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Lifejackets and personal buoyancy aids — Lifejackets — 275 N

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d'aide à la flottaison - Rettungswesten - 275 N
Gilets de sauvetage - 275 N

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CEN

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Foreword

This European Standard was prepared by CEN/TC 162, Protective clothing including hand and arm protection and lifejackets, the secretariat of which is held by DIN.

This European Standard has been prepared under a mandate given to CEN by the Commission of the European Communities (and the Secretariat of the European Free Trade Associations, and supports essential requirements of EC Directive(s).

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 1994, and conflicting national standards shall be withdrawn at the latest by May 1994.

In accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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Introduction

This standard has been prepared to meet the needs of persons engaged in activities in or near water. Lifejackets manufactured and maintained to this standard will give a reasonable assurance of safety from drowning to a person who, for whatever reason, is no longer capable of helping himself fully, and is subject to conditions which normally impair the performance of lifejackets of lesser buoyancy. It is not intended to replace the standard agreed by the International Maritime Organization, or those specified for use in aircraft by the Federal Aviation Authority, the Civil Aviation Authority, and other aviation regulatory bodies, rather to apply to those people who would not be required to comply with those standards.

This standard allows for the buoyancy of a lifejacket to be provided by a variety of materials, some of which may require preparation before entering the water (e.g. inflation of chambers by gas from a cylinder). However, this broad group of buoyant devices is divided into two main types, those which require the user to initiate the buoyancy provision (by gas inflation), and those which provide full buoyancy without any user intervention (those inflated by a fully automatic method), as well as combinations thereof. In contrast to the standard for lifejackets of 150 N buoyancy, orally inflated lifejackets and those which depend solely on inherent buoyancy are not permitted. However, lifejackets containing buoyancy produced by both inherently buoyant materials and gas inflation are acceptable under this standard. Automatically-operated lifejackets are those suited to persons likely to enter the water unexpectedly, whereas manually-operated lifejackets should only be used if it is certain that the wearer will have sufficient time to produce full buoyancy. In every circumstance, the user should ensure that the correct operation of the lifejacket is suited to the specific application. The compliance of a lifejacket with this standard does not imply that it is suitable for all circumstances. The requirement for regular maintenance is another factor of paramount importance in the choice and application of specific lifejackets.

This 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.

The primary aims in wearing a lifejacket are:

- a) to support the wearer in reasonable safety in the water, particularly if that person is unable to swim, is exhausted, injured, or otherwise incapacitated. In the case of automatically-

- operated lifejackets, to perform in this way without any intervention on the part of the wearer, except in initially donning the lifejacket;
- b) to enable the wearer to propel himself in the water without it being an encumbrance;
- c) to support the wearer, enabling his efforts to be expended in recovery rather than in remaining afloat;
- d) to assist the recovery of the wearer.

A lifejacket should provide a sufficient degree of buoyancy in a garment which is light in weight, not unnecessarily bulky, and allows freedom of movement. It should be secure in wear, providing positive support in the water, allowing the wearer to swim or actively assist himself or others. The amount of buoyancy specified, and its distribution, should ensure that the wearer is supported with his mouth and nose clear of the water, and at a correct attitude with the trunk inclined backwards.

Certain circumstances may alter this performance, such as extreme weather conditions, or the wearing of garments which provide (intentionally or otherwise) additional buoyancy, such as immersion suits. Users, owners and employers should ensure that any additional garments or equipment to be worn in conjunction with the lifejacket do not impair its performance. Similarly, certain lifejackets may not perform as well in extremes of temperature, although fully approved under this standard. Lifejackets 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. If the user intends taking a lifejacket into such conditions, then he should satisfy himself that it will not be adversely affected. The standard also allows the lifejacket to be an integral part of a safety harness designed to comply with the European standard. Lifejackets may also be made an integral part of a more substantial garment, for example to provide thermal protection during immersion, in which case the complete assembly as worn is required to comply with this standard. This standard is specifically intended to make allowance for these other factors which may adversely affect the performance of lifejackets of a lesser buoyancy. However, it still does not guarantee safe performance in every circumstance, although it does provide a much greater safety margin.

In compiling the standards required of a lifejacket, consideration has also been given to the potential length of service which the user might expect. Whilst a lifejacket which complies with the specification should be of substantial construction and material, its potential length of service depends mainly 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 intended to be accurate simulations of it. For example, the fact that a device passes the self-righting tests described herein does not guarantee that it will in every case self-right an unconscious user wearing waterproof clothing, although the buoyancy requirement should ensure that this occurs in the great majority of cases.

European standards exist for a range of four types of buoyancy garments, of which this standard defines just one. The four are each intended as being suitable for different activities in different risk situations, and include:

a) 275 N lifejackets – these have a buoyancy of no less than 275 N for the average adult and are intended for use offshore in extreme conditions, when heavy protective clothing is being used, or loads such as toolbelts are being carried (EN 399).

b) 150 N lifejackets - these have a buoyancy of no less than 150 N for the average adult and are intended for use offshore or when foul weather clothing is being used (EN 396).

c) 100 N lifejackets - these have a buoyancy of no less than 100 N for the average adult and are intended for use in relatively sheltered waters (EN 395).

d) 50 N buoyancy aids – these have a buoyancy of no less than 50 N for the average adult and are intended for use in sheltered waters when help is close at hand and the user is a swimmer, in circumstances where more bulky or buoyant devices would impair the user's activity or actually endanger him (EN 393).

It is essential that owners, users and employers choose garments which meet the correct standards for the circumstances in which they may be used, and those selling them should make clear to prospective purchasers to which category each product belongs, alternative garments in other categories, and the limitations to normal use of each of the four categories, prior to the purchase. Similarly, those framing legislation regarding the wearing of these garments should consider carefully which type is most appropriate for the foreseeable conditions of use, allowing for the more severe circumstances which often pertain in emergencies.

1 Scope

This standard specifies the requirements for construction, performance, sizing, marking and test methods for lifejackets of 275 N nominal buoyancy excluding the IMO lifejacket and those specified for use in aircraft (by the Federal Aviation Authority, Civil Aviation Authority and other aviation regulatory bodies).

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 393	<i>Lifejackets and personal buoyancy aids - Buoyancy aids - 50 N</i>
EN 394	<i>Lifejackets and personal Buoyancy aids - Additional items</i>
EN 395	<i>Lifejackets and personal buoyancy aids - Lifejackets – 100 N</i>
EN 396	<i>Lifejackets and personal buoyancy aids - Lifejackets - 150 N</i>
ISO 105-B04: 1988	<i>Textiles- Tests for colour fastness – Part B04 : Colourfastness to weathering: Xenon. arc</i>
ISO 105-E02: 1989	<i>Textiles- Tests for colour fastness – Part E02 : Colour fastness to sea water</i>
ISO 105-X12: 1987	<i>Textiles- Tests for colour fastness – Part X12 : Colour fastness to rubbing</i>
ISO 188 : 1982	<i>Rubber vulcanized - Accelerated ageing or heat- resistance tests</i>
ISO 1421 : 1977	<i>Fabrics coated with rubber or plastics – Determination of breaking strength and elongation at break</i>
ISO 2411 : 1991	<i>Rubber- or plastics-coated fabrics – Determination of coating adhesion</i>
ISO 3801 : 1977	<i>Textiles- Woven fabrics – Determination of mass per unit length and mass per unit area</i>
ISO 4674 : 1977	<i>Fabrics coated with rubber or plastic – Determination of tear resistance</i>
ISO 5081 : 1977	<i>Textiles – Woven fabrics – Determination of breaking strength and elongation (strip method)</i>
ISO 5082 : 1982	<i>Textiles- Woven fabrics – Determination of breaking strength – Grab method</i>

ISO 7854 : 1984	<i>Rubber- or plastics-coated fabrics – Determination of resistance to damage by fixing (dynamic method)</i>
ISO 9227 : 1990	<i>Corrosion tests in artificial atmospheres - Salt spray tests</i>
AATC Method 30 : 1981	<i>Fungicides, evaluation on textiles: mildew and rot-resistance of textiles</i>

3 Definitions

For the purposes of this standard, the definitions of EN 394 : 1993 and EN 396 : 1993 apply.

4 Requirements

4.1 General

The lifejacket may incorporate additional items compliant with EN 394, none of which shall impair its performance with respect to the requirements of this standard.

4.2 Materials and components

4.2.1 Materials and components shall not be damaged by storage at temperatures of - 30 °C to + 60 °C when tested according to **6.1**, nor shall they be damaged by salt water with oil on the surface, when tested according to **6.2**.

4.2.2 Resistance to rot and illumination shall be tested according to the methods of AATCC Method 30 : 1981, and ISO 105-B04 : 1988. Illumination shall take place to Class 5-6 with 1/2 unit tolerance. Materials which are screened by some form of cover when in normal use shall not undergo illumination testing. Following exposure to rot 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 4 similar seams for each type of seam

4.3 Textile and fabric materials and components

4.3.1 Textiles shall be rot proof to **4.2.2** and of sufficient strength to withstand all tests in clause 6 without sustaining damage. After testing of resistance to rot and/or illumination according to **4.2.2**, cloth, seams (joints), and fastening devices (including zip fasteners) shall have a tensile strength of at least 300 N per 25 mm, when tested according to the method of ISO 5082.

4.3.2 Coated fabrics used in the construction of inflatable buoyancy chambers shall comply with the following requirements.

- a) Coating adhesion shall be tested in accordance with ISO 2411 : 1991 using the method described at **5.2.2.1** at 100 mm/min, and shall be not less than 50 N per 50 mm width.

- b) Coating adhesion shall also be tested when wet following ageing according to ISO 188, with an exposure of (336,0 ± 0,5) h in fresh water at (70,0 ± 1,0) °C, following which the method at ISO 2411 : 1991 **5.2.2.1** shall be applied at 100 mm/min, and shall not be less than 40 N per 50 mm width;

- c) Tear strength shall be tested in accordance with ISO 4674 : 1977 using method A1, and shall not be less than 35 N..

- d) Resistance to flex cracking shall be tested in accordance with ISO 7854 : 1984 method A using 9000 flex cycles, following which there shall be no visible cracking or deterioration.

- e) Breaking strength shall be tested in accordance with ISO 1421 : 1977 using the CRE or CRT methods following conditioning of (24,0 ± 0,5) h at room temperature, and shall be not less than 200 N per 50 mm width when tested.

- f) Breaking strength shall be tested in accordance with ISO 1421 : 1977 using the CRE or CRT methods following conditioning of (24,0 ± 0,5) h immersion in fresh water at room temperature, and shall be not less than 200 N per 50 mm width when tested.

- g) Elongation at break shall be tested in accordance with ISO 1421 : 1977 using the CRE or CRT methods following conditioning of (24,0 ± 0,5) h at room temperature, and shall be not more than 60 %.

- h) Elongation at break shall be tested in accordance with ISO 1421 : 1977 using the CRE or CRT methods following conditioning of (24,0 ± 0,5) h immersion in fresh water at room temperature, and shall be not more than 60 %.

4.3.3 The other fabrics used in the construction of covers of inherently buoyant compartments, the retention system, and any other component the failure of which would render the entire item non-conformant with this standard, shall comply with the following requirements.

- a) Breaking strength shall be tested to ISO 5081 : 1977 using the CRE or CRT methods, following (24,0 ± 0,5) h conditioning at room temperature, and shall be not less than 10 N/mm.

- b) Elongation at break shall be tested to ISO 5081 : 1977 using the CRE or CRT methods, following (24,0 ± 0,5) h conditioning at room temperature, and shall be not more than 60 %.

- c) Tear resistance shall be tested according to ISO 4674 : 1977 (method A2, tensile speed (100 ± 10) mm/min, with a pre-tension of 2 N for materials of up to 200 g/m², 5 N for materials of over 200 g/m² and up to 500 g/m², and 10 N for materials of over 500 g/m²), and shall be not less than 10 N.

4.3.4 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.

4.4 Metal components

4.4.1 When tested in accordance with ISO 9227 : 1990 for a period of 96 h, metal components shall not be significantly affected by corrosion. This shall be tested by a functional test.

4.4.2 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.

4.5 Oral inflation tubes

4.5.1 The lifejacket shall have a simple and rapid method of deflation, which shall also be used for oral inflation. This oral inflation tube shall be free from burrs and shall incorporate an effective non-return valve.

4.5.2 A lifejacket shall have a minimum air flow through the oral inflation tube of 85 l/min, and the non-return valve shall open initially at an applied air pressure of between 1,0 kPa and 3,0 kPa, when tested according to **6.3**.

4.5.3 If an oral inflation tube protrudes from the surface of the device, and the non-return valve either protrudes from the tube when in normal use or the valve can be separated from the tube, then it shall be tested according to **6.4**. It shall not be removed by a force of (90 ± 1) N.

4.6 Inflation operating head

An external inflation operating head shall withstand a force of 220 N applied to it as described in **6.5** without any evidence of fracture, leakage of gas from the buoyancy chamber, or other damage.

4.7 Gas cylinder

4.7.1 A cylinder shall be seamless and of a type which is not rechargeable following release of its contents.

4.7.2 A cylinder excluding the sealing disk shall be capable of withstanding an internal pressure of 54 MPa without bursting.

4.7.3 The material from which a cylinder is made shall resist corrosion in a marine environment or shall be suitably protected to resist corrosion.

4.7.4 A charged cylinder shall not, when conditioned for $(96,0 \pm 0,5)$ h at a temperature of $(65 \pm 2)^\circ\text{C}$, lose gas or suffer any permanent change, except that a slight deformation of the cap which does not impair normal performance is permitted.

4.7.5 If filled with carbon dioxide, the maximum acceptable nominal mass in grams of carbon dioxide shall be no more than 75 % of the volume in ml of the cylinder.

4.8 Types of buoyancy

4.8.1 At least the minimum amount of buoyancy required by this standard shall be provided by the inflation of chambers with gas provided in cylinders, or a combination of inherently buoyant material and the inflation of chambers with gas. The use of chambers permanently inflated with gas, or filled with inherently buoyant material which does not comply with this standard, shall not be permitted.

4.8.2 If a lifejacket contains inherently buoyant material which is divided itself into more than 150 separable pieces (for example, granules), then the inherently buoyant material shall be retained in at least six separate compartments in the device, each compartment being of approximately equal size, so as to reduce the risk of physical damage to a part of the device resulting in severe loss of buoyancy.

4.8.3 If the manufacturer makes the claim that the lifejacket is partially inherently buoyant, then it shall provide by its inherent buoyancy alone at least the buoyancy required of an equivalently sized device under EN 393.

4.8.4 In the case of a lifejacket dependent upon inflatable chambers for reaching the buoyancy specified, in whole or in part, and manufactured for use by children of under 30 kg in body weight, the lifejacket shall either be automatically inflated or shall additionally function as an inherently buoyant lifejacket to EN 395.

4.9 Inflatable buoyancy chambers

Inflatable buoyancy chambers shall be capable of withstanding an internal pressure of 40 kPa without damage or permanent deformation within a temperature range of -5°C to 30°C . An inflatable section shall also be tested to an internal pressure of air at 3,5 kPa for 12 hours, during which it shall lose no more than 0,25 kPa pressure.

4.10 Inherently buoyant material

4.10.1 Any inherently buoyant material used to provide buoyancy shall be capable of withstanding compression and movement in normal wear without sustaining permanent loss of buoyancy. The maximum loss of buoyancy when three valid samples are tested according to the method at annex H shall not exceed 10 % in any foam or granular material providing inherent buoyancy.

4.10.2 Any inherently buoyant material used to provide buoyancy shall be shown to have thermal stability under the conditions of the test described in **6.6**, in which the maximum loss of volume in any sample shall not exceed 5 %.

4.11 Total buoyancy provided

4.11.1 For the purpose of assessment to this standard, items of different size are to be accompanied by stated minimum and maximum weight range equivalents, which shall be in reasonable accord with the marked size ranges (which may actually be set using other dimensions such as height and girth as desired). However, the primary means of indicating the device's size as regards fit shall be one which is appropriate and meaningful to the prospective user, for instance the statement of weight and girth ranges, as required by **8.1d**).

4.11.2 The minimum amount of buoyancy provided shall be calculated according to table 1.

Wearer's weight kg	Minimum buoyancy N
up to 20	90
over 20 to 30	120
over 30 to 40	140
over 40 to 50	170
over 50 to 60	200
over 60 to 70	230
over 70	275

4.11.3 If a lifejacket is intended for two or more weight classes, the buoyancy shall be at least that stipulated for the heaviest class.

4.11.4 The buoyancy of the lifejacket shall be tested according to annex B. The difference between the measurements 24 h apart shall not exceed 5 % of the original buoyancy. The buoyancy measured in any test carried out for the purpose of ascertaining conformance with this standard shall not be less than that claimed on the marking of the lifejacket, nor that required by **4.11.2**.

4.11.5 Where the lifejacket is also fitted with additional buoyancy to that required by **4.11.2**, it shall be manufactured from materials which are not detrimental to the performance of those used in compliance with this standard.

4.11.6 The total buoyancy measured shall for all tests be sufficient that, when diminished by the greater of the two percentage losses determined for any inherently buoyant material as determined at **4.10**, it shall still meet the requirements of the respective category in **4.11.2**. For example, if for a given device which requires a minimum buoyancy for its size of 50 N (according to **4.11.2**), the lowest buoyancy measured under **4.11.4** is 53 N, and the tests according to **4.10.1** return a maximum loss of 4 %, and according to **4.10.2** a maximum loss of 3 %, then the minimum acceptable buoyancy would be 50 N + (4 % of 50 N), which equals 52 N.

4.12 Colour

4.12.1 The colour of the exposed portions of the lifejacket when deployed shall be in the range from yellow to red, excluding components such as webbing, zips and other fittings. The colour shall be checked against colour samples from the NCS Colour Atlas, and comparisons shall be made in daylight. The exposed portions shall, after illumination according to **4.2.2**, have easily visible colours within the tolerance range defined by the following ranges:

- 0070 -
- 1070 - in tones
- 0080 - Y 30R - Y 80R
- 1080 -
- 0090 -
- and
- 0070 -
- 0080 - in tones
- 0090 - Y - Y 20R

and the corresponding fluorescent colours in the same tolerance ranges.

4.12.2 The colour of the lifejacket shall be resistant to rubbing, wet and dry, when tested according to ISO 105-X12 : 1987 to at least class 3, and to salt water when tested according to ISO 105-E02 : 1989 to at least class 4.

4.13 Retroreflective material

4.13.1 There shall be affixed to the surface of the lifejacket at least 400 cm² area of material which is retroreflective of light and complies with the specification at annex D. This material shall be placed on surfaces which are normally above the water when the lifejacket is in use.

4.13.2 If the lifejacket is sized for a child or small adult, and cannot provide sufficient surface area above water, then it shall be permitted to affix only 300 cm², or even 200 cm², provided that the highest possible value shall be used for the available surface area.

4.14 Whistle

The lifejacket shall be provided with a whistle which is not adversely affected by water or humidity, and shall be firmly attached to the lifejacket by means of a lanyard, and housed in a loop or small pocket on the lifejacket.

4.15 Becket

4.15.1 There shall be affixed to the lifejacket a lifting becket, which shall be constructed of a rot-resistant material and which is suitable for gripping by hand or affixing lifting devices.

4.15.2 It shall withstand a load of 2600 N for adult sizes, and 1500 N for children's sizes, when tested according to the method at **A.5**, following which there shall be no evidence of damage which might impair the function of either the becket or the lifejacket.

4.15.3 The becket shall be positioned over the centre of the chest, anterior to lines from each axilla to midway between the lower end of the sternum and the umbilicus, and within 100 mm of the midline.

4.15.4 The minimum length of the loop of the becket shall be 100 mm, as measured from the attachment of the loop to its furthest point from the point of attachment.

4.15.5 The minimum width of the becket shall be 20 mm.

4.15.6 The colour shall be distinctive from that of the lifejacket.

4.15.7 The becket shall be conspicuous when the wearer is floating normally, but may be enclosed within a cover when the lifejacket is being worn but is not deployed to aid flotation.

4.16 General performance

4.16.1 The device shall not be uncomfortable in design nor weight when worn, nor unnecessarily bulky, when tested according to **6.7**.

4.16.2 It shall not unduly restrict the vision, hearing or breathing of the wearer when tested according to **6.7.4** and **6.7.9**.

4.16.3 It shall not contain nor have attached any component which in normal use is capable of causing injury or discomfort to the wearer or damage due to hazardous attachments. This shall be tested according to **6.7.5** and **6.7.8**.

4.16.4 It shall be possible to swim 10 m whilst wearing the device, tested to **6.7.9**, and to climb a vertical ladder as tested to **6.7.10**.

4.16.5 It shall be simple to maintain in a fully serviceable condition whether in continuous or repeated use or if stowed for long periods in reasonable conditions. It shall be resistant to crushing and compression as tested to **6.9**.

4.16.6 Strength of assembly shall be tested according to annex A for $(5,0 \pm 0,1)$ min in both wet and dry conditions. No damage shall result which would result in the device failing to function in accordance with this standard. For the purposes of this test, the means of adjustment to the wearer shall be marked (e.g. at the position of webbing passing through a buckle). The maximum acceptable movement of the mark during each test period shall be 25 mm.

4.16.7 If any form of sprayhood is fitted to cover the face in whole or in part (for example, to protect mouth and nose from water splash), then it shall not result in excessive levels of carbon dioxide forming within it, when tested to **6.10**.

4.17 Donning, adjustment and fit

4.17.1 Donning shall be obvious and simple on the briefest of instructions. It shall be possible without assistance, except in lifejackets intended for use by children. The ease in donning and discarding the lifejacket shall not be unduly affected by adverse conditions in use such as poor light, cold, or wet. When tested according to **6.7.3**, donning shall take no longer than 1 min.

4.17.2 The means of adjustment within the stated size range shall be obvious and easy to carry out to ensure a secure fit. This shall be assessed to **6.7.3**, **6.7.8** and **6.7.9**. Security of fit shall not be dependent upon highly elastic material. If crotch straps or other non-elastic devices for improving the security of fit and retention are provided, and it is possible (without physically damaging the lifejacket) to wear the lifejacket with and without the straps or devices, then all tests in **6.7** shall be performed both with and without the straps or devices in place.

4.17.3 The device shall allow the wearer freedom in action and movement when assessed to **6.7.4**, **6.7.9** and **6.7.10**.

4.17.4 The lifejacket shall not show any tendency for the wearer to slip out of it whilst in use during the tests in **6.7**.

4.18 Inflation system

4.18.1 Lifejackets shall inflate sufficiently within 5 s of operating the inflation mechanism when tested to **6.8.3**. It shall also be possible to top up the inflation when in the water, as tested to **6.7.11**.

4.18.2 The force required to operate the pull toggle on an inflation operating head shall not exceed 120 N, but shall exceed 20 N when tested according to **6.8.4**.

4.18.3 An automatically inflated lifejacket shall be subjected to the spray test described in annex G, during which the inflation mechanism shall not operate. Automatically inflated lifejackets shall also initiate firing in automatic mode within 5 s of testing according to **6.8.6**.

4.19 In-water performance

4.19.1 The lifejacket shall provide lateral and occipital support of the wearer's head so that the mouth of a well relaxed individual is held well clear of a still water surface, with the trunk of the body inclined backwards from the vertical at an angle of between 30° and 90°, when tested as described in **6.7.6**. The freeboard measured using the method described in annex F shall not be less than 100 mm in any subject. When testing small children, see **6.7.1**.

4.19.2 The inflated lifejacket shall automatically turn a well relaxed person into the position required by **4.19.1** within 5 s when that person falls into the water or lies face down in the water, as tested to **6.7.7**.

5 Sampling

5.1 Materials and components

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

5.2 Performance tests using human subjects

One lifejacket in each size category shall be tested, by a minimum of five subjects as specified in **5.3**. Most performance tests are subject to influence of natural variation, particularly in the morphometry of individual subjects. It is always possible to find, within the requirements below, subjects who are sufficiently different from the average as to behave unusually. Every effort must therefore be made to ensure that, within the weight ranges stipulated, subjects are close to average in morphometry.

5.3 Subject requirements

At least five subjects shall be used to test each of the manufacturer's size ranges, according to the following restrictions:

Size range	Subject requirements
Up to 20 kg	1 subject under 15 kg; 3 subjects 18 kg to 20 kg; at least 1 subject up to 20 kg
Ranges 20 kg to 70 kg	1 subject in the lowest 10 % of the manufacturer's stated size range; 3 subjects in the upper 10 % of the range; at least 1 other subject within the stated range
Less than 20 kg to less than 70 kg	1 subject under 15 kg; 1 subject 18 kg to 20 kg; 2 subjects in the upper 10 % of the range; at least 1 other subject within the stated range
70 kg and over	1 subject 70 kg to 80 kg; 1 subject 80 kg to 90 kg; 1 subject 90 kg to 100 kg; at least 2 other subjects of over 70 kg
Less than 70 kg to 70 kg and over	2 subjects in the lowest 10 % of the manufacturer's stated size range; 1 subject 80 kg to 90 kg; 1 subject 90 kg to 100 kg; at least 1 other subject within the stated range

Example 1

A single lifejacket claimed to be suitable for sizes equivalent to a 40 kg to 60 kg weight range requires 1 subject 40 kg to 44 kg and 3 subjects 54 kg to 60 kg, and at least one other subject to make a total of five.

Example 2

A single lifejacket claimed to be suitable for sizes equivalent to less than 20 kg to 40 kg weight range requires 1 subject under 15 kg, 1 subject 18 kg to 20 kg, 2 subjects 36 kg to 40 kg, and at least one other subject to make a total of five.

Example 3

A single lifejacket claimed to be suitable for sizes equivalent to greater than 50 kg weight range requires 2 subjects 50 kg to 55 kg, 1 subject 80 kg to 90 kg, and 1 subject 90 kg to 100 kg, and at least one other subject to make a total of five.

5.4 Sex and dress

Subjects shall include both males and females, and they shall wear bathing costumes.

5.5 Criteria for passing and failure

All required samples shall pass all objective tests for the entire device to meet the requirements of this standard. However, 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 subjective test in a single example and in no more than one test subject. In these circumstances, another example or subject (within the same weight category, if applicable), as appropriate, should be subjected to the same test and before the same test panel as at **6.7.1**. If this additional test is still not clearly passed as required in this standard, then the device shall be deemed to have failed, whilst if it is clearly passed, the test panel may deem that the device has passed the test overall.

6 Test methods

6.1 Temperature cycling

The lifejacket shall be conditioned, in its normal storage state, for $(24,0 \pm 0,5)$ h at a temperature of $(- 30 \pm 2)$ °C, then for $(24,0 \pm 0,5)$ h at a temperature of (60 ± 2) °C. It shall be inflated to an internal air pressure of $(20,0 \pm 0,5)$ kPa and maintained at that pressure for (10 ± 1) min at the end of each period at the given temperature, and leakage and damage shall be assessed by visual and aural examination.