
**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*



Reference number
ISO 12217-2:2015(E)



COPYRIGHT PROTECTED DOCUMENT

© ISO 2015, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	v
Introduction	vii
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
3.1 Primary	2
3.2 Hazards	4
3.3 Downflooding	4
3.4 Dimensions, areas and angles	5
3.5 Condition, mass and volume	6
3.6 Other terms and definitions	9
4 Symbols	12
5 Procedure	13
5.1 Maximum load	13
5.2 Sailing or non-sailing	13
5.3 Tests, calculations and requirements to be applied	14
5.4 Variation in input parameters	14
6 Requirements for monohull boats	14
6.1 Requirements to be applied	14
6.2 Downflooding	15
6.2.1 Downflooding openings	15
6.2.2 Downflooding height	18
6.2.3 Downflooding angle	19
6.3 Recess size	19
6.3.1 Application	19
6.3.2 Simplified methods	20
6.3.3 Direct calculation method	22
6.4 Minimum righting energy	22
6.5 Angle of vanishing stability	22
6.5.1 Normal requirement	23
6.5.2 Alternative requirement for design category B	23
6.6 Stability index (STIX)	24
6.6.1 Method	24
6.6.2 Dynamic stability factor (FDS)	25
6.6.3 Inversion recovery factor (FIR)	25
6.6.4 Knockdown recovery factor (FKR)	25
6.6.5 Displacement-length factor (FDL)	26
6.6.6 Beam-displacement factor (FBD)	26
6.6.7 Wind moment factor (FWM)	26
6.6.8 Downflooding factor (FDF)	27
6.6.9 Calculation of the stability index (STIX)	27
6.7 Knockdown-recovery test	28
6.8 Wind stiffness test	29
6.8.1 General	29
6.8.2 Practical test	29
6.8.3 Compliance by calculation	30
6.8.4 Requirements	30
6.9 Flotation requirements	31
6.10 Capsize-recovery test	32
6.11 Detection and removal of water	33
7 Requirements for catamarans, trimarans and form-stable monohulls	34
7.1 Requirements to be applied	34

7.2	Downflooding openings.....	34
7.3	Downflooding height.....	34
7.4	Recess size.....	34
7.5	Stability information.....	35
7.6	Safety signs.....	36
7.7	Bare poles factor.....	37
7.8	Rolling in breaking waves.....	37
7.9	Pitchpoling.....	37
7.10	Diagonal stability.....	38
7.11	Habitable multihull boats.....	38
7.12	Buoyancy when inverted.....	39
7.13	Escape after inversion.....	40
8	Safety signs.....	41
9	Application.....	42
9.1	Deciding the design category.....	42
9.2	Meaning of the design categories.....	42
	Annex A (normative) Full method for required downflooding height.....	44
	Annex B (normative) Methods for calculating downflooding angle.....	47
	Annex C (normative) Determining the curve of righting moments.....	50
	Annex D (normative) Method for calculating reserve of buoyancy after inversion or swamping.....	53
	Annex E (normative) Flotation material and elements.....	55
	Annex F (normative) Information for owner's manual.....	57
	Annex G (normative) Determination of safe wind speed information.....	61
	Annex H (normative) Determination of longitudinal righting characteristics.....	64
	Annex I (informative) Summary of requirements.....	67
	Annex J (informative) Worksheets.....	70
	Annex K (informative) Illustration of recess retention level.....	89
	Bibliography.....	90

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 12217-2:2013), 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*

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.

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.