in accordance with ISO 12402-9:2020, 5.5.6, and withstand a (750 ± 10) N load for (1,0 ± 0,1) min without any damage. The force required to accomplish separation of the buddy line shall be greater than 750 N

and less than 1 500 N. The separation of the buddy line from the PFD shall not adversely affect the integrity of the PFD, when tested according to ISO 12402-9:2020.

PFDs with buddy lines conforming to this document shall be marked with the words “buddy line”. Also, a marking shall be included on the buddy line or the outside of a pocket in which a buddy line is stowed, in letters ≥12 mm high with the words “NOT FOR LIFTING”.

5.5 Sprayhood

5.5.1 General

A sprayhood shall be securely attached to the PFD. If any form of hood or sprayhood is fitted to cover the face in whole or in part to protect mouth and nose from water splash, gas exchange shall be tested according to 5.5.2 of this document.

When not in use, the sprayhood shall be stowed in a position which keeps it clear of the user’s face. It shall not interfere with the operation of the lifejacket or create a hazard, for example through snagging when tested according to ISO 12402-9:2020, 5.6. When tested as a combined assembly with the PFD in accordance with ISO 12402-9:2020, 5.5.2 and 5.5.3, the sprayhood, including any clear window material, should show no sign of damage, such as shrinking, cracking, swelling, dissolution or change of mechanical qualities, by visual inspection.

The sprayhood shall be able to be deployed to protect the airway whilst the user is in the water, with the lifejacket fully deployed and inflated, if inflatable. When deployed, it shall not impair the performance of the lifejacket when tested as an assembly with the PFD according to ISO 12402-9:2020, 5.6.

The sprayhood shall be fitted with a clear material so that, when deployed, it shall not unduly restrict vision. This shall be confirmed by visual inspection and interrogation of the subjects.

If, when deployed, the sprayhood reduces the effectiveness of any retroreflective material on the lifejacket, the sprayhood shall itself provide an additional retroreflective area at least equal to that obscured.

The sprayhood shall be easily removable from its protective position, and shall be capable of being re-stowed so that it does not fall back to its deployed position. This shall be demonstrated when tested in accordance with ISO 12402-9:2020, 5.6.

PFDs including a sprayhood conforming to this document shall be marked with the word “sprayhood”.

5.5.2 Gas exchange test

5.5.2.1 General

Respiratory gas exchange can be measured as a decrease in oxygen concentration or an increase in carbon dioxide concentration.

The CO_2 and O_2 values, by volume (to the nearest 1 %), in dry air are related as follows:

$$CO_2 = 21 - O_2 \text{ in percent}$$

5.5.2.2 Absolute values shall be measured with continuous flow electronic equipment.

Two test persons between 20 years and 30 years of age and free from all known impairments to pulmonary function, shall be used for this test. Each test subject wearing the lifejacket (inflated if inflatable) with the sprayhood deployed shall be positioned floating face up and relaxed in calm water.

The gas shall be sampled from under the sprayhood either on the right or left side of the face between nose and mouth and at a distance from the face centre line of $\left(10^{\ 0}_{-3}\right)$ cm.

The measurement shall be started 5 min after adjusting the sprayhood. Measurement shall be continuous during 5 min. The sprayhood fails if 5 % CO_2 is exceeded at any time, if the average value of CO_2 is more than 2,5 % in any one minute, or if O_2 falls below 16 % at any time.

5.6 Protective covers for additional hazards

5.6.1 General

Protective covers for additional hazards shall be made of a material which is robust and resistant to the abrasion of wear in rough use. Requirements and testing of the effect of abrasion on tensile strength shall be in accordance with ISO 12402-7:2020, Table 15. Protective covers shall not impede the conformity of the entire device with ISO 12402-2:2020 to ISO 12402-6:2020, and themselves shall not prevent the device components from meeting the requirements specified in ISO 12402-7:2020. PFDs with protective covers conforming to this document shall be marked with the words “protective cover” and the hazard protected against.

To conform with requirements caused by additional hazards, there might be certain requirements for the cover specified in standards for such applications, such as chemical resistance, etc. If so claimed, the cover shall be tested to the requirements of that standard and shall also be marked with the standard with which it complies, as applicable. By meeting those requirements, the PFD and its cover shall still maintain its function as a PFD according to the relevant part of the ISO 12402 series:2020.

After testing according to 5.6.2, the PFD shall still comply with the requirements as specified in the relevant parts of the ISO 12402 series:2020.

5.6.2 Additional protection

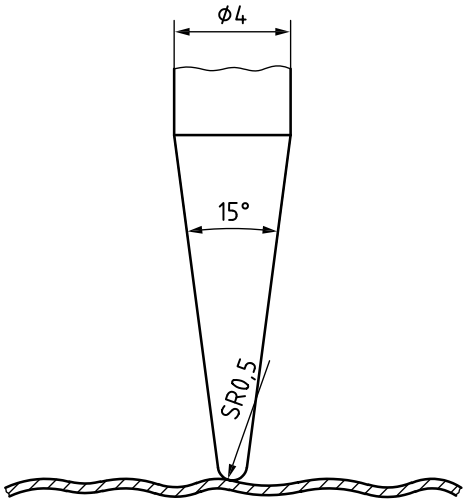
5.6.2.1 Puncture resistance

Protective covers shall withstand the following puncture resistance test:

The PFD, in its packed configuration, shall be placed front up on a rigid, smooth, flat plywood surface.

The test point (see Figure 1) is to be pressed against the exterior protective cover at three different locations (such as each front side and the collar), perpendicular to the surface, and with a uniform speed of 2,5 mm/s to 5,0 mm/s until a force of 62 N is attained. After the test, the PFD shall be inflated and there shall be no leakage.

Dimensions in millimetres



Key

SR radius

Figure 1 — Test point for puncture resistance

5.6.2.2 Small molten metal particles, splash resistance

Protective covers shall be submitted to the test of resistance to splashes of small molten metal particles in accordance with ISO 9150:1988 and shall not be perforated as a result of the test. Three test specimens are each to be subjected to 25 drops of mass (0,5 ± 0,03) g sprayed at a frequency of 1 drop every 3 s. After the test, the PFD shall be inflated and there shall be no leakage.

5.7 Multi-chamber buoyancy for back-up protection

5.7.1 General

This subclause refers to PFDs with back-up protection. The back-up protection can be either full or partial. In all cases, when the primary chamber(s) and back-up chamber(s) are inflated together, the PFD shall continue to meet the in-water performance requirements of the relevant part of the ISO 12402 series:2020 for which the PFD is designed.

Back-up protection chamber(s) shall not be provided with automatic inflation systems.

5.7.2 Full back-up protection

A PFD with full back-up protection (in case a primary chamber fails to function) shall provide the performance specified in the relevant part of the ISO 12402 series:2020. The back-up chamber(s), with the primary chamber(s) deflated, shall provide the performance necessary to meet the requirements of the relevant part of the ISO 12402 series:2020 for which the PFD is designed.

5.7.3 Partial back-up protection

A PFD with partial back-up protection (in case a primary chamber fails to function) shall continue to provide performance at a level of not less than that specified in ISO 12402-5:2020, 5.6, with the back-up chamber(s) inflated alone.

5.7.4 Inflatable buoyancy chambers

All buoyancy chambers, components and relief valves shall be capable of withstanding an overpressure without damage or permanent deformation or evidence of leakage when tested in accordance with ISO 12402-9:2020, 5.5.14.

Each buoyancy chamber shall be tested independently and as a combination.

5.7.5 Marking for back up performance

In addition to the information on the PFD required in 6.2 of the relevant part of the ISO 12402 series: 2020 for which the PFD is designed, markings shall state whether full or partial back up is provided, and the buoyancy provided by the primary buoyancy source(s) alone and the buoyancy provided by the back-up chamber(s) alone shall be stated.

5.7.6 Explanation of back up performance in information supplied by the manufacturer

In addition to the information in the explanatory leaflet supplied with the PFD required in Clause 7 of the part of the ISO 12402 series:2020 for which the PFD is designed, the leaflet shall state whether full or partial back up is provided, and the buoyancy provided by the primary buoyancy source(s) alone and the buoyancy provided by the back-up chamber(s) alone shall be stated.

5.8 Supplemental-chamber buoyancy for enhanced performance

5.8.1 General

This Clause refers to PFDs with supplemental inflation chamber(s) that provide performance or features exceeding the minimum requirements specified on the relevant part of the ISO 12402 series:2020 for which the PFD is designed in order to provide enhanced in-water performance or other accessory functions. Enhanced in-water performance can include items such as higher freeboard, improved head support, additional stability, etc. Other accessory functions can include items such as increased location detection, splash protection, etc. These PFDs incorporate a supplemental inflation chamber or chambers to provide these features for deployment after stabilisation in the water.

The buoyancy to meet the requirements of the relevant part of the ISO 12402 series:2020 for which the PFD is designed shall not rely on a supplemental chamber(s). Supplemental chambers provide additional buoyancy.

Supplemental inflation chambers shall be provided with oral inflation. Additional inflation sources are optional.

5.8.2 Testing

PFDs with supplemental chamber(s) shall meet the following.

A PFD with supplemental chamber(s) when inflated in combination with the primary chamber(s) shall provide performance that meets the performance level of the relevant part of the ISO 12402 series:2020 when tested in accordance with ISO 12402-9:2020, 5.6. Any supplemental chamber(s), when inflated alone, shall not present any additional risk, such as preventing the user from maintaining a face-up position in the water.

5.8.3 Over-pressure test of supplemental chamber(s)

When tested in accordance with ISO 12402-9:2020, 5.5.14, no rupture, visible damage, or leakage shall result in any of the chambers. For devices that incorporate relief valves, the valves shall operate as per the manufacturer's specifications.

5.8.4 Marking for enhanced performance

In addition to the marking on the PFD required in 6.2 of the relevant part of the ISO 12402 series: 2020 for which the PFD is designed, markings shall state both the buoyancy provided by the primary buoyancy source(s) alone and the buoyancy provided by the supplemental chamber(s) alone.

5.8.5 Explanation of supplemental chamber performance in information supplied by the manufacturer

In addition to the information in the explanatory leaflet supplied with the PFD required in Clause 7 of the relevant part of the ISO 12402 series:2020 for which the PFD is designed, the leaflet shall state both the buoyancy provided by the primary buoyancy source(s) alone and the buoyancy provided by the supplemental chamber(s) alone.

5.9 Lifting loops

5.9.1 If a PFD is provided with a lifting loop, it shall be tested according to ISO 12402-9:2020, 5.5.5, using the horizontal load value.

5.9.2 The lifting loop shall be affixed to the PFD in front of the chest anterior to two lines, each axial to the midline between the lower end of the sternum and the umbilicus and no more than 100 mm to the side of the midline.

5.9.3 The minimum length of the loop shall be 150 mm, measured from attachment to end of the loop.

5.9.4 The lifting loop shall have a minimum width of 20 mm and shall be of a colour distinctive from that of the PFD.

5.9.5 The lifting loop shall be visible when the user is floating normally.

5.10 Emergency position-indicating lights

5.10.1 Requirements

5.10.1.1 General

The emergency position-indicating light shall be robust in construction, when tested in accordance with 5.10.2.1.

The light source shall be capable of being affixed to a PFD so that it is above the surface of the water when in normal use.

The device shall not affect the performance of the lifejacket nor cause injury to the user, when tested in accordance with the human subject performance tests specified in ISO 12402-9:2020, 5.6.

5.10.1.2 Luminous intensity

The light emitted by the device shall be white in colour and provide a minimum luminous intensity of 0,75 cd in all directions of the upper hemisphere for a period of 8 h when tested in accordance with 5.10.2.4.

Flashing lights with a flash duration of over 300 ms, excluding all incandescence time, can be considered a fixed steady light for the measurement of the luminous intensity.

Incandescence time is the time interval between switching ON and reaching the luminous intensity of 0,75 cd. When the light is switched off, all the time during which the luminous intensity is below 0,75 cd should be disregarded.

5.10.1.3 Temperature and immersion

The complete device shall be able to withstand a temperature range from −30 °C to +65 °C, tested in accordance with 5.10.2.2. After completing the temperature cycling, the test samples shall show no signs of damage such as shrinking, swelling, dissolution or change of mechanical qualities.

Each light shall start functioning within 2 min of operation and shall reach the minimum luminous intensity of 0,75 cd within 5 min. In the case of a light powered by a seawater cell, immersed in fresh water, a luminous intensity of 0,75 cd shall be attained within 10 min. If the light is a flashing light, the rate of flashing for the full 8 h operative period shall be not less than 50 flashes and not more than 70 flashes per minute.

5.10.1.4 Water ingress

The device shall be designed to prevent water ingress when tested in accordance with 5.10.2.3.

5.10.2 Test methods

5.10.2.1 Drop test

One test sample shall be dropped from a height of (2,00 ± 0,05) m onto a rigidly mounted steel plate or smooth concrete surface, after which it shall be operated. When operated, it shall emit light meeting the requirements of 5.10.1.2.

5.10.2.2 Temperature cycling

Twelve test samples shall be subjected to ten cycles of exposure in air as follows.

a) Exposure for 8 h at (−30 ± 2) °C, to be completed in one day. The samples shall then be removed and exposed to ordinary room conditions until the next day.

b) Exposure for 8 h at (+65 ± 2) °C, to be completed in one day. The samples shall then be removed and exposed to ordinary room conditions until the next day.

c) Repeat a) and b) a further nine times.

5.10.2.3 Operational life test

Divide the twelve samples that have previously been exposed to temperature cycling equally between the three temperature values of (–1 ± 2) °C, ambient as per standard conditioning according to ISO 12402-7:2020, 4.1.6.2, and (+30 ± 2) °C. Connect surveillance wires to each of the lamp leads (not the battery terminals) to allow the voltages to be monitored.

NOTE If the samples are of a one-piece construction, it can be necessary to connect the surveillance wires during the production of the samples.

Connect the surveillance wires to a calibrated voltage-recording device. Start the recorder and switch on the units to be tested, with each unit immersed in a water bath.

The voltage of each sample under test shall be monitored continuously from 5 min after the start of the test until 8 h have elapsed. On completion of the 8 h test, all voltage traces from the recorders shall be examined, and the lamp and dome assembly from the unit displaying the lowest voltage during the test shall be used to complete the luminous intensity test in 5.10.2.4

5.10.2.4 Luminous intensity test

The lamp and dome assembly from the lowest performing unit in the operational life test shall be mounted onto a calibrated photometer and supplied with a calibrated voltage identical to that recorded in 5.10.2.3. The minimum luminous intensity over the upper hemisphere shall be measured

and recorded. If the point of minimum luminous intensity is known for a given design, the luminous intensity required in 5.10.1.2 need only be measured at that location.

Flashing lights shall be tested as follows.

For a flashing light which remains on at an intensity greater than 0,75 cd for over 0,3 s during each duty cycle, the luminous intensity test shall be carried out as described above.

For a flashing light which does not remain on at an intensity greater than 0,75 cd for at least 0,3 s, the luminous intensity test shall be carried out as described above and then the Blondel-Rey formula shall be applied as described in IMO Resolution A.689 (17) as amended through Resolution MSC 81(70). This shall be applied to determine the effective luminous intensity as required in 5.10.1.2.

5.10.2.5 Water ingress test

One light shall be immersed in fresh water at a depth of (300 ± 10) mm for a period of 24 h. On completion, the device shall meet the requirements of 5.10.1.2.

5.10.3 Marking of emergency position-indicating lights

Each light shall be marked clearly and indelibly with the following information:

a) the manufacturer's name or trademark;

b) the date of manufacture and date of expiry;

c) the batch or lot code;

d) instructions on how to activate the light (preferably as pictograms).

If the power source is hazardous, such as lithium batteries, the following text shall be included: “Lithium battery. Do not incinerate, do not recharge, do not tamper with”.

Where appropriate, instructions can be given regarding the stowage, use and disposal of the power source.

This information shall be given at least in the official language(s) of the country of destination.

Where the product is too small to affix all the markings, these shall be provided on the packaging and in the information supplied by the manufacturer.

5.11 PFDs with personal locator devices (PLDs)

5.11.1 General

PFDs with personal locator devices are designed to provide for enhanced location and rescue capabilities by having an attached or integrated PLD.

PFDs with added or integrated PLDs shall comply with all the requirements specified in the relevant part(s) of ISO 12402-2:2020 to ISO 12402-5:2020 except as modified or superseded by this clause.

5.11.2 Specific requirements for PFDs with integrated PLDs

It shall be checked that the PLD does not inhibit the operation, function and performance of the PFD and that the PFD does not inhibit the operation, function and performance of the PLD and its accessories.

If a PFD has previously been tested without a PLD integrated, and the PLD is integrated at a later stage, the PFD + PLD combination shall be re-tested to the following additional requirements in accordance with ISO 12402-9:2020:

a) 5.5.2, Rotating shock bin test;