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Personal flotation devices —

Part 7:
Materials and components — Safety requirements and test methods

Équipements individuels de flottabilité —

Partie 7: Matériaux et composants — Exigences de sécurité et méthodes d'essai

ICS 13.340.10

ISO/CEN PARALLEL ENQUIRY

This draft International Standard is a draft European Standard developed within the European Committee for Standardization (CEN) and processed under the CEN-lead mode of collaboration as defined in the Vienna Agreement. The document has been transmitted by CEN to ISO for circulation for ISO member body voting in parallel with CEN enquiry. Comments received from ISO member bodies, including those from non-CEN members, will be considered by the appropriate CEN technical body. **Accordingly, ISO member bodies who are not CEN members are requested to send *a copy* of their comments on this DIS directly to CEN/TC 162** (DIN, Burggrafenstraße, 6, D-10787 Berlin) **as well as returning their vote and comments in the normal way to the ISO Central Secretariat.** Should this DIS be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month FDIS vote in ISO and formal vote in CEN.

In accordance with the provisions of Council Resolution 15/1993 this document is circulated in the English language only.

Conformément aux dispositions de la Résolution du Conseil 15/1993, ce document est distribué en version anglaise seulement.

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Personal flotation devices - Part 7: Materials and components - Safety requirements and test methods (ISO/DIS 12402-7:2002)

Equipements individuels de flottabilité - Partie 7: Matériaux et composants - Exigences de sécurité et méthodes d'essai (ISO/DIS 12402-7:2002)

Persönliche Auftriebsmittel - Teil 7: Werkstoffe und Bestandteile - Sicherheitstechnische Anforderungen und Prüfverfahren (ISO/DIS 12402-7:2002)

This draft European Standard is submitted to CEN members for parallel enquiry. It has been drawn up by the Technical Committee CEN/TC 162.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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Foreword

This document (prEN ISO 12402-7:2002) has been prepared by Technical Committee CEN/TC 162 “Protective clothing including hand am protection and lifejackets”, the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 188 “Small craft”.

This document is currently submitted to the parallel Enquiry.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

This Standard is the seventh part of a series covering personal flotation devices. The series consists of:

Part 1: Lifejackets for seagoing ships — Safety requirements

Part 2: Lifejackets for extreme offshore conditions (level 275) — Safety requirements

Part 3: Lifejackets for offshore conditions (level 150) — Safety requirements

Part 4: Lifejackets for inland/close to shore conditions (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 and other relevant devices

Annex A is informative.

Introduction

This series of prEN ISO 12402 has been prepared to give guidance on the design and application of personal flotation devices (hereafter referred to as PFD) 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.

This series of standard 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:

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

b) those which require the user to be conscious to either orient the user with the face out of the water or to deploy the device to achieve face up flotation (buoyancy aids).

Within the main two classes there are a number of levels of support, types of buoyancy media, activation methods for inflatable types, and auxiliary items (such as location aids), all of which will affect the user's probability of survival. Within the types of buoyancy mediums 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 buoyancy provision. Hybrid PFDs always provide some buoyancy but rely on these same methods as inflatable 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 (self-acting 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, benign conditions, or help 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 standard 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.

This series of standard 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 stowed in a locker for emergency use. Throwable devices and flotation cushions are not covered by this standard.

The primary function of a PFD is to support the wearer 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 the standards are:

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

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

c) to provide self-acting (inherently buoyant or automatically inflated) PFDs that float the user 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 PFDs buoyancy with manual and oral operation;

d) 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, providing positive support in the water, allowing the user to swim or actively assist the user 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 user's ability to assist.

In certain circumstances of the environment (such as waves), the wearing of garments which provide (intentionally or otherwise) additional buoyancy, (such as immersion suits) 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, certain PFDs may not perform as well in extremes of temperature, although fully approved under this standard. 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 assumed that the PFD will not be adversely affected. The standard also allows a PFD to be an integral part of a safety harness designed to conform to ISO/DIS 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 standard.

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 which conforms to the specification 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 are not necessarily accurate simulations of it. For example, the fact that a device passes the self-righting tests 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.

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 and alternative choices and the limitations to normal use, prior to the purchase.

Similarly, those framing legislation regarding the wearing of these garments should consider carefully which class and performance level is most appropriate for the foreseeable conditions of use, allowing for the more severe circumstances which often pertain in emergencies. More information for the selection and application is given in prEN ISO 12402-10.

1 Scope

This part of prEN ISO 12402 specifies the requirements for construction, performance and marking of materials and components of personal flotation devices as well as relevant test methods.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

EN 530, *Abrasion resistance of protective clothing material — Test methods.*

EN 10088-1, *Stainless steels — Part 1: List of stainless steels.*

EN ISO 105-B04, *Textiles — Tests for colour fastness — Part B04: Colour fastness to artificial weathering: Xenon arc fading lamp test (ISO 105-B04:1994).*

EN ISO 105-E02, *Textiles — Tests for colour fastness — Part E02: Colour fastness to sea water (ISO 105-E02:1994).*

prEN ISO 105-E04, *Textiles — Tests for colour fastness — Part E04: Colour fastness to perspiration (ISO 105-E04:1994).*

EN ISO 105-X12, *Textiles — Tests for colour fastness — Part X12: Colour fastness to rubbing (ISO 105-X12:1993).*

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

prEN ISO 12402-2, *Personal flotation devices — Part 2: Lifejackets for extreme offshore conditions (level 275) — Safety requirements.*

prEN ISO 12402-3, *Personal flotation devices — Part 3: Lifejackets for offshore conditions (level 150) — Safety requirements.*

prEN ISO 12402-4, *Personal flotation devices — Part 4: Lifejackets for inland/close to shore conditions (level 100) — Safety requirements.*

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

prEN ISO 12402-8, *Personal flotation devices — Part 8: Accessories — Safety requirements and test methods.*

prEN ISO 12402-9, *Personal flotation devices — Part 9: Test methods.*

ISO 188, *Rubber, vulcanised or thermoplastic — Accelerated ageing and heat-resistance tests.*

ISO TR 211, *Essential oils — General rules for labelling and marking of containers.*

ISO 1421:1998, *Rubber- or plastics-coated fabrics — Determination of tensile strength and elongation at break.*

ISO 2231:1989, *Rubber- or plastics-coated fabrics — Standard atmospheres for conditioning and testing.*

ISO 2411:1991, *Rubber- or plastics-coated fabrics — Determination of coating adhesion.*

ISO 3768, *Metallic coatings; Neutral salt spray test (NSS test).*

ISO 3801:1977, *Textiles — Woven fabrics — Determination of mass per unit length and mass per unit area.*

ISO 4674:1977, *Fabrics coated with rubber or plastic — Determination of tear resistance.*

ISO 5081:1977, *Textiles — Woven fabrics — Determination of breaking strength and elongation (Strip method).*

ISO 5082:1977, *Textiles — Woven fabrics — Determination of breaking strength — Grab method.*

ISO 5084, *Textiles — Determination of thickness of textiles and textile products.*

ISO 7229, *Rubber- or plastics-coated fabrics — Measurement of gas permeability.*

ISO 7854:1984, *Rubber- or plastics-coated fabrics — Determination of resistance to damage by flexing (dynamic method).*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests.*

ISO 11474, *Corrosion of metals and alloys — Corrosion test in artificial atmosphere — Accelerated outdoor test by intermittent spraying of a salt solution (Scab test).*

ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method.*

ISO 14993, *Corrosion of metals and alloys — Accelerated testing involving cyclic exposure to salt mist, "dry" and "wet" conditions.*

ISO/DIS 12401, *Small craft — Deck safety harness and safety line for use on recreational craft — Safety requirements and test methods.*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories.*

AATCC Method 30:1981, *Fungicides, evaluation on textiles: mildew and rot-resistance of textiles*[1)].

ASTM B 117, *Standard Practice for Operating Salt Spray (Fog) Apparatus.*

ASTM D 412, *Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension / Note: 2. revision 1998.*

ASTM D 413, *Standard Test Methods for Rubber Property-Adhesion to Flexible Substrate.*

ASTM D 471, *Standard Test Method for Rubber Property-Effect of Liquids / Note: 1. editorial change.*

ASTM D 2061, *Standard Test Methods for Strength Tests for Zippers / Note: Revision 1998.*

ASTM D 2062, *Standard Test Methods for Operability of Zippers / Note: Revision 1997. 1. editorial change.*

ASTM D 5034, *Standard Test Methods for Breaking Strength and Elongation of Textile Fabrics (Grab Test).*

3 Terms and definitions

For the purpose of this part of prEN ISO 12402, the terms and definitions given in prEN ISO 12401-1 to prEN ISO 12402-5 and the following apply.

3.1
course
series of successive loops lying crosswise in knitted fabrics, that is, lying at right angles to a line passing through the open throat to the closed end of the loops

3.2
cylinder seal indicator
visual display on an inflation system which provides information regarding the status of the seal on an installed cylinder

3.3
design inflation range
range of buoyancy and pressure, as specified by the manufacturer, to which a compartment is capable of being inflated to provide the intended in-water performance

3.4
filling (also referred to as weft)
yarn running from selvage to selvage at right angles to the warp in woven fabrics

NOTE For knitted fabric see 3.15.

3.5
filling density
the weight of the gas charge for inflation medium containers, in kilograms, divided by the volume of the inflation medium container, in litres

3.6
full inflation
chamber or chambers inflated to any value within the design inflation range

3.7
initial jaw separation
distance between the bottom of the top clamp and the top of the bottom clamp of a tensile test machine prior to testing

1) Available from American Association of Textile Chemists and Colorists (AATCC) one Davis Drive, PO Box 12215, Research Triangle Park, NC 27709-2215 US

3.8
lot number
marking assigned to each group of materials or component produced which incorporates a means of identifying the year and quarter of manufacture (unless provided elsewhere), and provides a means of identifying the production of a particular factory, when a manufacturer produces at more than one factory

3.9
multi-point status indicator
status indicator which utilises two or more independent visual display points to communicate inflation system readiness

3.10
selvage
uncut edge portion of a fabric

3.11
serviceability
ease with which the inflation system mechanism is properly rearmed

3.12
serviceable
capable of continued use, i.e. exhibits no signs of functional deterioration, deformation of hardware, indicators not functional, oral inflation tube blocked or detached, and manual inflator trigger detached

3.13
single-point status indicator
status indicator which combines all system checks into a single visual display point to communicate inflation system readiness

3.14
status indicator
part or parts of an inflation system which provide user feedback to assist in keeping an inflatable PFD in an armed and ready condition

3.15
wale
column of loops in successive courses in knitted fabrics. The column is parallel to the loop axes

3.16
warp
yarn running lengthwise, parallel to the selvage, in a woven fabric

NOTE For knitted fabrics see 3.1.

3.17
coated fabric
flexible materials composed of a textile fabric and an adherent polymeric material with a single surface coating weight of at least 155 g (5,5 ounces) applied to one or both surfaces

3.18
laminated fabric
layered fabric structure wherein a fabric is joined into a continuous sheet material, such as foam, in such a way that the identity of the continuous sheet material is retained, either by heat method or by an adhesive

3.19
warp test
test in which the warp yarns or course loops are being broken or torn

NOTE In the breaking load and seam slippage tests, warp is the long dimension of the sample. In the tearing strength test, warp is the short dimension of the sample.

4 Materials and components

4.1 General

4.1.1 Principles

All materials and components of personal flotation devices have to meet the requirements specified in this standard.

NOTE It is recommended that

— all tests procedures described hereafter will be performed by third party test houses only, which comply with the requirements of EN 45000 and/or ISO Guide 25 or ISO CASCO 228;

— the tests will be performed by experienced test houses familiar with the products specified by the series of prEN ISO 12402 where assessment is subjected. The test will be witnessed by a test panel of at least three experts familiar with testing and the products specified in the series of prEN ISO 12402.

All materials and components may incorporate into or combined with additional items compliant with prEN ISO 12402-8 none of which shall impair its performance with respect to the requirements of this standard.

4.1.2 Sampling

One sample of materials and components common to a range of products may be presented and the results used to cover the full range of products.

4.1.3 Criteria for passing failure

All required samples shall pass all objective tests for the entire device to meet the requirements of the series of prEN ISO 12402 with the following proviso. Due to the high variability between subjects and the difficulty in assessing some subjective measures, it is permitted that a device does not completely meet the requirements of a test in a particular measurement and by no more than one test subject. In these circumstances, another two samples or subjects (within the same weight, height and morphology, if applicable), should be subjected to the same test and before the same test panel as described in prEN ISO 12402-9. If this additional test is still not clearly passed in accordance with the series of prEN ISO 12402, then the device shall be deemed to have failed. The test panel should deem that the device has passed the test procedures, if it has now fulfilled the test requirements completely.

4.1.4 Units of measurement

Units of measurement shall be according to international standard units system. When a value for measurement is followed by a value in other units in parentheses, the first stated value is the requirement.

4.1.5 Material

4.1.5.1 Components and fabrics

Components and fabrics shall not be damaged by storage at temperatures of – 30 °C to + 65 °C nor shall they be damaged by salt water when tested according to ISO 9227 for a time span of 96 h.

4.1.5.2 Polymeric material

This material shall comply with the regrind requirements specified in International Standards for polymeric materials and is to be determined the same when it is of the same generic type, the same kind and amount of resin, filler, stabilisers or reinforcement as demonstrated by the applicable identification tests.

4.1.5.3 Corrosion of metal components

When tested in accordance with ISO 3768 for a period of 160 h metal components shall not be significantly affected by corrosion. This shall be tested by a functional test following the corrosion test.

4.1.5.4 Magnetic properties

No component shall affect a magnetic compass of a type commonly used in small boats by more than 1 degree, when placed at a distance of 500 mm from it.

4.1.6 Colour

When a textile or polymeric product is furnished in a range of colours, samples representative of the range are to be provided. The samples are to consist of a fluorescent colour (when applicable) and the lightest (e.g., white) and darkest (e.g., black) colours. Additional samples intermediate between the darkest and lightest are required. An equivalent number of samples is to be provided for each additional colour to be tested.

Colour fastness shall be tested according to EN ISO 105-B 04, EN ISO 105-E 02 and EN ISO 105-X 12.

4.1.7 Sample conditioning

Materials and components common to a range of samples may be presented as one sample of each item.

Prior to testing materials and components shall be conditioned for (24 ± 0,1) h under standard atmosphere.

4.1.7.1 Standard conditioning

a) Samples of fabrics (i.e., fabric, webbing, thread, tie tape), except for textile products, the applicable number of samples specified in each section are to be conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity for not less than 24 h prior to the tests.

b) For textile products, the samples are to be conditioned at (21 ± 1) °C [(70 ± 2) °F] and (65 ± 2) % relative humidity for not less than 24 h.

c) A different temperature and relative humidity that provides equivalent conditioning is not prohibited from being used.

d) If spelled out be tested under “wet conditions”, the sample has to be soaked for 8 h in fresh water, or as specified by the test procedure itself.

4.1.7.2 Temperature cycling

The component or sample of fabric shall be conditioned, in its normal storage state, and then exposed for (24,0 ± 0,5) h at a temperature of (– 30 ± 2) °C, then for (24,0 ± 0,5) h at a temperature of (65 ± 2) °C. Any damage shall be assessed by visual and aural examination and be reported. The component or sample shall undergo ten cycles.

4.1.7.3 Accelerated weathering

Weathering resistance of components and fabrics for PFDs shall be determined by natural summer weathering exposure to 25, 75 or 138 MJ/m^2 (as specified) of UV radiation (below 385 nm) during the months of May 21 through October 21. Specimens are to be mounted face side exposed, open backing, 45° angle facing south.

As alternatives to natural weathering can be used:

a) 500 kJ /(m^2 · nm) @ 340 nm of accelerated Xenon weathering exposure, or

b) 750 kJ /(m^2 · nm) @ 340 nm of accelerated Xenon weathering exposure.

Both methods shall be in accordance with the following specifications and follow after standard conditions:

— Irradiance: 0,55 W/m^2 at 340 nm

— Filters: IRA inner/Soda Lime outer

— Black panel temperature: (63 ± 2) °C

— Dry bulb temperature: (42 ± 2) °C

— Relative humidity (light only) 50 %

— Conditioning water temperature: (20 ± 5) °C

— Test cycles: 102 min of light/18 min of light and water spray/24 min dark and water spray

4.1.8 Perchloroethylene

Components and fabrics intended for use in personal flotation devices marked “Do not dry clean” is not required to comply with the requirements for exposure to perchloroethylene.

4.1.9 Mass of fabrics

Where the mass per unit area of a material is required to be measured, then it shall be measured according to method 5 of ISO 3801:1977.

4.1.10 Resistance to rot

Resistance for covers or uncovered bladders shall prove resistance to rot and illumination to be tested according to the methods of AATCC Method 30:1981 and ISO 105-B04:1988. Illumination shall take place to class 5 to 6 with 1/2 unit tolerance.

Bladders which are screened by a cover when not in action need not undergo illumination testing. Following exposure to rot and/or illumination, the tensile strength shall be measured using the grab method given in ISO 5082, using specimens of at least 60 mm width and with at least 100 mm of material on each side of the test point, with four similar seams for each type of seam.

Textiles shall be of sufficient strength to withstand all tests without sustaining damage. After testing of resistance to rot and/or illumination cloth, seams (joints) and fastening devices (including zip fasteners) shall have a tensile strength of at least 800 N per 50 mm, when tested according to the method of ISO 5082.

4.2 Thread

4.2.1 Construction

Thread shall not contain cotton or be monofilament.

4.2.2 Performance

Thread shall comply with the requirements specified in Table 1.

Table 1 — Thread

Property	Exposure	Test method	Number of samples[a]	Sample size[b] mm	Compliance criteria
single strand breaking and elongation	1. standard conditioning 2. 100 h of accelerated weathering[c] 3. 300 h of accelerated weathering[c]	ISO 2231	5 for each separate exposure	36	For exposure 1, the average breaking strength of 5 samples shall be at least 155 N. For exposure 2, the average breaking strength of 5 samples shall retain at least 60 % strength of that determined following standard conditioning. Following exposure 3, the average of 5 samples shall retain at least 40 % strength of that determined following standard conditioning. An identification test is to be performed for elongation.
loop breaking strength	standard conditioning	ISO 1421	5 (each consisting of two pieces)	356	Average breaking strength of 5 samples shall be at least 260 N.
length/weight	standard conditioning	ISO 3801	5	2743	Identification test
infrared analysis	none		1	305	Identification test for all thread material; except nylon 6 and nylon 6.6
differential scanning calorimetry	none		1	305	Identification test only for nylon 6 and nylon 6.6.

[a] Potentially colour dependent.

[b] Minimum 135 m for both lightest and darkest

[c] Mount samples vertically so the centre of each sample is in the same plane as the horizontal centreline of the radiation source.

4.2.3 Marking

Each spool of thread and each shipping label shall be permanently and clearly marked with the following information in a colour which contrasts with the colour of the surface on which the marking is to be applied:

a) manufacturer's name, tradename, or symbol;

b) style (model) number of the thread;

c) size of the thread, unless a unique style (model) number is provided for each size;

d) lot number of the thread

4.3 Fabric

4.3.1 Construction

If an inflatable chamber material is exposed when inflated, then the chamber needs to meet the weathering requirement, since a user could leave the device exposed for a long time.

4.3.2 Performance

4.3.2.1 Fabric used as drainage material shall comply with all of the applicable fabric requirements. Bladders which are screened by a cover when not in action need not undergo illumination testing. Following exposure to rot and weathering according to 4.1.7, the tensile strength shall be measured using the grab method given in ISO 5082, using specimens with a width of (100 ± 2) mm and a length of at least 150 mm.

4.3.2.2 Textile woven fabrics shall have an as received tensile strength of at least 400 N, the tensile strength measured using the grab method given in ISO 5082, using specimens with a width of (100 ± 2) mm and a length of at least 150 mm.

4.3.2.3 Textile knitted fabrics shall have an as received tensile strength of at least 570 N, the tensile strength measured using the grab method given in ISO 5082, using specimens with a width of (100 ± 2) mm and a length of at least 150 mm.

4.3.2.4 Textiles be of sufficient strength to withstand all tests on a PFD without sustaining damage. After testing of resistance to rot and weathering according to 4.1.7, cloth, seams (joints) and the seams used to attach fastening devices (such as zip fasteners) shall have a tensile strength as shown in Table 2.

4.3.2.5 Fabrics used in the construction of covers of buoyant compartments, the retention system, and any other component the failure of which would render the PFD non-conformant with this standard, shall comply with the following requirements:

a) breaking strength for woven fabrics shall be tested according to ISO 5082:1982 using the grab methods, following conditioning according to 4.1.7 and shall have the strength given in Table 2,

b) elongation at break of woven fabrics shall be tested according to ISO 5082:1982 with the elongation criteria as defined by ISO 5081:1977 using the grab methods, following standard conditioning according to 4.1.7, and shall be not more than 60 %;

c) tear resistance of woven fabrics shall be tested according to ISO 4674:1977, method A2 [tensile speed (100 ± 10) mm/min, with a pretension of 2 N for materials of up to 200 g/m^2, 5 N for materials of over 200 g/m^2 and up to 500 g/m^2, and 10 N for materials of over 500 g/m^2], and shall be not less than 10 N.

4.3.2.6 Fabric shall comply with the acceptance criteria specified in Table 2 when subjected to the tests therein. Separate samples are to be used for each different conditioning exposure.

Table 2 — Fabric

Property	Exposure	Test method	Number of samples[a]	Sample size[b] (mm)	Compliance criteria
breaking load (woven fabrics only)	1. standard conditioning 2. 100 h of accelerated weathering 3. 70 h immersion in: 3.1 ASTM Ref. Fuel B, 3.2 ASTM Ref. Oil 3.3 Perchloroethylene, if applicable 3.4 0,5 % detergent in “0” hardness water 4. 300 h of accelerated weathering	ISO13943 ISO 5081, ISO 5082	5 warp and 5 filling for each separate exposure	as specified by test method	Following each separate exposure 1 to 3, the average of 5 samples shall be at least 400 N for each direction Following exposures 2 and 3 the average of 5 samples shall retain at least 60 % strength of that determined following standard conditioning. Following exposure 4, the average of 5 samples shall retain at least 40 % strength of that determined following standard conditioning.
ball burst (knitted fabrics only)[c]	same as breaking load (woven fabrics)	ISO 5082 ISO 5081	10 for each separate exposure	130 × 180	Following each separate exposure in 1 to 3, the average of 10 samples shall be at least 570. Following exposures 2 and 3 the average of 10 samples shall retain at least 60 % strength of that determined following standard conditioning. Following exposure 4, the average of 10 samples shall retain at least 40 % strength of that determined following standard conditioning.
elongation (woven fabrics only)	standard conditioning	ISO 5082, elongation as defined in ISO 5081	5 warp and 5 filling for each separate exposure	As specified	Following standard conditioning, an average of 5 samples shall be not more than 60 % increase of elongation at break
tearing strength	standard conditioning	ISO 5081	5 warp 5 filling	80 × 200	Average of 5 samples shall be at least 35 N for each direction
fabric count	standard conditioning		5	300	Identification test
weight/area	standard conditioning	ISO 3801	8	180 diameter	Identification test