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Second edition
2024-10

Floating leisure articles for use on and in the water —

Part 1: Classification, materials, general requirements and test methods

Articles de loisirs flottants à utiliser sur ou dans l'eau —

Partie 1: Classification, matériaux, exigences et méthodes d'essai générales

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Contents

Page

Foreword

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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 document 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).

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This document was prepared by Technical Committee ISO/TC 83, *Sports and other recreational facilities and equipment*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 136, *Sports, playground and other recreational facilities and equipment,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 25649-1:2017), which has been technically revised.

The main changes are as follows:

— update of the introduction;

— update of Clause 2;

— in Table 1, Class E[b], deletion of the exclusion indicated in footnote a) in the classification for “Not an aquatic toy”);

— addition of the new 4.2 for device with or without added component;

— modification of Figure 1;

— measurements in Figure 6 and Figure 7 updated to include buoyancy aid;

— in 5.5.2, modification of the maximum body weight for Subject 1 – male;

— in 5.12.2.1, modification of the test procedure;

— update of the Bibliography.

A list of all parts in the ISO 25649 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

0.1 Motives, problems, risk assessment, methods

Investigations in statistical data related to drowning accidents and near-drownings create a new awareness about the enormous relevance of drownings in many countries.

Drowning is among the ten leading causes of death of children and young people in the world. Due to the absence of precise data, there is no information on the relation between drowning accidents and the involvement of certain products. Such links can only be shown for a limited number of products among the wide range of products related to water activities. Consumer protection needs to rely on conclusions by risk analysis, experience and analogy to known cases. Considerations based on probability and the precautionary principle are also important in addressing the problem. Beyond the statistical deficiencies, relations between certain products and an increased risk of drowning are plausible. A risk analysis (see Table 1) shows in ISO 25649-3 to ISO 25649-7 what the partial and final risks are.

Until now, standardization has addressed the risks through a wide series of standards aiming at the protection against drowning and at covering products used in leisure activities on and in the water. There are standards covering the relevant products for activities such as playing in the water, water sports, boating, diving, learning to swim and even the emergency devices as buoyancy aids and life jackets. Beyond these traditional activities and products, there is an increasing tendency for creating and marketing new products. These aim to increase pleasure and entertainment on the water but also to increase speed, action and thrill with new activities such as “tubing” or “white water rafting”. Some new products are traditional core products that have been partially modified, some are derived from traditional products but have been further developed into something new. Additionally, there is a clear trend to bring formerly land-based playground equipment on the water. The use of the word “amphibiation” is justified as in many cases the original function of the product is maintained, i.e. the product can be used both on land and water. Typical examples for amphibiated products are modifications of inflatable boats into bathing rafts or the further development of the earlier swim-ring into a flotation seat. Other examples are inflatable trampolines, climbing installations on the water and inflatable floating armchairs and sun loungers including a mini bar and sun shade. This trend is clear and likely to continue.

The nature of these new products provides an equal or even higher risk potential than the original core products. In parallel, the number of these products override the number of core products. In cases of collective use, the frequency of use is considerably increased, which in turn increases the likelihood of accidents, including drownings. Drowning is the final risk of the activities related to the mentioned products. Other somewhat lesser evils – partial risks – are likely to happen independently or in combination with the final risk.

With regard to safety-related standardization, an evident discrepancy emerges between the core products and the huge number of new products forming what the experts call the “grey zone”. Standardization in the past has focused on the core products, while “grey zone products” have not been considered and investigated, thus remaining excluded from the scopes of related standards. A systematic risk analysis or an investigation of the role of these new products in drowning accidents was never made. This has changed in recent times, with the triggering incident being the swim seat case, involving aquatic toys and related products and negligence. Today, what matters more than a disturbing gap in the series of existing standards, is the presence of several coincidences:

— the main user groups of these products are children and adolescents who in turn are the main victims of drowning;

— the main areas where drowning happens are the same areas where such products are used (rivers, lakes, pools, bathing beaches);

— the risks can be easily identified and partly proven, and the increase in numbers and frequencies of accidents were already mentioned.

0.2 Equal risk, equal requirement

Safety-related standardization covering products used in leisure activities on and in the water aims at:

— achieving equality of technical rules from equality of risks (risk-/rule-alignment);

— closing the standardization gap (i.e. completeness);

— setting clear boundaries between the product areas in order to avoid incorrect certification (e.g. unjustified CE-Mark);

— avoiding individually established testing procedures by the various test houses in the absence of a unified technical rule.

0.3 Risks and need for prevention

The following are considerations around the risks and the need for prevention.

— Relevance of drowning is proven (age groups, places, partly product involvement).

— The increase in the frequency of use and in the number of products likely contributes to accidents.

— Theoretical risk analysis shows additional risks below the final risk of drowning.

— Plausibility and likelihood of harm to users is evident, so is the probability of adequate safety standards to avoid or minimize this.

— Positive contribution to the basic problem of parental supervision is needed and claimed with regard to children activities, but is often weak, not existing or neglected.

— Safety provided by a product design that ensures the highest possible level of technical security does not exempt parental supervision for young children.

— There is a trend to bring more and more former land-based products on the water, as well as trends to adventure activities increasing the thrill of water related leisure activities and entertainment.

— There is a need for prevention.

0.4 Body entrapment, human tests subjects and USA anthropometric data

This document includes test procedures based on human test subjects. The anthropometric data for the worst-case human test subject – the heaviest and biggest person representing the 95th percentile of a population – have been derived from European body measurement data. The international worst-case regarding body dimensions is constituted by the USA-population. The 95 % body weight for the USA population needs to be increased from 90 kg to 110 kg and the Body Mass Index (BMI) should be specified between 35 and 40. This corresponds to a body height of 170 cm to 175 cm. Accordingly, the rigid test probe needs to be modified.

Floating leisure articles for use on and in the water —

Part 1:
Classification, materials, general requirements and test methods

1 Scope

This document specifies general safety requirements and test methods related to materials, safety and performance for classified floating leisure articles for use on and in water.

This document is not applicable to:

— aquatic toys (use in shallow waters/use under supervision);

— inflatable boats with a buoyancy > 1 800 N;

— buoyant aids for swimming instructions;

— air mattresses that are not specifically designed or intended for use on the water (e.g. velour bed, self-inflating mattress and rubberized cotton air mattress);

— floating seats for angling purposes;

— surf sports type devices (e.g. body boards, surf boards, stand-up-paddles boards);

— water ski, wakeboard or kite surfing board;

— devices made from rigid materials e.g. wood, aluminium, hard or non-deformable plastic;

— devices that are kept in shape by permanent air flow;

— rings intended for use on water slides;

— wading devices.

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 105-A02:1993, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

ISO 105-A03:2019, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining*

ISO 105-E03:2010, *Textiles — Tests for colour fastness — Part E03: Colour fastness to chlorinated water (swimming-pool water)*

ISO 105-E04:2013, *Textiles — Tests for colour fastness — Part E04: Colour fastness to perspiration*

ISO 105-X12:2016, *Textiles — Tests for colour fastness — Part X12: Colour fastness to rubbing*

ISO 868:2003, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 1817:2022, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 2411:2017, *Rubber- or plastics-coated fabrics — Determination of coating adhesion*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

ISO 25649-2:2024, *Floating leisure articles for use on and in the water — Part 2: Consumer information*

ISO 25649-3:2024, *Floating leisure articles for use on and in the water — Part 3: Additional specific safety requirements and test methods for Class A devices*

ISO 25649-4:2024, *Floating leisure articles for use on and in the water — Part 4: Additional specific safety requirements and test methods for Class B devices*

ISO 25649-5:2024, *Floating leisure articles for use on and in the water — Part 5: Additional specific safety requirements and test methods for Class C devices*

ISO 25649-6:2024, *Floating leisure articles for use on and in the water — Part 6: Additional specific safety requirements and test methods for Class D devices*

ISO 25649-7:2024, *Floating leisure articles for use on and in the water — Part 7: Additional specific safety requirements and test methods for Class E devices*

EN 71-1:2014+A1:2018, *Safety of toys — Part 1: Mechanical and physical properties*

EN 13138-3:2021, *Buoyant aids for swimming instruction — Part 3: Safety requirements and test methods for swim seats into which a user is positioned*

EN 16051-1:2012, *Inflation devices and accessories for inflatable consumer products — Part 1: Compatibility of valves and valve adapters*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16051-1:2012 and the following apply.

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

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

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

3.1
buoyancy
resultant upthrust of a body when totally submerged in water with its uppermost part just below the water surface

Note 1 to entry: For the purpose of measuring, the buoyancy of boats (see ISO 25649-7) is measured as the volume of any chamber which forms the inflatable hull, including *components* (3.4) that are permanently fixed to it. This buoyancy is measured by calculation or water filling and measuring the amount of water.

3.2
residual buoyancy
provision of remaining *buoyancy* (3.1) in case of a defect of any buoyancy chamber

3.3
inflatable system
device, including all its *components* (3.4), which ensure stable floating conditions and contribute to safety

3.4
component
subgroup of the entire device, integrated or detachable, that contributes to *buoyancy* (3.1), function and safety

3.5
protrusion
component (3.4) exceeding the base structure in height and thus contributing to wind drift of the device

3.6
static use
use that typically needs limited action from the user

Note 1 to entry: Product is mainly used for relaxing, sun bathing, lying, sitting, etc.

3.7
dynamic use
use during which the user is in full action

Note 1 to entry: Product is mainly used for activities such as jumping, climbing, rollicking (horse playing, rocking), sliding, swinging in and out from the water into or onto the inflatable, etc.

3.8
positional use
use of the product within a limited area

Note 1 to entry: The area where the product is used is supposed to be in safe proximity to the shore, pool edge, etc.

3.9
means of propulsion
devices used to generate the movements of a manually operated floating leisure article

EXAMPLE A paddle wheel, swing flipper, oar or paddle.

3.10
test panel
group of test subjects

3.11
conditioning
process to which the complete device is submitted prior to testing

3.12
load
human subjects and other items carried on or in an inflatable structure

3.13
floating stability
capability of a non-moving buoyant structure to withstand internal and external forces that tend to capsize it and to maintain a *stable floating position* (3.14)

Note 1 to entry: Internal forces leading to capsizing can result from uneven *load* (3.12) distribution, external forces leading to capsizing can result from wind or waves.

3.14
stable floating position
in-water position of a buoyant structure safeguarding upright floating and the on-board position of all passengers in sitting posture

3.15
reinforced material
material that consists of a basic fabric and a coated or laminated layer that ensures air tightness

4 Classification and criteria to distinguish floating leisure articles from aquatic toys

4.1 Classification

Floating leisure articles shall be classified by their intended use, means of propulsion and design as set out in Table 1.

Table 1 — Classification and criteria to distinguish floating leisure articles from aquatic toys

Class	Description/Structural design criteria	Not an aquatic toy because[b]:
A[a]	Floating leisure articles intended for quasi-static positional use on the water and position of user upon the buoyant structure. Single and collective use, mainly passive. Normally no mechanical means of propulsion, but possible. Some devices may be of design that provides floating stability; others do not and need to be balanced by the user. — Minimum age above 36 months. — The product use includes use in deep water.	— Largest uninflated dimension (D_L) exceeds 1,2 m; — provokes use in deep water; — due to size, product is at risk to be blown into open waters; — intended use includes adult users (according to the label); — product is not labelled as a toy; — product includes a body opening inside a circumferential buoyancy system around the user's body and thus a serious entrapment risk.
B[a]	Floating leisure articles intended for quasi-static use, but including a buoyant structure around the user's body (relatively tight fit), fully enclosing or with openings. Devices can provide a body holding system or user is expected to hold himself by the upper arms and hands. Body holding system might be an integrated seat, straps or other means of holding regardless of the body posture (sitting, standing, laying, kneeling etc.). User's body is more or less immersed. Normally the upper part (chest upwards) is out of the water. Single or collective / passive or active use. Normally no mechanical means of propulsion, but possible. — B1: use out of user's standing depth. — Minimum age / body weight variable, but above 36 months / 18 kg.	— Product includes a body opening inside a circumferential buoyancy system around the user's body and thus a serious entrapment risk; — for appropriate use of the product, water needs to be deeper than user's standing depth; — product is not labelled as a toy; — intended use includes adult users (according to the label); — use of product depends on deep water or use in deep water is foreseeable.
C[a]	Floating leisure articles for dynamic use, i.e. application at high speed. Position of user is upon or inside the buoyant structure. There can be a cockpit or seat or other means to give hold to the user. The device is towed behind external means of propulsion. Towing rope fixed to device or held by user. User is required to manage floating stability and safe course behind the towing devices. — C1: static use towable, static user. — C2: active sport use towable, active user, sport application. — C3: active extreme use towable, active user, extreme application. — Use beyond user's standing depth. — Minimum age variable, but above 6 years.	— Product is towed by non-manual means; — product use exceeds a speed limit of 3 km/h; — intended use includes adult users (according to the label); — product is not labelled as a toy; — use of product depends on deep water or use in deep water is foreseeable.
D[a]	Floating leisure articles for passive use (resting, relaxing on flat surface) but mainly active use i.e. climbing, jumping (more than 1 m), swinging, rotating and any related activity. No distinct position of user. Single or collective use. No mechanical means of propulsion. Shall be anchored. — Minimum age variable, but above 36 months. — The product includes use in deep water.	— product includes usability for jumping and climbing to a height of more than 1,0 m; — labelling does not include the warning note according to EN 71 series concerning supervision and use in shallow water only; — intended use includes adult users (according to the label).

[a] For typical products, see risk analysis (as described in the introduction).

[b] For each class, one of more reasons for exclusion can apply.

Table 1 *(continued)*

Class	Description/Structural design criteria	Not an aquatic toy because[b]:
E[a]	Inflatable boats with buoyancy less than 1 800 N and an overall length of more than 1,2 m. Single and collective use. Position of user inside the buoyant structure (wide cockpit). Propulsion: manual, motor, sail. — Minimum length over all (uninflated, flat) = 1,2 m. — Minimum age variable, but above 36 months.	— largest uninflated dimension (D_L) exceeds 1,2 m; — product is equipped or intended for mechanical means of propulsion; — labelling does not include the warning note according to EN 71 series concerning supervision and use in shallow water only; — intended use includes adult users (according to the label); — use of product depends on deep water or use in deep water is foreseeable.
[a] For typical products, see risk analysis (as described in the introduction). [b] For each class, one of more reasons for exclusion can apply.		

4.2 Test method for measurement

4.2.1 General requirements

Test measurement shall be performed on the entire inflatable system.

Two options are given to define the measuring method the largest uninflated dimension D_L, see Figures 1, 2, 3 and 4.

These figures are not exhaustive examples of existing devices. Different configurations shall be treated in the same sense as indicated.

4.2.2 Test method for measurement of the largest dimension (D_L)

4.2.2.1 General

To measure the largest dimension D_L, the following steps shall be applied.

a) Inflate the device and take note of which air chambers make contact with the water.

b) Deflate device completely.

c) Spread device evenly with the bottom side on a flat rigid surface and ensure that it is completely uninflated, squeezing the air out if required. The air chamber(s) in contact with the water when the device is in use as intended (see 4.2.2.2, Figure 1a) determines the underside of the device on the rigid surface.

d) Measure the largest dimension, D_L, of the flatly spread structure (completely uninflated device) as shown in Figure 1a and Figure 2a, ignoring long thin protrusions (e.g. neck and or tale or other components that do not contribute to wind drifting, as in Figure 1b).

In case the diameter of the protrusion (e.g. D_N in Figure 1a) is > 15 % of D_L, the measurement of the largest dimension shall include the full length of the protrusion.

4.2.2.2 Option A — Test measurement for device without added components

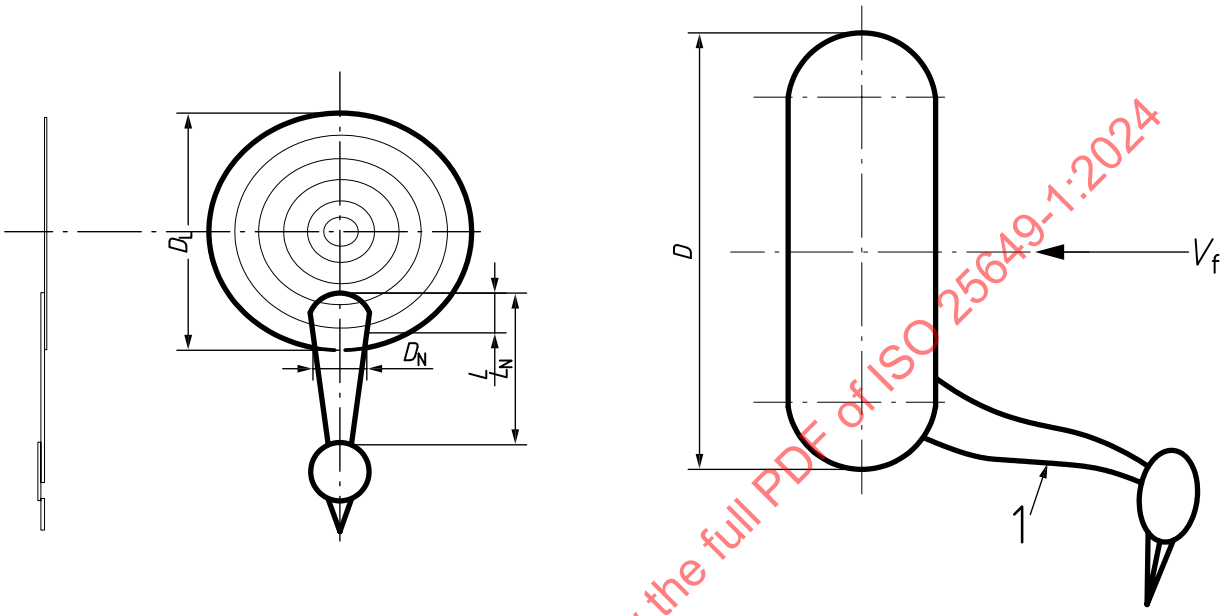
This test measurement is applicable when the device does not have components added to the base structure (e.g. Figures 1 and 2).

a) Inflate the device and take note of which air chambers make contact with the water.

b) Deflate device completely.

c) Spread device evenly with the bottom side on a flat rigid surface and ensure that it is completely uninflated, squeezing the air out if required. The air chamber(s) in contact with the water when the device is in use as intended (see 4.2.2.2, Figure 1a) determines the underside of the device on the rigid surface.

d) Measure the air chamber in contact with water, ignoring long thin protrusions (e.g. neck and/or tale, or other components that do not contribute to wind drifting, as in Figure 1b).



a) Device deflated – Top view **b) Device fully inflated – Side view**

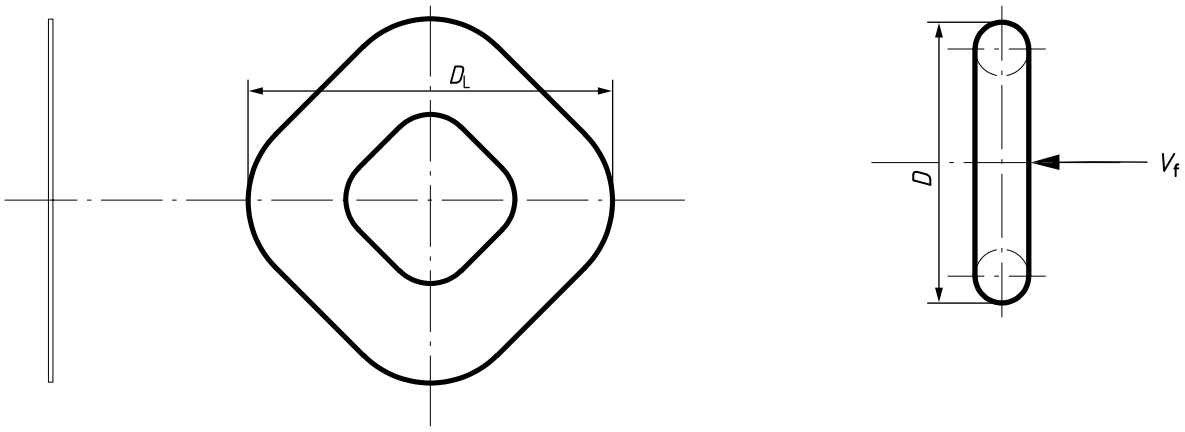
Key

D_L largest dimension of device (uninflated, flat)
D_N cross dimension of protrusion (e.g. neck) at distance[a]
L_N length of protrusion (e.g. neck)
L distance to measuring points
D diameter of base structure, inflated
1 long thin protrusion (e.g. swan neck)
V_f vertical flattening

NOTE:

[a] The cross dimension of protrusion D_N is measured at $0{,}3 \times L_N$.

Figure 1 — Example of circular device without relevant component



a) Device deflated – Top view **b) Device fully inflated – Side view**

Key

D_L largest dimension of device (deflated, flat)

D diameter of base structure, inflated

V_f vertical flattening

Figure 2 — Example of non-circular device without relevant component

4.2.2.3 Option B — Test measurement for device with added component(s)

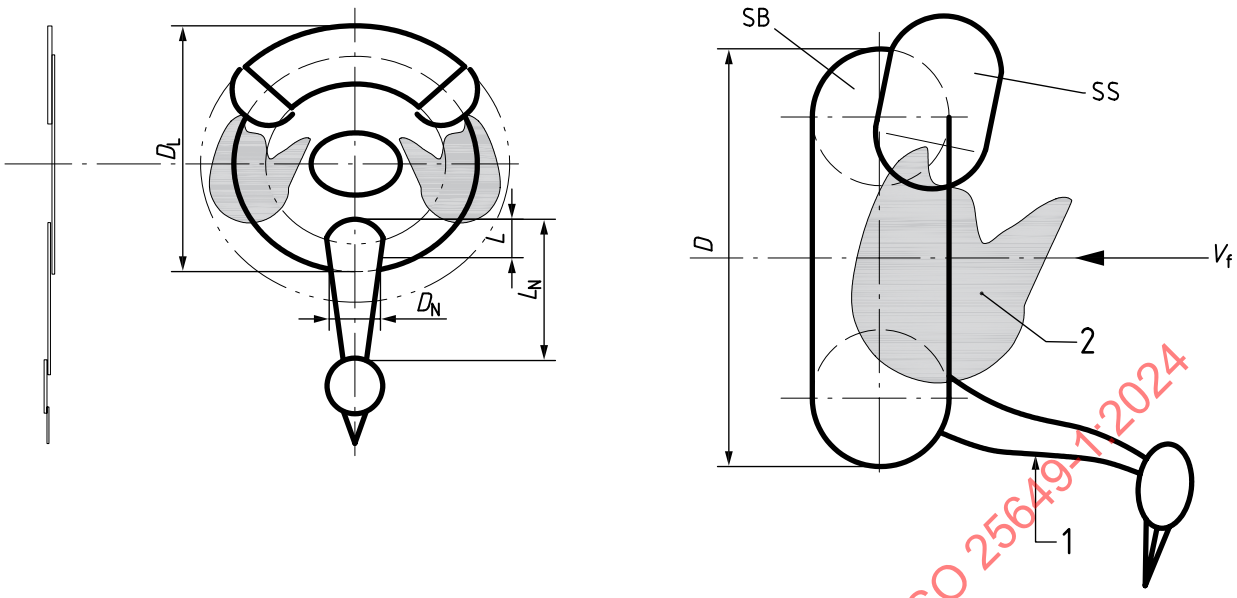
This test measurement is applicable when the device has component(s) added to the base structure (e.g. Figures 3 and 4).

a) Inflate the device and take note of which air chambers make contact with the water.

b) Deflate device completely.

c) Spread device evenly with the bottom side on a flat rigid surface and ensure that it is completely uninflated, squeezing the air out if required. The air chamber(s) in contact with the water when the device is in use as intended (see Figure 3a) determines the underside of the device on the rigid surface.

d) Measure the air chamber in contact with water plus component added to the base structure, ignoring long thin protrusions (e.g. neck and/or tale, or other components that do not contribute to wind drifting, as in Figure 3b).

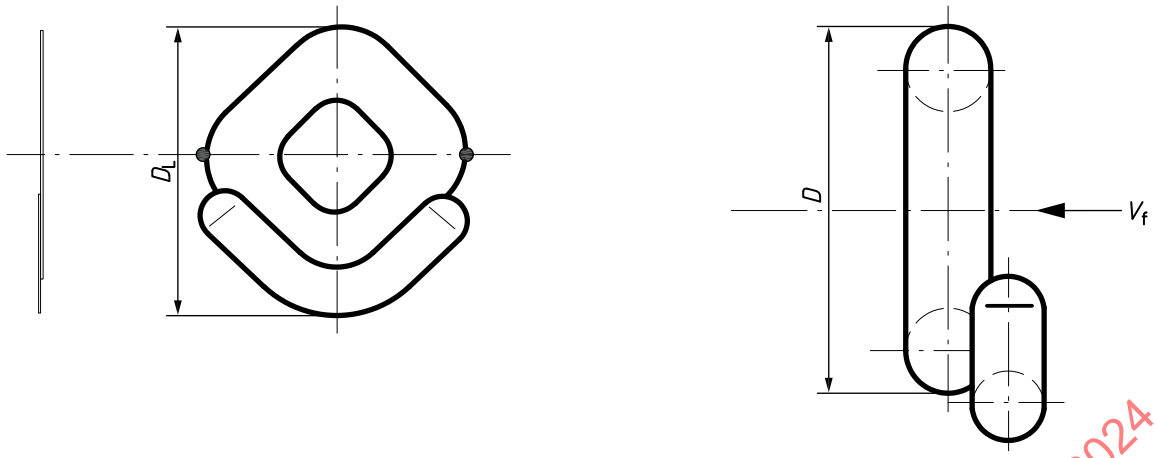


a) Device deflated – Top view **b) Device fully inflated – Side view**

Key

D_L	largest dimension of device (deflated, flat)
D_N	cross dimension of protrusion (e.g. neck) at distance
L_N	length of protrusion (e.g. neck)
L	distance to measuring points = 0,3 × L_N
D	diameter of base structure, inflated
1	long thin protrusion (e.g. swan neck)
2	protrusion (e.g. wings)
SB	base structure
SS	super structure
V_f	vertical flattening

Figure 3 — Example of circular device with relevant component(s)



a) Device deflated – Top view **b) Device fully inflated – Side view**

Key

D_L largest dimension of device (deflated, flat)
D diameter of base structure, inflated
V_f vertical flattening

Figure 4 — Example of non-circular device with relevant component

5 General safety requirements and test methods related to all classes

5.1 General

Floating leisure articles for use on and in the water shall be designed so that they are safe and usable for persons of a minimum age of 36 months, also in deep water where users are out of their standing depth.

Labelling shall make it clear to the consumer and user that these articles are intended for swimmers only, that they do not provide protection against drowning and that they are not Personal Protective Equipment (PPE).

These basic requirements are deemed to be met if a product complies with relevant parts of the ISO 25649 series.

Specific parts of the ISO 25649 series can include deviations and exclusions from the above.

5.2 Body entrapment

5.2.1 General

5.2.1.1 Introduction

Floating leisure articles shall not have accessible design features that can cause body entrapment. This requirement is deemed to be met if the following requirements are met and the specified test procedures prove that body entrapment does not occur.

Design features, i.e. gaps, openings, slots are categorized in design types A to E, as shown in Annex A and Annex B. They include features providing fixed interior spaces and features with flexible interior components or spaces and thus variable dimensions. Design features likely to cause entrapment may be arranged in the plane but also in 3-dimensional structures providing considerable height, e.g. ladder structures, labyrinths or body enclosing structures. Testing should be undertaken according to the instructions laid out in this document.

5.2.1.2 Accessibility

Design features shall be accessible to the test person in any floating position in which the product can take on water, including residual buoyancy for emergency situations.

Requirements related to grab handles and capsizing are detailed in specific parts.

5.2.1.3 Product categorization regarding age group and body weight of user/test persons/torso templates

Products shall be labelled with regard to their intended user groups in accordance with ISO 25649-2:2024. With regard to body entrapment, floating leisure articles shall be distinguished in two categories of use: child use and adult use. Child use includes age group 3 years to 10 years and body weight 18 kg to 45 kg.

Products for combined child /adult use or adult use only include all other user groups. The relevant foot and torso probes or the test persons shall be applied for testing according to these user groups.

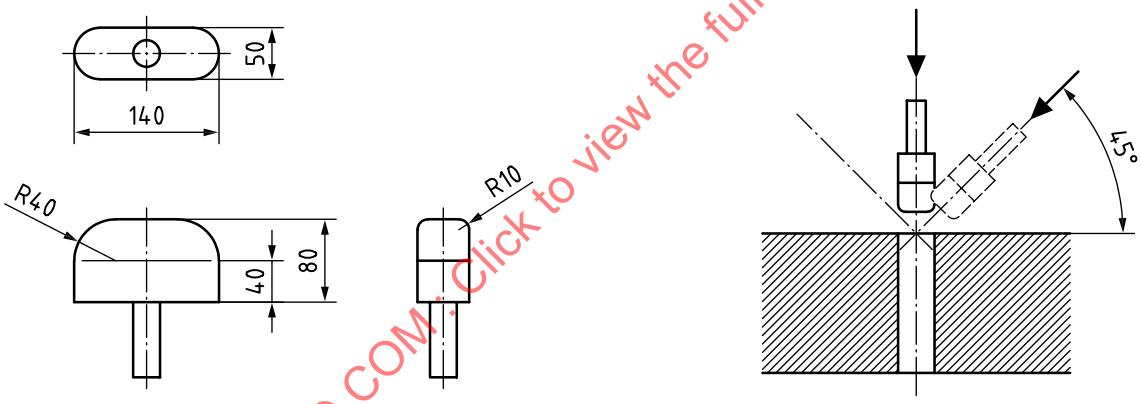
5.2.1.4 Probes

5.2.1.4.1 Foot probe, child

Figure 5 shows the test foot probe for a child, 3 years of age, 5th percentile (smallest foot dimension).

Dimensional tolerances of the probes shall be ±1 %.

Dimensions in millimetres



a) Dimensions of probe

b) Application of probe

Figure 5 — Foot probe

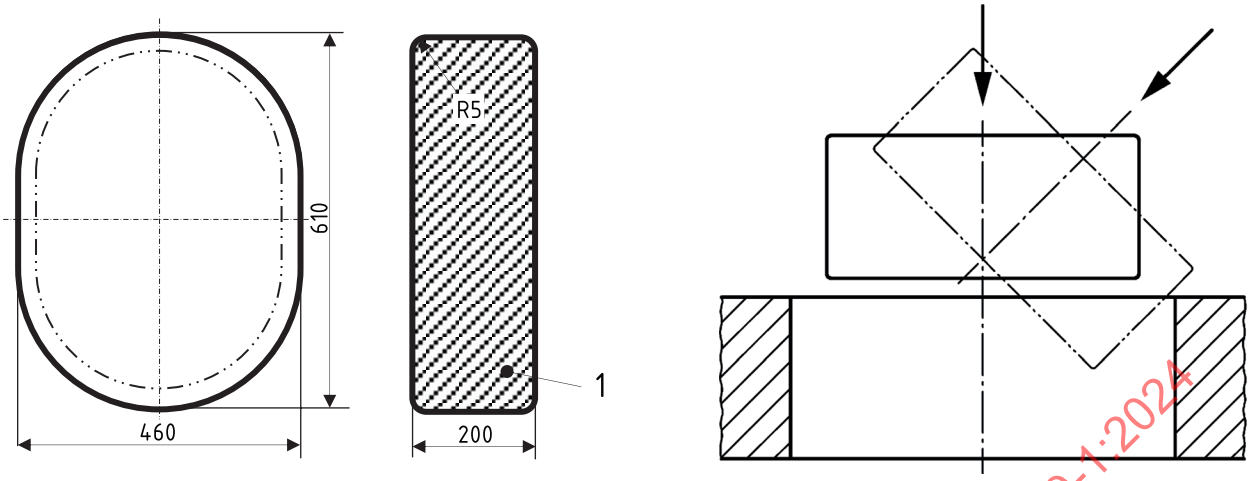
5.2.1.4.2 Torso probes, adult and child

The use of buoyancy aids should be taken into consideration when testing torso probes, to prevent entrapment. Tests shall be performed with and without buoyancy aids, for product classes D, E and F.

Figure 6 and Figure 7 shows the test torso probes for an adult and a child respectively.

Dimensional tolerances of the probes shall be ±1 %.

Dimensions in millimetres



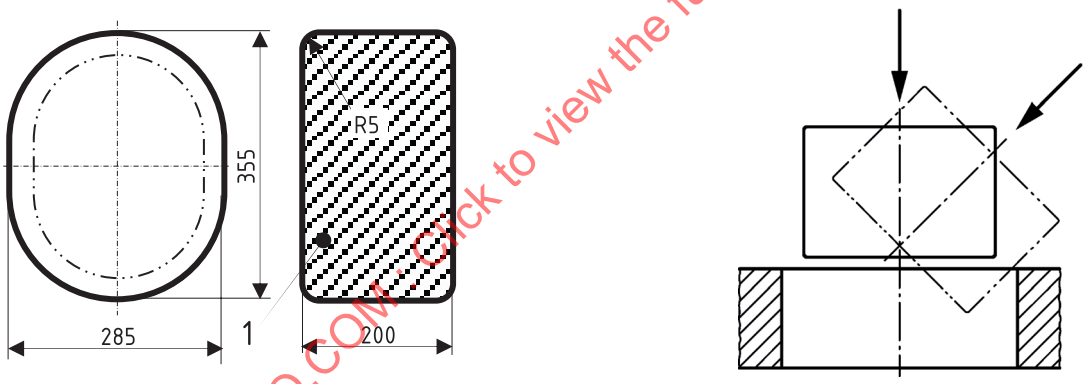
a) Dimensions of probe **b) Application of probe**

Key

1 adult torso

Figure 6 — Adult torso probe

Dimensions in millimetres



a) Dimensions of probe **b) Application of probe**

Key

1 child torso probe

Figure 7 — Child torso probe, 10 years of age

The material of the probe in Figure 6 and Figure 7 shall be rigid.

Dimensional tolerances of the probes shall be ±1 %.

5.2.1.4.3 Test subjects

The test subject representing the child of 10 years of age is Subject 4 in Table 2.

The test subject representing the adult is Subject 1 in Table 2.

5.2.2 Requirements on body entrapment

When tested in accordance with 5.2.3, all design features of a floating leisure article (e.g. gaps, openings, slots), which allow the initial ingress of the foot probe according to 5.2.1.4.1, shall prove that they subsequently allow the free passage of either the appropriate (see 5.2.1.3) test probe (adult/child) according to 5.2.1.4.2 or the relevant test subject according to 5.2.1.4.3.

For design features likely to cause body entrapment, see categorization of types of openings in Annex B.

5.2.3 Test procedure

In general, testing shall be performed with the probes (child/adult) as specified in 5.2.1.4, in cases where the design features likely to cause entrapment allow a simple dimensional check, i.e. a pass or not-pass assessment of the template(s). The appropriate test probe shall be applied vertically and pushed into the gaps, openings, etc. with a force of 100 N.

In special cases where body entrapment depends on the flexibility of body-enclosing components or where the arrangement of such hazardous design features is too complicated for a simple dimensional check, testing shall be done by the appropriate test subject. The procedure shall be an in-water test and shall include access to the hazardous feature in any stable floating position the product can take. Subject tests shall include the following sub-sequences:

a) appropriate test person is intentionally getting access into the potential entrapment design feature with the intent to pass through;

b) head first access, feet first access;

c) it shall be checked whether the process of intentionally and actively accessing the feature of entrapment turns itself into an opening movement and thus release of the test person (see Annex B).

5.2.4 Depths of gaps and openings

Openings, gaps, slots, etc. are considered as not causing body entrapment if they have a restriction in depth that prevents the user from getting too deep into them. This depth shall not allow an entry of the foot probe according to 5.2.1.4.1 of more than 30 cm for products intended for adult use only and not more as 20 cm for products intended for child use or combined adult and child use.

5.2.5 Measuring method

a) The foot probe is put into the potential entrapment design feature in any direction but not more than 45° from perpendicular in relation to the opening (See Figure 5b). The force applied to the foot probe is 100 N max.

b) When the probe is blocked, the depth of entry from the first contact point to the depth, which is reached after the application of 100 N, shall be measured along the virtual line of entry.

5.3 Torso entrapment on safety line with regard to children

5.3.1 Requirements

The child torso probe as shown in Figure 8 shall pass through the opening between the safety line and the hull of the device at any position under the force of its own weight.

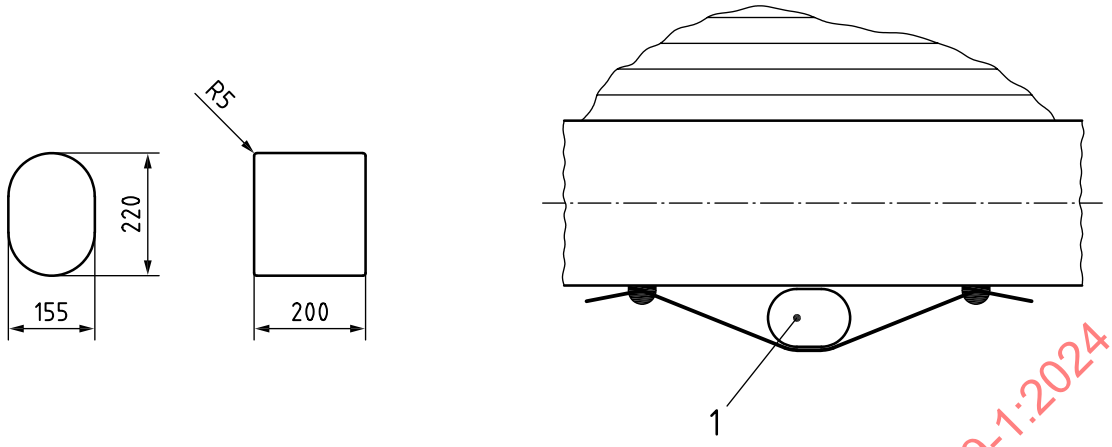
5.3.2 Test method

Put probe for torso entrapment horizontally into the gap between the safety line and the hull of the inflated structure. Check whether the probe becomes trapped.

The test probe applies to a child of 3 years of age, 95th percentile (biggest torso dimension, material: pine wood or similar).

Dimensional tolerances of the probes shall be ±1 %.

Dimensions in millimetres



Key

1 child's torso probe, 3 years of age

Figure 8 — Child torso probe

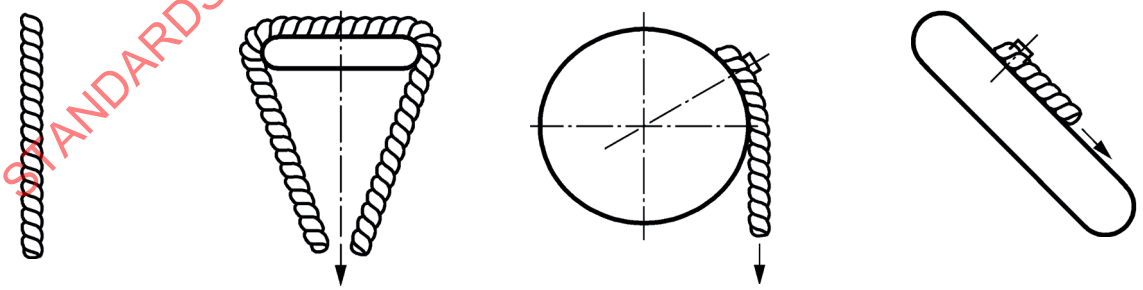
5.4 Accessible protruding parts causing entanglement

5.4.1 Requirements

To prevent the user from entanglement when unintentionally sliding out or from a device, there shall be no hazardous protrusions. The test rope shall slip off any part of the device that protrudes in the area where the user intentionally and foreseeably interacts with the product.

5.4.2 Test method

A loop of the plaited polyester test rope of 8 mm diameter as shown in Figure 9 shall be put around the protruding part. The pulling direction in relation to the protruding part shall be vertically to the centre line of this part. With the product in the position to simulate its intended use, apply a pulling force of 180 N either vertically downwards or in a downward direction most likely to cause failure. It shall be checked whether the test rope disengages under any circumstances, such as capsizing, slipping off or breakage of the protruding part.



a) Test rope: plaited polyester rope, 8 mm diameter, min. 600 mm in length

b) Test rope put around objects (top view)

c) Test rope put around objects (side view), vertical pulling

d) Test rope applied on objects hindering vertical pulling, pulling direction most likely to cause failure (side view)

Figure 9 — Test rope and its application

5.5 Human subject testing

5.5.1 General

Testing in the ISO 25649 series depends principally on testing with human test subjects. Due to the very nature, diversity and disparity of the products concerned, instrumental testing by using apparatuses, devices, etc. is not recommended. The use of rigid loads and distinct load application points should be replaced by positioning human test subjects. This approach is appropriate to adapt to the flexibility and irregularity of the products. Therefore, the determination and selection of an adequate test panel is of utmost importance. The same applies consequently for the assessment panel. Standard Model Cases on how to determine and select test panels exist and can be adapted to the needs of the testing.

5.5.2 Test panel

Test shall always include test subject 1 (see Table 2). If more than one test subject is used, there shall be a mix of male and female test subjects, in accordance with Table 2.

Table 2 — Test panel

Test subject	Sex	Age years	Body weight kg	Body height cm	Number of subjects	Mix[b]	Child/adult equivalence
Subject 1	male	> 18	≥ 110	≥ 180	according to manufacturer's instructions	1 time	2 children = 1 adult
Subject 2	male	> 18	70 – 80	≥ 170		50/50	
Subject 3	female	> 18	65 – 70	≥ 160		50/50	
Subject 4[a]	female	> 18	40 – 45	< 150		—	

[a] Test subject 4 represents a child. In order to avoid involvement of children in testing, the child subject is substituted by the statistically smallest adult woman (5th percentile).

[b] If a device is classified for an uneven number of adult users, subject 1 shall constitute the majority.

Test subjects shall be able-bodied and good swimmers. They shall be made familiar with the particularities of the product and the particularities of the in-water test procedures.

5.5.3 Assessment panel

The tests in the water shall be conducted and assessed by an assessment panel of at least three independent technical experts experienced in assessing floating leisure articles. The assessment panel directs the test subjects to take positions and to perform according to the standard's test specifications and pass/fail criteria. The responsible test house staff shall provide measures to avoid any accident during testing.

5.5.4 Positioning and posture of test subjects for testing floating stability (if applicable)

Each test subject shall be positioned:

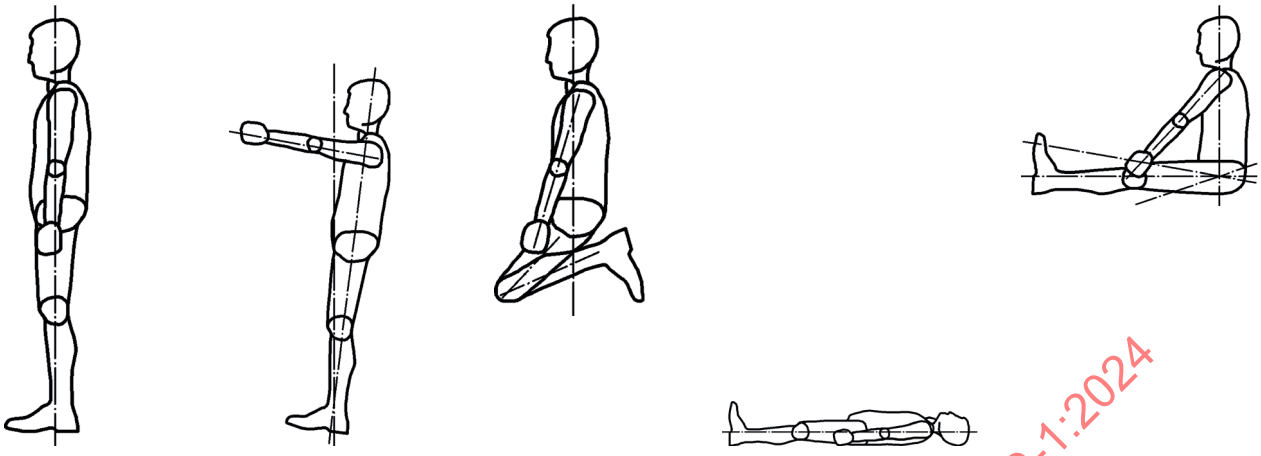
— on the intended position if there are distinct seats, sitting or lying areas or other positions for the user, as required in Annex A;

— on the position most likely to cause failure if free movement of users is possible;

— with the back leaned towards the outer wall, if the device provides a clear inner area surrounded by a wall.

The posture to be adopted shall be selected from the standard test postures as specified in 5.5.5 and specified in detail by ISO 25649-3:2024 to ISO 25649-7:2024. If there are various postures likely to be applied in practical use, the one most likely to cause failure shall be selected from the test postures (see 5.5.5 and Figure 10) and applied for testing.

5.5.5 Basic test postures



a) Posture 1 **b) Posture 1.1** **c) Posture 2** **d) Posture 3** **e) Posture 4**

Posture 1: upright standing, arms sideways to mid body, body centre line vertical, head upright.

Posture 1.1: upright standing, arms/hands holding a grab handle, body centre line slightly leant back (7°), feet on surface or climbing fitting.

Posture 2: kneeling position, torso rests on lower leg, arms/hands on upper legs, body centre line vertical, head upright.

Posture 3: lying position (on the back or on the stomach) entire body stretched out horizontally, feet, legs, torso, arms head on resting surface.

Posture 4: sitting position, legs stretched out or bent, hands on knees, torso centre line vertical, head up right.

NOTE For test positions and variations of these basic test postures according to product design, see ISO 25649-3 to ISO 25649-7, Classes A to D.

Figure 10 — Basic test postures of human test subjects

5.6 Design working pressure

5.6.1 Requirements

The recommended working pressures (if applicable) shall be specified by the manufacturer for each main buoyancy chamber of the fully inflated device. These pressures shall be indicated on the device and in the operator's instruction manual (see ISO 25649-2:2024). If for any reason working pressure is not given, inflate until full shape and functionality is achieved. Where relevant, the sequence of inflation shall be numbered next to the chamber's inflation valves.

The manufacturer shall provide appropriate equipment or a pressure gauge so that the user can ascertain that the specified working pressure has been reached. Alternatively, instructions shall be included in the operator's instruction booklet, enabling a sufficiently close estimate to be made. The working pressure shall be consistently expressed in bars.

5.6.2 Test method

The test consists of visual examination by the test panel.

5.7 Load bearing components

5.7.1 Requirements

If not otherwise stated in the specific parts, all load-bearing fittings, e.g. lifting and carrying handles and fittings for safety ropes, shall be compatible with the material of the hull itself and shall not, when loaded as described in 5.7.2, break or result in any impairment in air tightness or water integrity.

5.7.2 Test method

Any cordage used for test purposes shall have a diameter of 8 mm.

Progressively apply a load of 500 N to all the bearing components in any direction. Maintain for 1 min.

5.8 Towing device

5.8.1 Requirements

If not otherwise stated in the specific parts, floating leisure articles shall be equipped with means to attach a towing rope in case of an emergency. This means shall withstand a horizontal pulling force without any damage to the fitting and the entire structure according to 5.8.2.

If the device is marked with safety information symbol "pool use only" according to ISO 25649-2:2024, Figure 32, the means to attach a towing rope is not required.

5.8.2 Test method

Any cordage used for test purposes shall have a diameter of 8 mm.

Progressively apply a load of 1 kN to all the pulling components in any direction. Maintain for 15 min.

5.9 Valves and valve adapters

5.9.1 Requirements

Inflating and/or deflating valves shall be made of corrosion-resistant materials, shall be compatible with the material of the hull and shall not be capable of damaging the device. EN 16051-1:2012 gives examples on how to achieve compatibility valves and inflating devices geometry. They should meet the requirements specified in EN 16051-1:2012. In general, valves shall not:

a) inconvenience the persons in the device in their predetermined seating positions;

b) interfere with the operation of the device;

c) be damaged or torn off by moveable components of the device construction.

All valves shall enable airtight sealing by manual operation, independent of their sealing or non-return valve.

For the buoyancy system, valves with a non-return device in accordance with EN 16051-1:2012 shall be used.

Each filling valve shall enable a controlled pressure reduction.

5.9.2 Test method

A visual inspection and a practical test shall be used. In-house or outside test confirmation can be used to verify compliance.

5.9.3 Numbering of air chambers

If the sequence of air chamber inflation is relevant for function or safety of the product, the correct inflation sequence shall be indicated by numbers close to the valves.

5.10 Edges, corners and points

5.10.1 Requirements

All devices shall be designed so that they cannot cause harm to the user. Edges and corners of hard and rigid materials shall be chamfered or rounded.

Round edges or corners shall have a minimum radius of 1 mm and where a chamfer is part of the design, it shall be of (45 ± 5)° and at least 1 mm in width. There shall be no barbs or other sharp points or features.

5.10.2 Test method

Testing shall be by measurement and tactile assessment.

5.11 Shearing and crushing points

5.11.1 Requirements

Floating leisure articles not specifically excluding the use by children shall meet the requirements regarding parts moving against each other as specified in EN 71-1:2014+A1:2018, 4.10.1 d) and 4.10.2. Floating leisure articles for adult use only shall have no accessible shearing and/or crushing points. Shearing and crushing points exist if the distance between two rigid movable parts is less than 25 mm.

If access to shearing and crushing points is prevented by covers, none of the remaining openings shall allow a 5 mm cylindric probe to be inserted.

This requirement does not apply to oars and oar-locks.

5.11.2 Test method

Testing shall be done by measurement and panel assessment.

5.12 Strength of the hull and test conditions

5.12.1 Requirements

If applicable, the device shall remain airtight after each of the tests below (see 5.12.2 to 5.12.5).

All tests shall be performed at a temperature of (20 ± 3) °C unless specified otherwise.

5.12.2 Pressure test

5.12.2.1 Combined cycle pressure/static load test for devices manufactured from unsupported material

Inflate all chambers of the device to the design working pressure as instructed by the manufacturer or by the instructions, in any case not less than 0,03 bar[1)]. If no working pressure is given for test purposes, a pressure of 0,06 bar is valid. Keep the device inflated for 12 h.

1) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

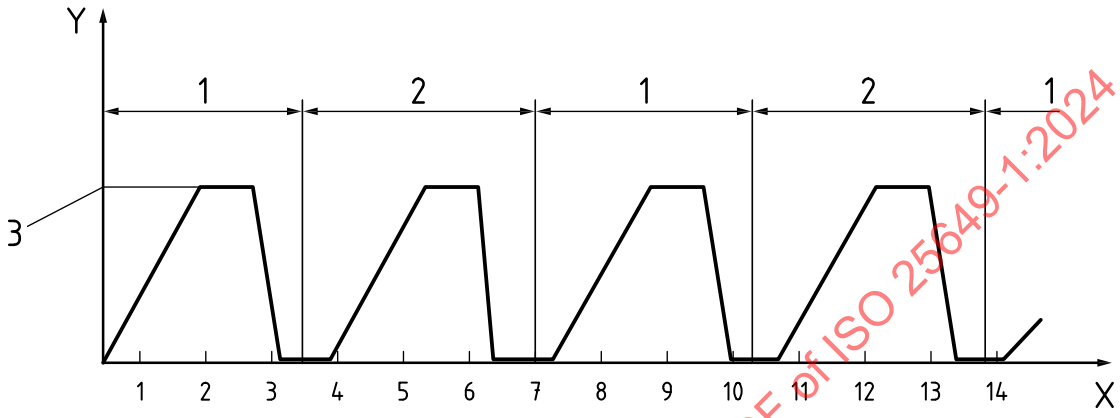
This test procedure shall be applied alternately to at least two adjoining inflated chambers (chamber 1, chamber 2) in turn, as required in Figure 11, and shall comprise 75 inflation/deflation cycles.

a) Inflate chamber 1 to a pressure of 1,1 times the design working pressure and keep it for the specified time.

b) Deflate chamber 1 to zero pressure and inflate chamber 2 to 1,1 times of the design working pressure and keep it for the specified time.

c) Repeat this process for 75 cycles (pressure tolerance: +10 % to −0 % of applied test pressure).

Test the air tightness of all inflated air chambers in accordance with the paper strip test in 5.12.4.



Key

X time, min
Y pressure (bar)
1 chamber 1
2 chamber 2
3 design working pressure

Figure 11 — Cyclic pressure test for buoyancy chambers (unsupported materials)

Test durations for the inflation cycle shall be as follows:

— time to inflate to 1,1 times working pressure: 2,0 min;

— maintain at 1,1 times working pressure: 0,5 min;

— time to deflate to zero pressure: 0,5 min;

— maintain at zero pressure: 0,5 min.

Adjoining chambers shall not be tested simultaneously.

In direct succession to this cyclic pressure test, the product shall be put on an even rigid floor and loaded statically with the weight of the designated user(s) for the duration of 20 min. The user(s) shall be represented by the test subjects as specified in 5.5.2 and Table 2. The test for adult users shall always include test subject 1 and children shall be represented by test subject 4.

Alternatively, corresponding dead weights or forces applied via a cushioned circular loading pad of appropriate dimension may be applied.

If dead weight is used, it shall be applied onto the product area expected/designed to carry the person/child during use.

If the product is intended for more than one user, the dead weight shall be applied over the appropriate number of loading surfaces specified for the user and for the usage position and applied onto the areas of the product expected/designed to carry the persons/children.

For items where the inflatable components are not carrying the user but acting as buoyancy providers only, dead weight shall be applied onto the non-inflatable product areas expected/designed to carry the person/child in the water environment, and it shall be observed that the inflatable buoyancy components do not separate from the user-carrying component or otherwise burst or fail under the pull of the weight.

5.12.2.2 Overpressure test for inflatables made from reinforced or fabric covered material

Inflate each compartment of the device to 1,5 times the manufacturer's design working pressure for 30 min. If no design working pressure is given, a pressure of 0,06 bar[2)] is valid. For Class D devices, a pressure of only 1,2 times the design pressure applies. No damage or rupture shall occur and the device shall be tested for air tightness as described in 5.12.5.

In case of the presence of an overpressure release valve, it shall be checked whether the valve operates as intended.

NOTE Flocked film materials do not fall under the category of being "reinforced".

5.12.3 Heat test (not applicable to Class D devices)

Assemble the device in accordance with the manufacturer's instructions and inflate it to a pressure of 1,1 times the design working pressure. If no working pressure is given, a pressure of 0,06 bar shall be used. When assembled, place the device in a heat chamber, set at (60 ± 2) °C, for a period of 6 h. On completion of the test period, remove the device from the heat chamber and allow to cool down to ambient temperature. Test the air tightness of the device in accordance with the relevant test specified in 5.12.5 for devices manufactured from reinforced material or 5.12.4 for devices manufactured from unsupported material.

5.12.4 Air tightness test for inflatables made from unsupported material

The air tightness is measured indirectly as shrinkage of the material. Test all chambers for buoyancy individually with all adjacent chambers deflated.

Inflate the chamber to be tested for buoyancy to a pressure of 1,1 times the manufacturer's design working pressure. If no working pressure is given, a pressure of 0,06 bar is valid. Immediately stick a strip of paper, approximately 100 mm long, at its ends onto the outer surface of the air chamber in a circumferential direction. Cut the strip in half horizontally. Following a test period of 2 h, there shall be no overlapping of the two cut ends.

5.12.5 Air tightness test for inflatables made from reinforced or fabric covered material

Support or insulate the device from the floor and do not expose it to any air current and direct sunlight. Inflate the device (all air chambers) for 30 min to a pressure that is 20 % in excess of the manufacturer's design working pressure, if indicated, in order to pre-stretch the device. Then reset the pressure to the design working pressure for a further period of 30 min in order to stabilize conditions. Reset the pressure to the design working pressure and record the ambient temperature and atmospheric pressure. Following a test period of 24 h, the pressure drop shall not be greater than 20 % in any air chamber. Record the final ambient temperature and atmospheric pressure.

The temperature difference between the start of the test and the end of the test shall not exceed ±3 °C.

The atmospheric pressure difference between the start of the test and the test readings shall not exceed ±1 %.

For each rise or fall by 1 °C in ambient temperature, an allowance of 0,004 bar may be respectively subtracted from, or added to, the recorded device pressure.

2) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

5.13 Buckles and other fixings

5.13.1 Requirements

If buckles or other detachable fastening devices are used as parts of the entire device in order to attach or connect functional parts or components, they shall require at least two simultaneous actions for their release or opening in order to prevent unintended opening. Where one of the two sequences of buckle opening relies on pressure, it is necessary to apply a force of at least 50 N on this release mechanism.

5.13.2 Test methods

Verification shall be executed by the test panel. In case of a locking system based on pressure, testing shall be in accordance with EN 13138-3:2021, Annex E.

6 Material requirements and test methods

6.1 General

6.1.1 Requirements

All materials used in floating leisure articles shall be visually clean and free from contamination. The use under normal conditions shall not materially impair their performance and they shall meet all the requirements specified in Clause 6 and Clause 7.

To avoid rotting, fibre materials shall not be made from natural fibres like cotton.

For conditioning, the test procedure related to immersion in chlorinated salt water (see 6.2.2) and storage in cold and hot conditions (see 6.3) shall be carried out prior to all other tests.

6.1.2 Test method

Testing shall be by visual inspection and manufacturer's certificate on request.

6.2 Chemical requirements for materials making up the hull, unsupported or reinforced

6.2.1 General

In-house or outside test confirmation can be used to verify compliance.

6.2.2 Resistance to mineral oil

6.2.2.1 Requirements

After the contact during a period of (22 ± 0,25) h, the change in mass per unit area shall not exceed 100 g/m^2.

6.2.2.2 Test method

Carry out the test on the external side of the material in contact with the ambient environment as specified in ISO 1817:2022 but with a sample size of 100 mm x 100 mm or a disc of 100 mm diameter by using mineral oil 15W40HD for diesel engines at a temperature of (40 ± 1) °C.

6.2.3 Resistance to chlorinated salt water

6.2.3.1 Requirements

After the contact during a period of minimum 36 h, the change in mass per unit area shall not exceed 100 g/m^2.

6.2.3.2 Test method

Carry out the test on the external side of the material in contact with the ambient environment as specified in ISO 1817:2022 by using salt water composed of distilled water and 30 g of sodium chloride per litre at a temperature of (40 ± 1) °C.

6.3 Physical requirements

6.3.1 Resistance to cold

6.3.1.1 Requirements

After an exposure of 4 h and the following treatment, there shall be no signs of cracking when the test sample is examined under a magnification of ×10.

6.3.1.2 Test method

Samples shall be tested and assessed in accordance with ISO 4675:2017. A sample with a size of 100 mm × 250 mm shall be kept in a suitable cooling chamber at a temperature of –5 °C. Then the sample shall be folded through 180° and kept under a weight of 5 kg for another 10 min in the cooling chamber. After removal the sample is examined for fractures or cracking.

6.3.2 Resistance to heat

6.3.2.1 Requirements

The test sample shall give neither evidence of blocking nor show damages of the surface after unfolding when the sample is examined under a magnification of ×5.

6.3.2.2 Test method

A test piece with a size of 100 mm × 250 mm shall be folded at its centre line, with the external sides laid together, and stored for 2 h in a heating chamber at a temperature of (60 ± 2) °C under a load of 50 N/50 cm^2. After removal from the heating chamber, the sample is allowed to cool down for 2 h under standard atmosphere, then unfolded and examined for blocking or surface damages.

6.4 Mechanical requirements of unsupported hull materials

6.4.1 General

Unless otherwise specified, the standard environmental conditions for the tests shall be a temperature of (20 ± 2) °C and a relative humidity of (65 ± 5) %.

NOTE See specific requirements in ISO 25649-3 to ISO 25649-7.

6.4.2 Resistance to puncturing

6.4.2.1 Requirements

Air-filled buoyancy chambers shall remain air tight when tested according to the procedure given in 6.4.2.2.

6.4.2.2 Test method

Using a steel needle tip with a radius of 0,5 mm, apply a force of 5 N to any part of the external surface of the device when inflated to the designed working pressure or, if no working pressure is given, until full shape and functionality are achieved. Apply the force gradually over a period of 5 s. Maintain the force for a further

5 s. Upon completion of the procedure, submerge the device or the tested part of the device in a bath of cold water and examine for leakage of air.

6.5 Mechanical requirements for reinforced hull materials

6.5.1 General

Specific requirements in accordance with ISO 25649-3:2024, ISO 25649-4:2024, ISO 25649-5:2024, ISO 25649-6:2024 and ISO 25649-7:2024 shall apply.

6.5.2 Adhesion of coatings, if applicable

6.5.2.1 Requirements

Where the hull of a floating leisure article consists of coated reinforcing materials (e.g. cloths), the adhesion between the coating and the substrate (base cloth) shall be sufficiently strong to exclude any unintentional separation of the coating from the substrate during the intended use of the floating leisure article.

The separating force between the coating and the reinforcing material shall be at least 20 N/cm^2.

6.5.2.2 Test method

Carry out the test in accordance with ISO 2411:2017.

6.6 Other materials

6.6.1 Wood

6.6.1.1 Requirements

The exposed types of timber and plywood used shall be suitable for the application and the use in the marine environment.

6.6.1.2 Test method

Verification shall be conducted through visual examination by the test panel.

6.6.2 Metal and synthetic material parts

6.6.2.1 Requirements

Materials used shall be of a type, strength and finish, suitable for the intended purpose of the components and compatible with the marine environment.

6.6.2.2 Testing

In-house or outside test confirmation can be used to verify compliance.

6.7 Threads

6.7.1 Requirements

To sew load bearing components, only threads manufactured from synthetic materials whose properties correspond to polyester or polyamide fibres shall be used.

6.7.2 Test method

Testing shall be by visual inspection and/or manufacturer's certificate on request.

7 Durability of warnings and markings

7.1 Resistance to perspiration

7.1.1 Requirements

When tested in accordance with the procedure in 7.1.2, the change in colour of the warnings and markings shall be ≥ 3 on the grey scale of fastness rating.

7.1.2 Test method

The test shall be carried out in accordance with the procedures in ISO 105-E04:2013. The assessment shall be carried out in accordance with ISO 105-A02:1993.

7.2 Resistance to chlorinated salt water

7.2.1 Colour fastness

When tested in accordance with the test methods in 7.2.4, the change in colour of the warnings and markings shall be ≥ 3 on the grey scale of fastness rating, in accordance with ISO 105-A03:2019.

7.2.2 Test liquid

The chlorinated salt water is prepared by dissolving 30 g of sodium chloride (NaCl) in 1 l of an aqueous solution of sodium hypochlorite (NaOCl) containing 50 mg of active chlorine at pH (7,5 ± 0,05). The sodium hypochlorite solution shall be prepared in accordance with ISO 105-E03:2010, 5.2. The solution shall always be prepared immediately prior to use using grade 3 water as specified in ISO 3696:1987, Clause 3.

7.2.3 Apparatus

A suitable apparatus for the conditioning procedure should consist of a glass or stainless-steel container that is big enough to hold the necessary volume of chlorinated salt water for a liquor ratio of 100:1 and a motor driven stirrer rotating at a frequency of 40 min^{-1}. In order to maintain the whole arrangement at room temperature, the procedure should be undertaken in a climate-controlled room, according to ISO 554:1976, 2.1 (designation 20/65).

7.2.4 Test method

Material samples showing the warnings/markings shall be submerged in agitated chlorinated salt water for 12 h, in darkness and at room temperature (20 ± 2) °C. Ensure that the test samples are thoroughly wetted. After removal from chlorinated salt water, the samples shall be rinsed in distilled water and dried by hanging in air at room temperature.

7.3 Adhesion of markings

7.3.1 Requirements

When tested in accordance with the procedures in 7.3.2, the markings shall not be damaged and shall remain legible in all details when assessed by the assessment panel. The requirements do not apply where the warnings or markings are embossed onto or moulded into the device.

7.3.2 Test method

The product shall be tested in accordance with the procedures given in ISO 105-X12:2016 (wet and dry) and for 100 cycles.

7.4 Requirements on repair means

Each floating leisure article shall be supplied with a repair kit, together with instructions for use, suitable for repairing small punctures of limited extent.

Annex A
(normative)

Templates

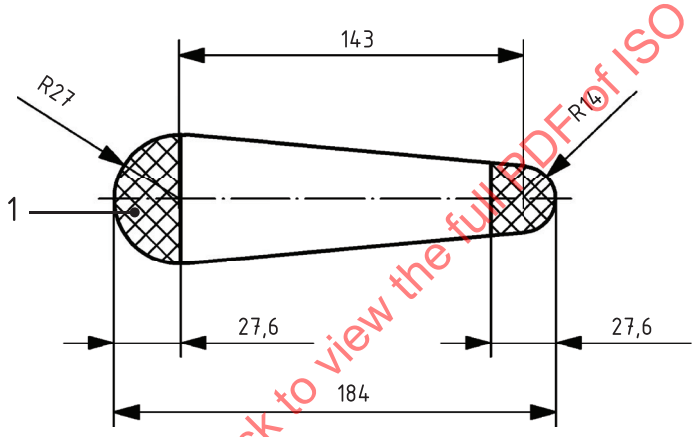
A.1 Space per person, templates for lying/sitting; adult/child

A.1.1 Lying

Figures A.1 and A.2 illustrate the minimum space dimensions necessary per person (adult and child respectively) in case of a lying intended use of floating leisure articles.

Dimensional tolerances of the probes shall be ±1 %.

Dimensions in centimetres

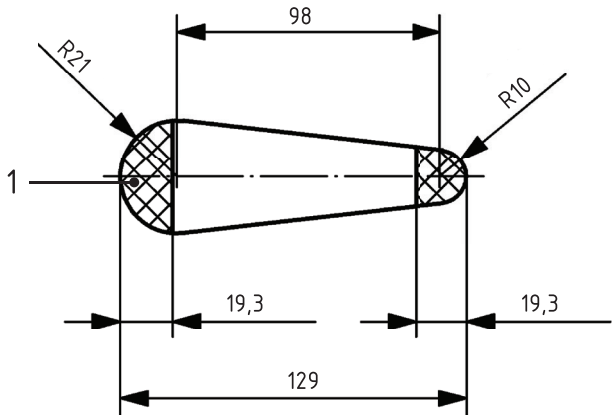


Key

1 allowed overhang (shaded areas)

Figure A.1 — Body length/shoulder width template adult, 95th percentile, male

Dimensions in centimetres



Key

1 allowed overhang (shaded areas)

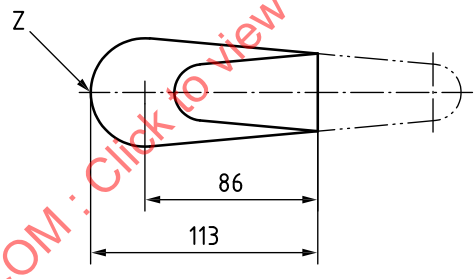
Figure A.2 — Body length/shoulder width template child, 6 years of age, 95th percentile, male

A.1.2 Sitting

Figures A.3 and A.4 illustrate the minimum space dimensions necessary per person (adult and child respectively) in case of a sitting (legs stretched out) intended use of floating leisure articles.

Dimensional tolerances of the probes shall be ±1 %.

Dimensions in centimetres

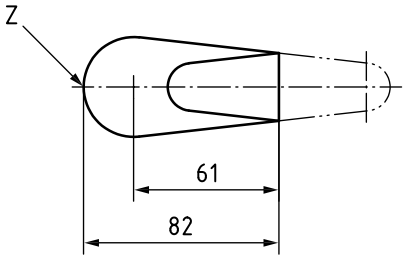


Key

Z reference point for application/positioning underneath overhanging walls/components

Figure A.3 — Sitting (legs stretched out) length/shoulder width template adult, 95th percentile, male

Dimensions in centimetres



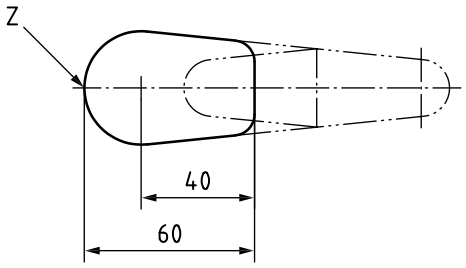
Key

Z reference point for application/positioning underneath overhanging walls/components

Figure A.4 — Sitting (legs stretched out) length/shoulder width template child, 6 years of age, 95th percentile, male

Figure A.5 illustrates the minimum space dimensions necessary for a child in case of a sitting (legs tuck up) intended use of floating leisure articles.

Dimensions in centimetres



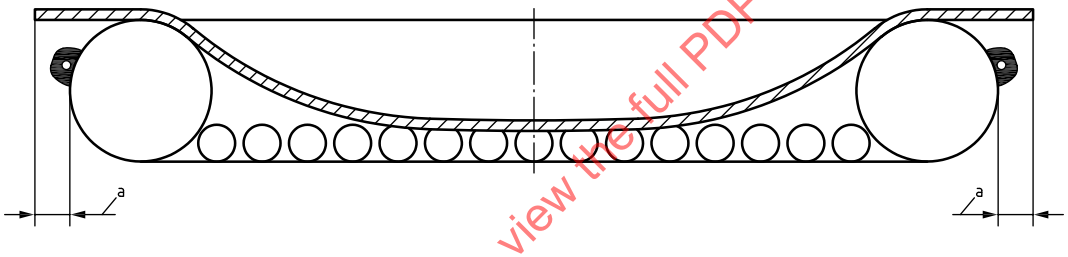
Key

Z reference point for application/positioning underneath overhanging walls/components

Figure A.5 — Sitting (legs tuck up) length/shoulder width template child, 6 years of age, 95th percentile, male

A.1.3 Template application and overhang

See Figure A.6 for template application and overhang.



a 15 % overhang max.

Figure A.6 — Application of template and overhang

A.2 Template material

The templates shall be made from foam sheet (e.g. polychloroprene) with a shore A hardness of (80 ± 10) and a thickness of 15 mm. The shore A hardness shall be determined in accordance with ISO 868:2003.