



BSI Standards Publication

Small craft — Stability and buoyancy assessment and categorization

Part 3: Boats of hull length less than 6 m

National foreword

This British Standard is the UK implementation of EN ISO 12217-3:2017. It is identical to ISO 12217-3:2015. It supersedes BS EN ISO 12217-3:2015, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GME/33, Small craft.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Amendments/corrigenda issued since publication

Date	Text affected
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English Version

Small craft - Stability and buoyancy assessment and
categorization - Part 3: Boats of hull length less than 6 m
(ISO 12217-3:2015)

Petits navires - Évaluation et catégorisation de la
stabilité et de la flottabilité - Partie 3: Bateaux d'une
longueur de coque inférieure à 6 m (ISO 12217-
3:2015)

Kleine Wasserfahrzeuge - Stabilitäts- und
Auftriebsbewertung und Kategorisierung - Teil 3:
Boote unter 6 m Rumpflänge (ISO 12217-3:2015)

This European Standard was approved by CEN on 23 July 2017.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of ISO 12217-3:2015 has been prepared by Technical Committee ISO/TC 188 “Small craft” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 12217-3:2017.

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of an identical text or by endorsement, at the latest by February 2018, and conflicting national standards shall be withdrawn at the latest by February 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 12217-3:2015.

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

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

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 12217-3:2015 has been approved by CEN as EN ISO 12217-3:2017 without any modification.

Annex ZA (informative)

Relationship between this European Standard and the essential requirements of Directive 2013/53/EU

This European Standard has been prepared under a Commission's standardization request M/075 to provide one voluntary means of conforming to essential requirements of Directive 2013/53/EU of the European Parliament and of the Council of 20 November 2013 on recreational craft and personal watercraft and repealing Directive 94/25/EC (OJ L 354, 28.12.2013, p. 90–131).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Annex I.A of Directive 2013/53/EU

Clause(s)/sub-clause(s) of this EN	Essential Requirements of Directive 2013/53/EU	Remarks/Notes
Clause 5; 6; 9; Annex G	I.A.1 - Watercraft Design Categories	EN ISO 12217-3 is applicable to boats of hull length less than 6 m, whether propelled by human or mechanical power, except habitable sailing multihulls. The evaluation of stability and buoyancy properties using EN ISO 12217-3 will enable boats of hull length less than 6 m to be assigned to a design category (C or D) appropriate to its design and maximum load. Design categories A, B, C and D defined in this standard correspond to design categories A, B, C and D of Directive 2013/53/EU.
Clause 5, 6, 7 Annexes A, B, C, D	I.A.3.2 - Stability and Freeboard	
Clause 6.2, 6.7, 6.8, 6.9, 7.4, 7.5, 7.8 Annexes C, D, E	I.A.3.3 - Buoyancy and flotation	EN ISO 12217-3 includes the flotation characteristics of craft susceptible to swamping. Habitable non-sailing multihulls susceptible to inversion shall also comply with the inverted buoyancy requirements of ISO 12217-2:2015, clause 7.12.

Clause 6.3, 7.2 Annexes A, B,	I.A.3.5 - Flooding	In respect of watertight integrity and downflooding openings including ventilation openings and fittings.
Clause 5	I.A.3.6 - Maximum recommended load	
Clause 6.2	I.A.3.8 - Escape	Habitable non-sailing multihulls susceptible to inversion shall also comply with the escape requirements of ISO 12217-2:2015, clause 7.13. This standard does not include means of escape in the event of fire.
Annex F	I.A.2.5 - Owner's manual	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#).

The committee responsible for this document is ISO/TC 188, *Small craft*.

This third edition cancels and replaces the second edition (ISO 12217-3:2013), of which it constitutes a minor revision. It incorporates the following modifications:

- Introduction and [Clause 9.2](#): the reference to the European Directive has been updated (2013/53/EU);
- [Clause 1](#), [subclauses 6.2](#), [6.3.1.5 d](#)) [3](#)) and [F.2 g](#)): vulnerable has been replaced with susceptible.
- [Clause 3](#): definitions [3.1.1](#), [3.3.5](#) and [3.4.9](#) have been amended;
- [Subclause 6.3.2.2 c](#)): option 5 has been included;
- [Subclauses 6.4.2.3](#) and [6.4.2.4](#): the formulae coefficients have been corrected;
- [Subclauses 6.5.2.5](#) and [6.5.3.3 e](#)) [2](#)) and [Table G.1](#) have been slightly amended to remove inconsistencies.
- [Subclause 6.6.1](#) and [Table G.1](#): the formulae have been harmonised with ISO 12217-1;
- [Subclause 7.5.1 b](#)) has been aligned with the text in ISO 12217-2.
- [Subclause 9.2](#): the text has been amended;
- [Annex H](#): worksheets 2, 4, 6, 8 and 15 have been corrected to align with corrections listed above;
- [Annex I](#) has been added;
- Bibliography: reference to ISO 7010 has been added;
- Editorial and cross-referencing corrections have been made to definitions [3.2.2](#) and [3.2.3](#) and to [subclauses 6.4.1](#), [6.4.2.1](#), [6.4.2.2](#) and [6.4.2.3](#), to [Table G.2](#), and to [Annex H](#), worksheet 6.

ISO 12217 consists of the following parts, under the general title *Small craft — Stability and buoyancy assessment and categorization*:

ISO 12217-3:2015(E)

- *Part 1: Non-sailing boats of hull length greater than or equal to 6 m*
- *Part 2: Sailing boats of hull length greater than or equal to 6 m*
- *Part 3: Boats of hull length less than 6 m*

Introduction

This part of ISO 12217 enables the determination of the limiting environmental conditions to be determined for which an individual boat has been designed.

It enables the boat to be assigned to a design category appropriate to its design and maximum load. The design categories used align with those in the Recreational Craft Directive of the European Union, EU Directive 2013/53/EU.

[Annex H](#) provides worksheets to assist in the systematic assessment of a boat according to this part of ISO 12217.

Small craft — Stability and buoyancy assessment and categorization —

Part 3: Boats of hull length less than 6 m

CAUTION — Compliance with this part of ISO 12217 does not guarantee total safety or total freedom of risk from capsize or sinking.

IMPORTANT — The electronic file of this document contains colours which are considered to be useful for the correct understanding of the document. Users should therefore consider printing this document using a colour printer.

1 Scope

This part of ISO 12217 specifies methods for evaluating the stability and buoyancy of intact (i.e. undamaged) boats. The flotation characteristics of craft susceptible to swamping are also encompassed.

The evaluation of stability and buoyancy properties using this part of ISO 12217 will enable the boat to be assigned to a design category (C or D) appropriate to its design and maximum load.

This part of ISO 12217 is applicable to boats of hull length less than 6 m, whether propelled by human or mechanical power, except habitable sailing multihulls. Boats of hull length less than 6 m which are fitted with a full deck and quick-draining cockpit(s) complying with ISO 11812 may alternatively be assessed using ISO 12217-1 or ISO 12217-2 (for non-sailing and sailing boats, respectively), in which case higher design categories may be assigned.

In relation to habitable multihulls, this part of ISO 12217 includes assessment of susceptibility to inversion, definition of viable means of escape and requirements for inverted flotation.

This part of ISO 12217 excludes:

- inflatable and rigid-inflatable boats covered by ISO 6185, except for references made in ISO 6185 to specific clauses of ISO 12217;
- personal watercraft covered by ISO 13590 and other similar powered craft;
- aquatic toys;
- canoes and kayaks;
- gondolas and pedalos;
- sailing surfboards;
- surfboards, including powered surfboards;
- hydrofoils, foil stabilized boats and hovercraft when not operating in the displacement mode; and
- submersibles.

NOTE Displacement mode means that the boat is only supported by hydrostatic forces.

It does not include or evaluate the effects on stability of towing, fishing, dredging or lifting operations, which need to be separately considered if appropriate.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2896:2001, *Rigid cellular plastics — Determination of water absorption*

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 8666, *Small craft — Principal data*

ISO 9093-1, *Small craft — Seacocks and through-hull fittings — Part 1: Metallic*

ISO 9093-2, *Small craft — Seacocks and through-hull fittings — Part 2: Non-metallic*

ISO 10240, *Small craft — Owner's manual*

ISO 11812, *Small craft — Watertight cockpits and quick-draining cockpits*

ISO 12216, *Small craft — Windows, portlights, hatches, deadlights and doors — Strength and watertightness requirements*

ISO 12217-1:2015, *Small craft — Stability and buoyancy assessment and categorization — Part 1: Non-sailing boats of hull length greater than or equal to 6 m*

ISO 12217-2:2015, *Small craft — Stability and buoyancy assessment and categorization — Part 2: Sailing boats of hull length greater than or equal to 6 m*

ISO 14946, *Small craft — Maximum load capacity*

ISO 15083, *Small craft — Bilge-pumping systems*

ISO 15085, *Small craft — Man-overboard prevention and recovery*

3 Terms and definitions

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

NOTE The meanings of certain symbols used in the definitions are given in [Clause 4](#).

3.1 Primary

3.1.1

design category

description of the sea and wind conditions for which a boat is assessed to be suitable

Note 1 to entry: See also [9.2](#).

3.1.2

recess

volume open to the air that might retain water within the range of loading conditions and corresponding trims

EXAMPLE Cockpits, wells, open volumes or areas bounded by bulwarks or coamings.

Note 1 to entry: Cabins, shelters or lockers provided with closures according to the requirements of ISO 12216 are not recesses.

Note 2 to entry: Cockpits that are open aft to the sea are considered to be recesses. Flush decks without bulwarks or coamings are not recesses.

3.1.3**quick-draining recess**

recess fulfilling all the requirements of ISO 11812 for “quick-draining cockpits and recesses”

Note 1 to entry: ISO 11812 contains requirements with which most sailing dinghies cannot comply.

Note 2 to entry: According to its characteristics, a cockpit may be considered to be quick-draining for one design category, but not for a higher category.

3.1.4**watertight recess**

recess fulfilling all the requirements of ISO 11812 for “watertight cockpits and recesses”

Note 1 to entry: This term only implies requirements in respect of watertightness and sill heights, but not those for drainage.

3.1.5**fully enclosed boat**

boat in which the horizontal projection of the sheerline area comprises any combination of:

- watertight deck and superstructure, and/or
- quick-draining recesses complying with ISO 11812, and/or
- watertight recesses complying with ISO 11812 with a combined volume of less than $(L_H B_H F_M)/40$, and

all closing appliances having their degree of watertightness in accordance with ISO 12216

Note 1 to entry: The size of recesses permitted for some boats of design category C is restricted by the requirements of [6.4](#).

3.1.6**partially protected boat**

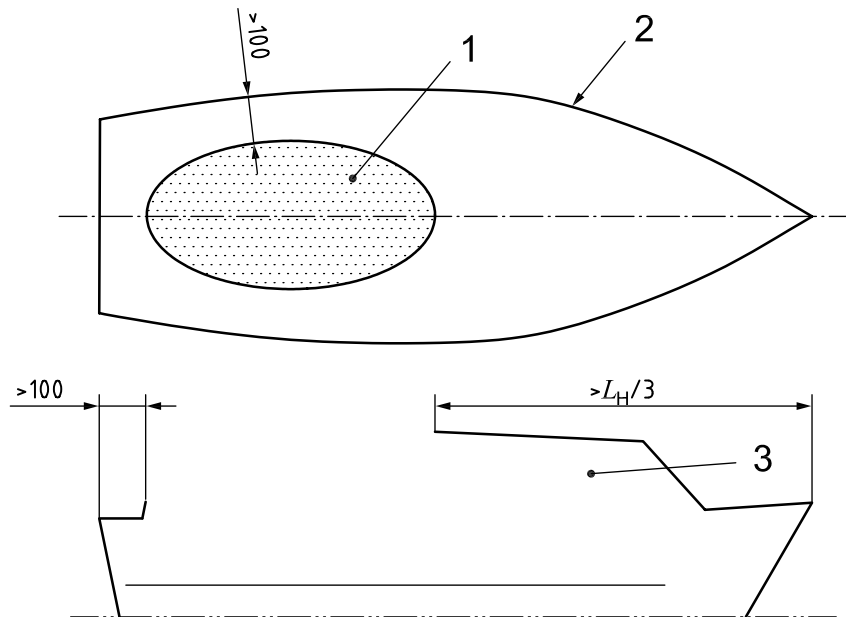
boat which does not fulfil the definition of a fully-enclosed boat and in which the plan projected area of decking, cabins, shelters, outboard engine wells or other rigid covers which are watertight from above according to ISO 12216 and which immediately shed water directly overboard (i.e. not via drains) and

- comprises at least one-third of the plan projected area of the sheerline, and
- includes all the area within $L_H/3$ from the bow, and
- includes at least 100 mm inboard from the sheerline,

except that the area of any watertight recesses with a total volume of less than $(L_H B_H F_M)/40$ may shed water via drains

Note 1 to entry: This is illustrated in [Figure 1](#).

Note 2 to entry: Outboard engine wells are considered to provide a covering suitable for this purpose.



Key

- 1 recess area open from above (less than two-thirds of the total sheerline area)
- 2 sheerline
- 3 open shelter or enclosed cabin

Figure 1 — Partially protected boat

3.1.7 habitable boat

boat having a fully enclosed cabin with rigid roof fitted with one or more bunks, benches, pipecotts, hammocks or similar locations that can be used for sleeping when the boat is under way

Note 1 to entry: A boat is considered to be “habitable” if a fabric closure is used instead of a rigid door, or the cabin has fabric sides.

Note 2 to entry: The following are not considered to render a boat “habitable”:

- a cockpit tent, or
- an open-sided cuddy intended to provide limited protection from spray, provided it is not fitted with fabric closures all round.

Note 3 to entry: Locations used for sleeping have minimum dimensions of 1,5 m diagonal length, 0,4 m width at the widest point, and with a minimum headroom of 0,4 m over the length. The cabin sole and compartments designated by the builder to be used exclusively for storage and referenced in the owner's manual are not included.

3.2 Downflooding

3.2.1 downflooding opening

any opening in the hull or deck (including the edge of a recess) that might admit water into the interior or bilge of a boat, or a recess, apart from those excluded in [6.3.1.5](#)

3.2.2**downflooding height** h_D

smallest height above the waterline to any downflooding opening (apart from those excluded in 6.3.1.5) when the boat is upright in calm water in the maximum load condition, measured to the critical downflooding point which might be within pipes or ducts inside the hull

Note 1 to entry: Downflooding height is expressed in metres.

3.2.3**downflooding angle** ϕ_D

angle of heel at which the downflooding openings (apart from those excluded in 6.3.1.5) become immersed, when the boat is in calm water and in the appropriate loading condition at design trim

Note 1 to entry: Downflooding angle may be determined using either of the methods in Annex B.

Note 2 to entry: Where openings are not symmetrical about the centreline of the boat, the case resulting in the smallest angle is used.

Note 3 to entry: Downflooding angle is expressed in degrees.

3.3 Condition and mass**3.3.1****empty craft condition**

empty boat including fittings and equipment as listed below but excluding all optional equipment and fittings not included in the manufacturer's basic outfit:

- a) structure: comprising all the structural parts, including any fixed ballast keel and/or drop keel/centreboard/daggerboard(s) and rudder(s);
- b) ballast: any fixed ballast installed;
- c) internal structure and accommodation: bulkheads and partitions, insulation, lining, built-in furniture, flotation material, windows, hatches and doors, permanently installed mattresses and upholstery materials;
- d) permanently installed engine(s) and fuel system: comprising inboard engine(s), including all supplies and controls as needed for their operation, permanently installed fuel systems, including tanks;
- e) fluids in permanently installed systems: residual working fluids as needed for their operation (see examples below), but excluding contents of fluid ballast systems and tanks, and main storage tanks which are included in maximum load;

EXAMPLES fluids in hot or cold water, fuel, lubricating or hydraulic oil systems.

- f) internal equipment: including:

- all items of equipment permanently attached to the craft, e.g. tanks, toilet system(s), water transfer equipment;
- bilge pumping system(s), cooking and heating devices, cooling equipment, ventilation system(s);
- electrical installation and equipment, including permanently installed batteries mounted in the position intended by the builder;
- fixed navigational and electronic equipment;
- fixed fire fighting equipment, where fitted;

g) external equipment: including:

- all permanently attached standard or specified deck fittings, e.g. guardrails, pulpits and pushpits, bowsprits and their attachments, bathing platforms, boarding ladders, steering equipment, winches, sprayhood(s);
- awning(s), cockpit tables, gratings, signal mast(s), where fitted;
- mast(s), boom(s), standing and running rigging, in the stowed position ready for use; all standing and running rigging in place;

Note 1 to entry: The mass in the empty craft condition is denoted by m_{EC} and is expressed in kilograms.

3.3.2

light craft condition

empty craft condition plus standard equipment (3.4.10) plus removable ballast (whether solid or liquid) when supplied and/or intended by the manufacturer to be carried when the boat is afloat, with elements positioned as follows:

- a) where provision is made for propulsion by outboard engine(s) of more than 3 kW, the heaviest engine(s) recommended for the boat by the manufacturer, mounted in the working position(s);
- b) where batteries are fitted, they are mounted in the position intended by the builder, and if there is no specific stowage provided for batteries, the mass of one battery for each engine over 7 kW is allowed for, and located within 1,0 m of the engine location;
- c) all upwind sails supplied or recommended by the builder as standard, onboard and rigged ready for use, but not hoisted, e.g. mainsail on boom, roller furling sails furled, hanked foresails on stay stowed on foredeck

Note 1 to entry: For the minimum mass of outboard engines and batteries, refer to [Tables C.1](#) and [C.2](#).

Note 2 to entry: The mass in the light craft condition is denoted by m_{LC} and is expressed in kilograms.

3.3.3

maximum load

greatest load which the boat is designed to carry in addition to the light craft condition, comprising:

- the crew limit at 75 kg each (adult) or 37,5 kg (child);
- the personal effects of the crew;
- stores and cargo (if any), dry provisions, consumable liquids;
- contents of all permanently installed storage tanks filled to 95 % of their maximum capacity, including fuel, drinking water, black water, grey water, lubricating and hydraulic oil, bait tanks and/or live wells plus ballast water at 100 % capacity;
- consumable liquids in portable tanks (drinking water, fuel) filled to 95 % of the maximum capacity;
- dinghy or other small craft intended to be carried aboard, and any outboard motor associated with them;
- liferaft(s) if carried in excess of the minimum required in essential safety equipment;
- non-edible stores and equipment normally carried on the boat and not included in the manufacturer's list of standard equipment, e.g. loose internal equipment and tools, spare parts, additional anchors or sails, dinghy and outboard if carried aboard;
- an allowance for the maximum mass of optional equipment and fittings not included in the manufacturer's basic outfit

Note 1 to entry: Liferafts are not included in essential safety equipment for Categories C and D.

Note 2 to entry: As a guide, not less than 20 kg/person should be allowed for personal effects on habitable boats

Note 3 to entry: As a guide, the mass of yachting liferafts varies from approximately $12 + 2CL$ (kg) to double this, according to specification.

Note 4 to entry: The mass of maximum load is denoted by m_L and is expressed in kilograms.

3.3.4

maximum load condition

boat in the light craft condition with the maximum load added so as to produce the design trim

Note 1 to entry: The mass in the maximum load condition is denoted by m_{LDC} and is expressed in kilograms.

3.3.5

loaded arrival condition

boat in the maximum load condition minus 85 % of the maximum capacity of fixed or portable storage tanks for fuel, oils and drinking water, and minus 90 % of edible stores, but including the worst combination of optional fittings or equipment with respect to stability

Note 1 to entry: In this condition, tanks have 10 % of their maximum capacity remaining.

Note 2 to entry: The mass in the loaded arrival condition is denoted by m_{LA} and is expressed in kilograms.

3.4 Other definitions

3.4.1

crew

collective description of all persons on board a boat

3.4.2

crew limit

CL

maximum number of persons (with a mass of 75 kg each) used when assessing the design category

Note 1 to entry: A half number denotes a child weighing less than 37,5 kg.

3.4.3

design trim

longitudinal attitude of a boat when upright, with crew, fluids, stores and equipment in the positions designated by the designer or builder

Note 1 to entry: Crew are assumed to be in positions designated by the builder. In the absence of builder's instructions, crew and gear are assumed to be positioned in a manner most likely to provide a favourable test result, provided that such positions are consistent with the proper operation of the boat and that crew are assumed to be either standing at designated positions fitted with handholds, or seated.

3.4.4

essential safety equipment

loose equipment considered essential to the safe operation of the boat, which may include distress flares and rockets, lifebuoy with light and battery, first aid box, wire cutters for standing rigging, lifejackets, safety harnesses and lines, portable fire fighting equipment, flashlight, binoculars, radio (e.g. VHF), ball and cone visual signals, charts and navigational publications in the corresponding design category

Note 1 to entry: Quantities carried may vary according to the size of boat, design category and crew limit.

Note 2 to entry: As a guide, the mass allowed for essential safety equipment but excluding any liferaft(s) should not be less than $3L_H$ (kg).

Note 3 to entry: Liferafts are not considered to be essential safety equipment in design categories C and D.

3.4.5

flotation element

element which provides “buoyancy” to the boat and thus influences the flotation characteristics

3.4.5.1

air tank

tank made of hull construction material, and integral with hull or deck structure

3.4.5.2

air container

container made of stiff material, and not integral with the hull or deck structure

3.4.5.3

low density material

material with a specific gravity of less than 1,0 primarily incorporated into the boat to enhance the buoyancy when swamped

3.4.5.4

rib collar

heavy duty tubular collar fitted around the periphery of the boat and always intended to be inflated whenever the boat is being used

3.4.5.5

inflated bag

bag made of flexible material, not integral with hull or deck, accessible for visual inspection and intended always to be inflated when the boat is being used

Note 1 to entry: Bags intended to be inflated automatically when immersed (e.g. at the masthead as a means to prevent inversion) are not regarded as flotation elements.

3.4.6

length of hull

L_H

length of the hull measured according to ISO 8666

Note 1 to entry: Length of hull is expressed in metres.

3.4.7

loaded waterline

waterline of the boat when upright in the maximum load condition

3.4.8

reference sail area

A_S

actual profile area of sails set abaft a mast, plus the maximum profile area of all masts, plus reference triangle area(s) forward of each mast as defined in ISO 8666

Note 1 to entry: Sail area is expressed in square metres.

3.4.9

recess retention level

level of water in recesses, when the boat is at design trim, at which 20% of the uppermost periphery of the surrounding coaming (measured in horizontal plane parallel to waterline at design trim) would be covered by water, assuming that all gates, doors or drainage openings are considered to be sealed.

Note 1 to entry: This definition is illustrated in [Annex I](#).

3.4.10**standard equipment**

devices including outboard motors (excluding those for tenders), loose furniture and furnishings such as tables, chairs, non-permanently installed mattresses, curtains, etc., portable bilge pumping equipment, anchors, chain, warps, sails, loose external equipment such as fenders, boathook and boarding ladder, oars (if appropriate), and essential safety equipment

Note 1 to entry: Where outboard engine(s) are fitted, the heaviest engine(s) recommended for the boat by the manufacturer is(are) included, the mass allowed for outboard engines and their batteries (if not permanently installed) not being less than that given in columns 1 and 3 of [Tables C.1](#) and [C.2](#).

Note 2 to entry: As a guide, the mass allowed for anchors, anchor chain, warps and fenders should not be less than about $0,25L_H^{2,2}$ (kg). In some cases up to double this mass may be appropriate.

3.4.11**watertightness degree**

degree of watertightness as specified in ISO 11812 and ISO 12216

Note 1 to entry: The degree of watertightness is summarized as follows.

Degree 1: Degree of tightness providing protection against effects of continuous immersion in water.

Degree 2: Degree of tightness providing protection against effects of temporary immersion in water.

Degree 3: Degree of tightness providing protection against splashing water.

Degree 4: Degree of tightness providing protection against water drops falling at an angle of up to 15° from the vertical.

3.4.12**windage area**

A_{LV}

projected profile area of hull, superstructures, deckhouses, outboard motors and spars above the waterline at the appropriate loading condition, the boat being upright

Note 1 to entry: Canopies and screens that can be erected when under way in bad weather are included, e.g. cockpit dodgers, pram hoods.

Note 2 to entry: Windage area is expressed in square metres.

3.4.13**angle of vanishing stability**

ϕ_V

angle of heel nearest the upright (other than upright) in the appropriate loading condition at which the transverse stability righting moment is zero; determined assuming that there is no offset load, and that all potential downflooding openings are assumed to be watertight

Note 1 to entry: Where a boat has recesses which are not quick-draining, ϕ_V is to be taken as the downflooding angle to these recesses, unless the loss of buoyancy due to such recesses is fully accounted for in determining ϕ_V .

Note 2 to entry: Angle of vanishing stability is expressed in degrees.

3.4.14**under way**

not at anchor, or made fast to the shore, or aground

4 Symbols

For the purposes of this part of ISO 12217, the symbols in [Table 1](#) apply.

Table 1 — Symbols

Symbol	Unit	Meaning
ϕ	degree (°)	Angle of heel
ϕ_D	degree (°)	Downflooding angle, see 3.2.3
ϕ_O	degree (°)	Angle of heel measured during offset-load test, see 6.5
ϕ_V	degree (°)	Angle of vanishing stability, see 3.4.13
A_{LV}	m ²	Windage area of hull in profile at the appropriate loading condition, see 3.4.12
A_S	m ²	Reference sail area, see 3.4.8
A'_S	m ²	Standard sail area, see 7.7.2.4
B_H	m	Beam of hull measured according to ISO 8666
B_{WL}	m	Beam waterline according to ISO 8666 on the loaded waterline. In the case of multi-hulls, this is the sum of the maximum waterline beam of each of the hulls
CL	—	Crew limit according to 3.4.2
F_M	m	Freeboard amidships to the loaded waterline according to ISO 8666
h_D	m	Actual downflooding height measured according to 3.2.2 and 6.3.2
$h_{D(R)}$	m	Required downflooding height according to 6.3.2
L_H	m	Length of hull measured according to ISO 8666
L_{WL}	m	Length waterline in relevant load condition measured according to ISO 8666
m_{EC}	kg	Mass of the boat in the empty craft condition, see 3.3.1
m_L	kg	Mass of the maximum load, see 3.3.3
m_{LA}	kg	Mass of the boat in the loaded arrival condition, see 3.3.5
m_{LC}	kg	Mass of the boat in light craft condition, see 3.3.2
m_{LDC}	kg	Mass of the boat in the maximum load condition, see 3.3.4

5 Procedure

5.1 Maximum load

Decide on the crew limit and the maximum load that the boat is intended to carry in accordance with the definitions. The crew limit shall not exceed that determined by the seating or standing space requirements of ISO 14946.

IMPORTANT — Ensure that the maximum load is not underestimated.

NOTE If a boat is assessed with different amounts of maximum load, different design categories may be assigned according to the load.

5.2 Sailing or non-sailing

Determine whether the boat is sailing or non-sailing. Non-sailing boats are those where

$$A_S < 0,07 \times (m_{LDC})^{2/3} \quad (1)$$

where

A_S is the reference sail area according to [3.4.8](#), expressed in square metres;

m_{LDC} is the mass of the boat in the maximum load condition, as defined in [3.3.4](#) and expressed in kilograms.

All other boats are sailing boats. [Table 2](#) gives values of reference sail area for different maximum load condition masses.

Table 2 — Minimum reference sail area for sailing boats

m_{LDC} (kg)	200	300	400	500	600	700	800	900	1 000	1 100	1 200	1 500
A_S (m ²) shall be $\geq$	2,4	3,1	3,8	4,4	5,0	5,5	6,0	6,5	7,0	7,5	7,9	9,2

5.3 Tests to be applied

5.3.1 General

5.3.1.1 Non-sailing boats shall be assessed using [Clause 6](#) and [5.3.1.2](#) (if appropriate).

Sailing boats other than habitable multihulls shall be assessed using [Clause 7](#). Habitable multihull sailing boats shall be assessed using ISO 12217-2. For habitable non-sailing multihulls see [6.2](#) below.

NOTE 1 A habitable boat is defined in [3.1.7](#).

NOTE 2 For any given test, the requirements may vary according to the chosen option, e.g. for downflooding height.

5.3.1.2 If a sailing boat can also be used as a non-sailing boat, e.g. with oars or engine, it shall also generally be assessed as a non-sailing boat, see also [7.1](#). The design category finally given is that for which the boat satisfies all the relevant requirements. See [Annex G](#).

NOTE 1 Boats may be given different crew limits and/or design categories according to whether they are being used as sailing or non-sailing boats.

NOTE 2 Attention is drawn to option 3 in [Table 3](#), which may be appropriate in some cases.

5.3.1.3 If a sailing boat also used as a non-sailing boat has been assessed using options 7, 8 or 9 of [Table 7](#), if it is unable to pass any non-sail test then the boat is deemed to be acceptable if the safety sign given in [Figure 8](#) is displayed in a prominent position. When this sign is fitted, it shall comply with [Clause 8](#).

5.4 Alternatives

If the boat does not reach the desired design category, modify the maximum load and/or the number of crew and repeat the assessment.

Boats which are fully enclosed may alternatively be assessed using ISO 12217-1 or ISO 12217-2, for non-sailing and sailing boats respectively, in which case they may be able to attain design category A or B.

5.5 Variation in input parameters

Users of this part of ISO 12217 shall consider the effect on compliance of variations in the empty craft mass within the builder's manufacturing tolerances.

6 Tests to be applied to non-sailing boats

6.1 General

Non-sailing boats may be assessed by any one of six options according to length of hull, amount of flotation and decking, and whether the boat is fitted with suitable recesses complying with ISO 11812. These options and the corresponding tests to be applied are given in [Table 3](#).

NOTE For any given test, the requirements may vary according to the chosen option, e.g. for downflooding height.

The design category finally given in respect of stability and buoyancy is that for which the boat satisfies all the relevant requirements.

Fully enclosed boats may alternatively be assessed using ISO 12217-1, in which case higher design categories may be assigned.

Where boats are fitted with a bow loading ramp then either the bow ramp must be watertight to degree 2 (see [3.4.11](#)) or the boat must comply with this part of ISO 12217 when the bow ramp is open.

Table 3 — Tests to be applied to non-sailing boats

Option	1 ^a	2	3 ^a	4	5	6 ^a
Applicable to	$L_H < 6,0$ m			$L_H \geq 4,8$ m and $L_H < 6,0$ m		
Design categories possible	C and D	C and D	D	C and D	D	C and D
Applicable to engine powers of	Any amount	Any amount	≤ 3 kW	Any amount	Any amount	Any amount
Applicable to the following types of engine installation	Any	Any	Any	Any	Any	Inboard engines only
Decking or covering	All boats except “fully enclosed” ^b	Fully enclosed ^c	All boats except “fully enclosed” ^b	Partially protected ^d	All boats except “fully enclosed” ^b	All boats except “fully enclosed” ^b
Downflooding-height test	6.3^e	6.3	—	6.3	6.3	6.3
Recess size	—	6.4^f	—	—	—	—
Offset-load test	6.5	6.5	—	6.5	6.5	6.5
Heel due to wind action	6.6^g	6.6^g	6.6^g	6.6^g	6.6^g	6.6^g
Flotation standard	Level	—	See 6.9	—	—	Basic
Flotation test	6.7	—	See 6.9	—	—	6.8
Flotation elements	Annex D	—	Annex D	—	—	Annex D
Capsize-recovery test	—	—	6.9	—	—	—
Detection and removal of water	6.10	6.10	6.10	6.10	6.10	6.10

^a Boats using options 1, 3 and 6 are considered to be susceptible to swamping when used in their design category.

^b That is, any boat that is not “fully enclosed”, thus including boats without any decking.

^c This term is defined in [3.1.5](#). Option 2 boats may alternatively be assessed using ISO 12217-1.

^d This term is defined in [3.1.6](#).

^e The downflooding height test is not required on some boats – see [6.3.2.1](#).

^f This requirement only applies to design category C.

^g The application of [6.6](#) is only required for boats where A_{LV} in the condition used for the offset-load test $\geq 0,5L_H B_H$.

6.2 Habitable non-sailing multihull boats

6.2.1 Habitable non-sailing multihull boats, if considered to be susceptible to inversion when used in their design category, in addition to [Clause 6](#) shall also comply with:

- a) the requirements for inverted buoyancy given in ISO 12217-2:2015, 7.12, and
- b) the requirements for escape after inversion given in ISO 12217-2:2015, 7.13.

NOTE A habitable boat is defined in [3.1.7](#).

6.2.2 Boats of design category C are considered to be susceptible to inversion if:

$$h_C/B_H > 0,22V_D^{1/3} \quad (2)$$

where

h_C is the height of the centroid of the above water profile area above the waterline in the light craft condition, in metres;

V_D is the volume of displacement in the light craft condition, in cubic metres.

6.2.3 Boats of design category D are considered not to be susceptible to inversion if they comply with [6.5](#) and [6.6](#).

6.3 Downflooding

NOTE These requirements are to ensure that a level of watertight integrity appropriate to the design category is maintained.

6.3.1 Requirements for downflooding openings

6.3.1.1 All closing appliances (as defined in ISO 12216) such as windows, portlights, hatches, deadlights and doors shall comply with ISO 12216, according to design category and appliance location area.

Openings to centreboard or drop keel casings fitted to habitable sailing boats shall comply with watertightness degree 3 if their height is less than that corresponding to Area I.

6.3.1.2 No hatches or opening type windows shall be fitted in the hull with the lowest part of the opening less than 0,2 m (design category C) or 0,1 m (design category D) above the loaded waterline, except for emergency escape hatches on design category C boats, where 0,1 m is allowable.

6.3.1.3 Seacocks complying with ISO 9093-1 and ISO 9093-2, respectively, together with means of preventing flow into the boat when the seacock is open shall be fitted to through-hull pipe fittings located with any part of the opening below either the heeled or upright waterline when fully loaded, apart from:

- a) engine exhausts, or
- b) drains forming an integral part of the hull and of equal strength and tightness extending from the outlet to above the fully loaded upright waterline by at least 0,06 m for design category C or 0,04 m for design category D; and also above the heeled waterline defined as follows:
 - 1) 0° for non-sailing boats;
 - 2) 7° for sailing multihulls; or
 - 3) 30° or immersion of the sheerline, whichever occurs first, for monohull sailing boats.

NOTE 1 Means of preventing flow into the boat may comprise:

- a pipe or hose extending above the heeled waterline, or
- a pipe or hose leading to a downflooding point above the heeled waterline, or
- a non-return valve, or
- a pipe or hose connected to a system that cannot flood the interior of the boat, or
- for seacocks not connected internally, a permanent cap or means of securing the seacock in the closed position.

Instructions for the correct and safe operation of seacocks shall be included in the owner's manual.

NOTE 2 Special requirements for seacocks on bilge system discharges are given in ISO 15083.

6.3.1.4 Openings within the boat, such as outboard engine trunks, free-flooding fish bait tanks or openings in centreboard casings, shall be considered as possible downflooding openings.

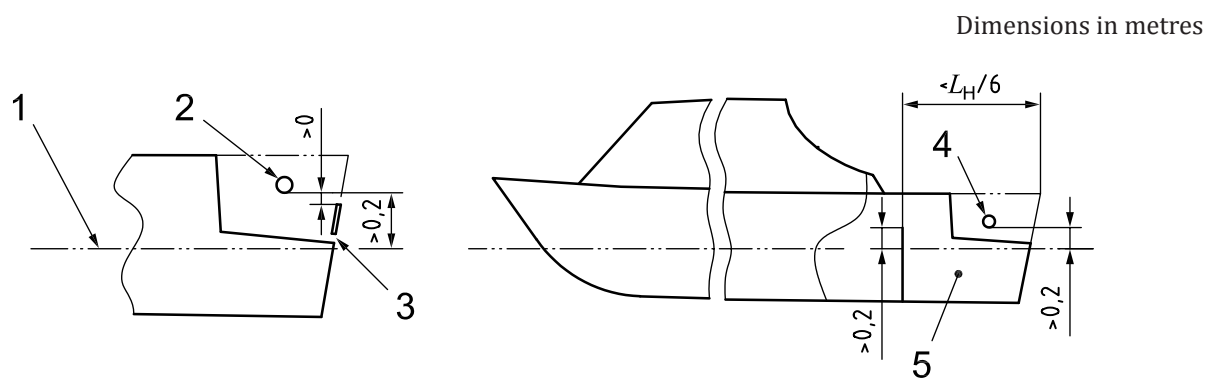
6.3.1.5 The requirements given in [6.3.2](#) and [6.3.3](#) apply to all downflooding openings except:

- a) watertight recesses with a combined volume less than $(L_H B_H F_M)/40$, or quick-draining recesses;
- b) drains from:
 - quick-draining recesses, or
 - watertight recesses which, if filled, would not lead to downflooding or capsize when the boat is upright,

and which:

- 1) are freeing ports fitted with non-return flap closures which are watertight from the exterior to degree 3 of ISO 12216, or
- 2) have a combined cross-sectional area smaller than three times the minimum area required to comply with ISO 11812 for quick-draining cockpits;
- c) non-opening appliances;
- d) opening appliances located in the topsides which comply with ISO 12216 which are:
 - 1) referenced in the owner's manual as watertight closure to be kept shut when under way, and
 - 2) clearly marked on the inboard side "KEEP SHUT WHEN UNDER WAY" in upper case letters not less than 4,8 mm high, and
 - 3) positioned so that the lowest part of the opening is above the loaded waterline by at least 50 % of the minimum downflooding height required by [6.2.2](#) or in the case of means of escape fitted to habitable multihulls considered to be susceptible to inversion (see [6.2](#) and [7.1](#)) positioned with the bottom of the clear opening not less than 0,1 m above the loaded waterline when the boat is upright;
- e) opening appliances which are fitted in a compartment of such restricted volume that, even if flooded, the boat satisfies all the requirements;
- f) opening appliances located other than in the topsides which comply with ISO 12216 to tightness degree 2 and which are referenced in the owner's manual as being "KEEP SHUT WHEN UNDER WAY" and clearly marked as such on the appliance on the inboard side in upper case letters not less than 4,8 mm high;

- g) engine exhausts or other openings that are only connected to watertight systems;
- h) discharge pipes fitted with non-return valves;
- i) openings in the sides of outboard engine wells which are of
 - 1) watertightness degree 2 and having the lowest point of downflooding more than 0,1 m above the loaded waterline, or
 - 2) watertightness degree 3 and having the lowest point of downflooding more than 0,2 m above the loaded waterline and also above the top of the transom in way of the engine mounting, provided that well drain holes are fitted, see [Figure 2](#), or
 - 3) watertightness degree 4 and having the lowest point of downflooding more than 0,2 m above the loaded waterline and also above the top of the transom in way of the engine mounting, provided that well drain holes are fitted, and that the part of the interior or non-quick-draining spaces into which water may be admitted has a length less than $L_H/6$ and from which water up to 0,2 m above the loaded waterline cannot drain into other parts of the interior or non-quick-draining spaces of the boat, see [Figure 2](#).



Key

- 1 waterline
- 2 watertightness degree 3 or 4
- 3 drain
- 4 watertightness degree 4
- 5 non-quick-draining space

Figure 2 — Openings in outboard engine wells

6.3.2 Downflooding height with maximum load

6.3.2.1 Test

This test is to demonstrate sufficient margins of freeboard for the boat in the maximum load condition before water is shipped aboard.

The downflooding height test is not required to be conducted on the following boats:

- those which, when tested in accordance with [C.4.3](#), have been shown to support, in addition to the mass required by [C.2](#) and [Table C.5](#), in the same location an additional equivalent dry mass (kg) of $(75CL + 10\% \text{ of the dry mass of stores and equipment included in the maximum total load})$, or
- those boats that do not take on water when heeled to 90° from the upright in the light craft condition.

This test shall be performed using people as described below, using test weights to represent people (at 75 kg per person), or by calculation (using a lines plan and displacement derived by a weighing or measured freeboards).

- a) Select a number of people equal to the crew limit, having an average mass of not less than 75 kg.
- b) In calm water, load the boat with all items of maximum load, with the people positioned so as to achieve the design trim.
- c) Measure the height from the waterline to the points at which water could first begin to enter any downflooding opening except those excluded in [6.3.1.5](#). Where a downflooding opening is fully protected by a higher coaming around the recess from which it leads, the downflooding height shall be measured to the lowest point of that coaming, see [Figure B.1](#). Where an opening in the hull is permanently attached to a watertight pipe or trunk rising to a higher level within the boat, the downflooding height is taken to the critical height within that pipe or trunk.

Downflooding height to downflooding points within quick-draining or watertight recesses shall be measured as though the following openings are closed:

- freeing ports fitted with non-return flap closures which are watertight from the exterior to degree 3 of ISO 12216, or
- drains having a combined cross-sectional area smaller than three times the minimum area required to comply with ISO 11812 for quick-draining cockpits.

6.3.2.2 Requirements

- a) Determine the design category by comparing the measurements with the requirements for minimum downflooding height, as modified by b) to f) below, using either
 - 1) the method of [Annex A](#), which generally gives the lowest requirement, or
 - 2) [Figure 3](#), which is based only on boat length.
- b) For boats assessed using options 1, 3, 5 or 6, the required downflooding height within $L_H/3$ of the bow shall be increased as shown in [Figure 4](#).