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

**Part 2:  
Sailing boats of hull length greater  
than or equal to 6 m**

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

*Partie 2: Bateaux à voiles d'une longueur de coque supérieure ou  
égale à 6 m*

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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](http://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](http://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](http://www.iso.org/foreword).

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

This third edition cancels and replaces the second edition (ISO 12217-2:2013), of which it constitutes a minor revision. It incorporates the following modifications:

- Introduction: the reference to the European Directive has been updated (2013/53/EU);
- [Clause 1](#), [6.2.1.6 d\) 3\)](#), [7.6](#), [7.11](#), [7.12](#), [7.13](#), [Annex I](#), [Table I.2](#), and [Annex J](#), Worksheets 2, 12, 14 and 16: vulnerable has been replaced with susceptible;
- [Clause 3](#): definitions [3.1.1](#), [3.5.5](#), [3.5.6](#) and [3.6.11](#) have been amended;
- [Subclause 6.3.1](#): second item in the list has been inserted;
- [Subclauses 6.3.2.3](#) and [6.3.2.4](#): formulae coefficients have been corrected;
- [Subclause 6.6.2](#): exponent '0,3' has been deleted;
- [Subclause 6.6.7](#): symbols have been corrected;
- [Subclause 6.6.8](#): a note has been added to explain the phrase "fully flooded with water";
- [Clause 9.2](#): the text and [Table 11](#) have been amended;
- [Subclause H.3.2 c\)](#): the coefficient in the formula has been corrected;
- [Annex J](#): worksheets 1, 2, 5, 7, 12 and 16 have been corrected to align with corrections listed above;
- [Annex K](#) has been added;
- Bibliography: reference to ISO 7010 has been added;
- Editorial and cross-referencing corrections have been made to [Table 1](#), [Annex J](#), worksheets 1, 5, 7, 12, 14 and 16, and to [subclauses 6.3.1](#), [6.3.2.2](#) and [6.3.2.3](#).

## ISO 12217-2:2015(E)

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*

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## Introduction

This part of ISO 12217 enables the determination of limiting environmental conditions 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 J](#) provides worksheets to assist in the systematic assessment of a boat according to this part of ISO 12217.

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# Small craft — Stability and buoyancy assessment and categorization —

## Part 2: Sailing boats of hull length greater than or equal to 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.0

### 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 boats 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 (A, B, C or D) appropriate to its design and maximum load.

This part of ISO 12217 is principally applicable to boats propelled primarily by sail (even if fitted with an auxiliary engine) of 6 m up to and including 24 m hull length. However, it can also be applied to boats less than 6 m if they are habitable multihulls or may be applied if they do not attain the desired design category specified in ISO 12217-3 and they are decked and have quick-draining recesses which comply with ISO 11812.

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;
- gondolas and pedalos;
- surfboards including sailing surfboards; and
- hydrofoils and foil stabilized boats when not operating in the displacement mode.

**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 9094 (all parts), *Small craft — Fire protection*

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 12217-3:2015, *Small craft — Stability and buoyancy assessment and categorization — Part 3: Boats of hull length less than 6 m*

ISO 14946, *Small craft — Maximum load capacity*

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

### 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

##### **sailing boat**

boat for which the primary means of propulsion is by wind power, having reference sail area ([3.4.8](#))

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

Note 1 to entry:  $m_{LDC}$  is the mass of the boat in the maximum load condition, expressed in kilograms.

##### 3.1.3

##### **catamaran**

boat with two main load-bearing hulls

EXAMPLE Boats with a centreline or bridge-deck nacelle which supports less than 30 % of the mass in the maximum load condition are considered to be catamarans. Proas are asymmetric catamarans.

##### 3.1.4

##### **trimaran**

boat with a centre main hull and two sidehulls in which the centre hull, when the boat is upright, supports 30 % or more of the mass in the maximum load condition

**3.1.5****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.

**3.1.6****quick-draining recess**

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

Note 1 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.

Note 2 to entry: ISO 11812 contains requirements with which most sailing dinghies cannot comply.

**3.1.7****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.

**3.1.8****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 which comply 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 have their degree of watertightness in accordance with ISO 12216

Note 1 to entry: The size of recesses permitted for boats of design category A, B or some boats of design category C is restricted by the requirements of [6.3](#).

**3.1.9****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.

### 3.1.10

#### **habitable part of a boat**

spaces within a habitable boat with rigid roof that are fitted with a toilet or in which there is provision for any of the following activities: sitting, sleeping, cooking, eating, washing, navigation, steering

Note 1 to entry: Compartments designated by the builder to be used exclusively for storage and referenced in the owner's manual are not included.

## 3.2 Hazards

### 3.2.1

#### **capsize**

event when a boat reaches any heel angle from which it is unable to recover to equilibrium near the upright without intervention

### 3.2.2

#### **knockdown**

event when a boat reaches a heel angle sufficient to immerse the masthead, and from which it may or may not recover without intervention

### 3.2.3

#### **inversion**

event when a boat becomes upside down

## 3.3 Downflooding

### 3.3.1

#### **downflooding opening**

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 6.2.1.6

### 3.3.2

#### **downflooding angle**

$\phi_D$   
angle of heel at which downflooding openings (apart from those excluded in 6.2.1.6) become immersed, when the boat is in calm water and in the appropriate loading condition at design trim

Note 1 to entry: Where openings are not symmetrical about the centreline of the boat, the case resulting in the smallest angle is used.

Note 2 to entry: The following are specifically considered:

- $\phi_D$  is the downflooding angle to any downflooding opening;
- $\phi_{DA}$  is the angle of heel at which openings which are not marked "KEEP SHUT WHEN UNDER WAY" having a combined total area, expressed in square centimetres (cm<sup>2</sup>), greater than the number represented by  $1,2L_H B_H F_M$  first become immersed;
- $\phi_{DC}$  is the downflooding angle at which recesses which are not quick-draining begin to fill with water;
- $\phi_{DH}$  is the downflooding angle at which any main access hatch (i.e. having an opening area greater than 0,18 m<sup>2</sup> each) giving direct access to the main open air helm position first begins to become immersed.

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

**3.3.3****downflooding height** $h_D$ 

smallest height above the waterline to any downflooding opening, apart from those excluded in 6.2.1.6, when the boat is upright in calm water and 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.

Note 2 to entry: See [Figure B.1](#)

**3.4 Dimensions, areas and angles****3.4.1****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.

**3.4.2****length waterline** $L_{WL}$ 

waterline length measured according to ISO 8666 when the boat is upright in calm water, in the appropriate loading condition and at design trim

Note 1 to entry: For multihull boats,  $L_{WL}$  relates to that of the longest individual hull.

Note 2 to entry: Length waterline is expressed in metres.

**3.4.3****beam of hull** $B_H$ 

maximum beam of the hull using the method of ISO 8666; for catamaran and trimaran boats, maximum beam across the outer hulls

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

**3.4.4****beam waterline** $B_{WL}$ 

greatest beam measured according to ISO 8666 at the waterline in calm water which, for multihull boats, is the sum of the maximum waterline beams of each of the hulls, the boat being upright, in the appropriate loading condition and at design trim

Note 1 to entry: Beam waterline is expressed in metres.

**3.4.5****beam between hull centres** $B_{CB}$ 

on catamaran and trimaran boats, the transverse distance between the centres of buoyancy of the outer hulls

Note 1 to entry: Beam between hull centres is expressed in metres.

#### 3.4.6

##### freeboard amidships

$F_M$   
distance of the sheerline or deck above the waterline at  $L_{WL}/2$  measured according to ISO 8666, the boat being upright, in the appropriate loading condition and at design trim

Note 1 to entry: Freeboard amidships is expressed in metres.

Note 2 to entry: Where no loading condition is specified, maximum load condition should be assumed.

#### 3.4.7

##### draught of canoe body

$T_C$   
draught of the main buoyant part of the hull(s) below the waterline, as defined in ISO 8666, the boat being upright in the appropriate loading condition and at design trim

Note 1 to entry: Draught of canoe body excludes appendages such as rudders or skegs, and is expressed in metres.

#### 3.4.8

##### reference sail area

$A_S$   
actual profile area of sails set abaft a mast, plus the maximum profile areas 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

##### standard sail area

$A'_S$   
actual profile area of the largest sail plan suitable for windward sailing in true winds of 10–12 kn (5,1–6,2 m/s), including overlaps, and supplied or recommended by the builder as standard

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

#### 3.4.10

##### angle of vanishing stability

$\phi_V$   
angle of heel nearest the upright (other than upright) in the appropriate loading condition at which the transverse stability righting moment is zero

Note 1 to entry: This is determined assuming that there is no offset load, and that all potential downflooding openings are considered to be watertight.

Note 2 to entry: Where a boat has recesses which are not quick-draining,  $\phi_V$  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  $\phi_V$ .

Note 3 to entry: Angle of vanishing stability is expressed in degrees.

### 3.5 Condition, mass and volume

#### 3.5.1

##### 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;