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**Small craft — Stability and buoyancy  
assessment and categorization —**

**Part 3:  
Boats of hull length less than 6 m**

*Petits navires — Évaluation de la stabilité et de la flottabilité et  
catégorisation —*

*Partie 3: Bateaux d'une longueur de coque inférieure à 6 m*

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Printed in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 12217 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12217-3 was prepared by Technical Committee ISO/TC 188, *Small craft*.

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

— 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*

Annexes A, B, C, D and E form a normative part of this part of ISO 12217. Annexes F and G are for information only.

## 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.

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# 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 capsizing or sinking.**

### 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 vulnerable 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.

This part of ISO 12217 excludes

- aquatic toys,
- canoes, kayaks or other boats with a beam of less than 1,1 m,
- inflatable and rigid-inflatable boats up to 8 m covered by ISO 6185,
- personal watercraft covered by ISO 13590,
- hydrofoils and hovercraft when operating in the dynamically supported mode, and
- submersibles.

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

### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 12217. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 12217 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

## ISO 12217-3:2002(E)

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

ISO 8666:—<sup>1)</sup>, *Small craft — Principal data*

ISO 9093-1:1994, *Small craft — Seacocks and through-hull fittings — Part 1: Metallic*

ISO 9093-2:—<sup>1)</sup>, *Small craft — Seacocks and through-hull fittings — Part 2: Non-metallic*

ISO 9094-1:—<sup>1)</sup>, *Small craft — Fire protection — Part 1: Craft with a hull length of up to and including 15 m*

ISO 9094-2:—<sup>1)</sup>, *Small craft — Fire protection — Part 2: Craft with a hull length of over 15 m*

ISO 10240:1995<sup>2)</sup>, *Small craft — Owner's manual*

ISO 11812:2001, *Small craft — Watertight cockpits and quick-draining cockpits*

ISO 12216:—<sup>1)</sup>, *Small craft — Windows, portlights, hatches, deadlights and doors — Strength and tightness requirements*

ISO 12217-1:2002, *Small craft — Stability and buoyancy assessment and categorization — Part 1: Non-sailing boats of hull length greater than or equal to 6 m*

ISO 12217-2:2002, *Small craft — Stability and buoyancy assessment and categorization — Part 2: Sailing boats of hull length greater than or equal to 6 m*

ISO 14946:2001, *Small craft — Maximum load capacity*

IMO Resolution MSC.81(70) — *Revised Recommendation on Testing of Life-Saving Appliances*

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### 3 Terms and definitions

For the purposes of this part of ISO 12217, the following terms and definitions apply.

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 by this part of ISO 12217

NOTE See also 8.2.

##### 3.1.2 recess

any volume open to the sky that may retain water

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

NOTE Cabins, shelters or lockers provided with closures according to the requirements of ISO 12216 are not recesses.

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1) To be published.

2) Undergoing revision.



**3.1.3****quick-draining recess**

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

NOTE 1 ISO 11812 contains requirements with which most sailing dinghies cannot comply.

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

**3.1.4****watertight recess**

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

NOTE This term only implies requirements in respect of watertightness and sill heights, but not those for drainage.

**3.1.5****fully decked 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  $L_H B_H F_M / 40$ ,

all closing appliances being watertight in accordance with ISO 12216

**3.1.6****partially decked boat**

boat in which at least two-thirds of the horizontal projection of the sheerline area is equipped with decking, cabins, shelters or rigid covers which are watertight according to ISO 12216 and designed to shed water overboard, in which area all that within  $L_H / 3$  from the bow and also the area 100 mm inboard from the periphery of the boat are included

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NOTE Outboard engine wells are considered to provide a covering suitable for this purpose.

**3.2 Downflooding****3.2.1****downflooding opening**

any opening (including the edge of a recess) that may admit water into the interior or bilge of a boat, or a recess, apart from those excluded in 6.2.1.1

**3.2.2****downflooding height**

$h_D$

smallest height above the waterline to any downflooding opening, apart from those excluded in 6.2.1.1, when the boat is upright in calm water at loaded displacement mass and design trim

NOTE Downflooding height is expressed in metres.

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

boat equipped as the light craft mass according to ISO 8666 with the following added and positioned as appropriate:

- 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 shall be mounted in the position intended by the builder;
- c) mast(s), boom(s), and other spar(s) on board and rigged in the stowed position ready for use, but not set; all standing and running rigging in place;
- d) any sails supplied by the builder, 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 In item b), the mass allowed for outboard engine batteries shall not be less than that given in column 3 of Tables B.2 and B.3. If there is no specific stowage provided for batteries, the mass of one battery for each engine over 7 kW shall be allowed for, and located within 1,0 m of the engine location.

**3.3.2  
maximum total load**

$m_{MTL}$

maximum load which the boat is designed to carry in addition to the light craft condition, comprising the manufacturer's maximum recommended load as defined in ISO 14946, including all liquids (e.g. fuel, oils, fresh water, water in ballast or bait tanks and live wells) to the maximum capacity of fixed or portable tanks

NOTE Maximum total load is expressed in kilograms.

**3.3.3  
loaded displacement mass**

$m_{LDC}$

mass of the boat in light craft condition with maximum total load added

NOTE Loaded displacement mass is expressed in kilograms.

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**3.4 Other definitions**

**3.4.1  
crew**

collective description of all persons on board a boat

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**3.4.2  
crew limit**

CL

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

**3.4.3  
design trim**

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

NOTE 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 hand holds, or seated.

**3.4.4  
flotation element**

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

**3.4.4.1  
air tank**

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

**3.4.4.2  
air container**

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

**3.4.4.3****low density material**

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

**3.4.4.4****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

**3.4.4.5****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 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.

**3.4.5****loaded waterline**

waterline of the boat when upright at loaded displacement mass and design trim

**3.4.6****watertightness degree**

degree of watertightness as specified in ISO 11812 and ISO 12216

NOTE 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.

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## 4 Symbols

For the purposes of this part of ISO 12217, the symbols in Table 1 apply.

**Table 1 — Symbols**

Symbol	Units	Meaning
$A_S$	m <sup>2</sup>	Nominal sail area according to ISO 8666
$B_H$	m	Beam of hull according to ISO 8666
$B_{WL}$	m	Beam waterline according to ISO 8666 on the loaded waterline. In the case of multihulls, 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 midships according to ISO 8666 to the loaded waterline
$h_D$	m	Actual downflooding height according to 6.2
$h_{D(R)}$	m	Required downflooding height according to 6.2
$L_H$	m	Length of hull according to ISO 8666
$m_{LCC}$	kg	Mass of the boat in light craft condition, see 3.3.1
$m_{LDC}$	kg	Mass of the boat in light craft condition with maximum total load added, see 3.3.3
$m_{MTL}$	kg	Mass of the maximum total load, see 3.3.2

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## 5 Procedure

### 5.1 Maximum total load

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Decide on the crew limit and the maximum total 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.

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

It is important to ensure that the maximum total load is not underestimated.

### 5.2 Sailing or non-sailing

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

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

where

$A_S$  is the nominal sail area according to ISO 8666, expressed in square metres;

$m_{LDC}$  is the loaded displacement mass of the boat, expressed in kilograms.

All other boats are sailing boats. Table 2 gives values of nominal sail area for different loaded displacement masses.

**Table 2 — Minimum nominal sail area for sailing boats**

$m_{LDC}$ (kg)	200	300	400	500	600	700	800	900	1000	1100	1200	1500
$A_S$ (m <sup>2</sup> ) 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

Non-sailing boats shall be assessed using clause 6.

Sailing boats other than habitable multihulls shall be assessed using clause 7. Habitable multihull sailing boats shall be assessed using ISO 12217-2.

If a sailing boat can also be used as a non-sailing boat, e.g. for rowing or for engine propulsion, it shall also meet the requirements for non-sailing boats. The design category finally given is that for which the boat satisfies **all** the relevant requirements.

### 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 decked 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 categories A or B.

## 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.

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

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

Option	1 <sup>a</sup>	2	3 <sup>a</sup>	4	5	6 <sup>a</sup>
Applicable to length of hull	Up to 6,0 m			From 4,8 m up to 6,0 m		
Design categories possible	C and D	C and D	D	C and D	D only	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	Any amount	Fully decked <sup>b</sup>	Any amount	Partially decked <sup>c</sup>	Any amount	Any amount
Downflooding-height test	6.2 <sup>d</sup>	6.2	6.2	6.2	6.2	6.2
Offset-load test	6.3	6.3	—	6.3	6.3	6.3
Flotation standard	Level	—	See 6.6	—	—	Basic
Flotation test	6.4	—	See 6.6	—	—	6.5
Flotation elements	Annex C	—	Annex C	—	—	Annex C
Capsize-recovery test	—	—	6.6	—	—	—

<sup>a</sup> Boats using options 1, 3 and 6 are considered to be susceptible to swamping when used in their design category.  
<sup>b</sup> This term is defined in 3.1.5.  
<sup>c</sup> This term is defined in 3.1.6.  
<sup>d</sup> This test is not required to be applied if, when swamped during the test described in 6.4, the boat supports an equivalent dry mass of 133 % of the maximum total load, or if the boat does not take on water when heeled to 90° from the upright in light craft condition.

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**6.2 Downflooding-height tests**

**6.2.1 Downflooding openings**

**6.2.1.1** The requirements given below, and in 6.2.2 and 6.2.3, shall 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) piped drains from quick-draining recesses or from watertight recesses which, if filled, would not lead to downflooding or capsize when the boat is upright;
- c) non-opening appliances;
- d) opening appliances located in the topsides which comply with ISO 12216 to tightness degree 2 and which are referenced in the Owner’s Manual and are clearly marked “WATERTIGHT CLOSURE – KEEP SHUT WHEN UNDERWAY”; and which are
  - 1) emergency escape hatches or appliances fitted with screwed closures, or
  - 2) in a compartment of such restricted volume that, even if flooded, the boat satisfies all the requirements, or
  - 3) in a boat of design category C or D and which, when at loaded displacement mass, would not sink if the affected compartment was flooded as a result of the appliance being left open.

- e) opening appliances located inboard of the topsides which comply with ISO 12216 to tightness degree 2 and which are referenced in the Owner's Manual and are clearly marked "WATERTIGHT CLOSURE — KEEP SHUT WHEN UNDERWAY";
- f) engine exhausts or other openings that are only connected to watertight systems;
- g) 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 1, 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 1.



#### Key

- 1 Waterline
- 2 Watertightness degree 3 or 4
- 3 Drain
- 4 Watertightness degree 4
- 5 Non-quick-draining space

**Figure 1 — Openings in outboard engine wells**

**6.2.1.2** All closing appliances fitted to downflooding openings shall comply with ISO 12216, according to design category and appliance location area.

**6.2.1.3** No opening type appliances shall be fitted in the hull less than 0,2 m above the loaded waterline unless they comply with ISO 9093 or they are emergency escape hatches complying with ISO 9094.

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