March 2020

DIN EN ISO 12215-5

ICS 47.080

Supersedes
DIN EN ISO 12215-5:2019-06

Small craft –
Hull construction and scantlings –
Part 5: Design pressures for monohulls, design stresses, scantlings determination (ISO 12215-5:2019);
English version EN ISO 12215-5:2019,
English translation of DIN EN ISO 12215-5:2020-03

Kleine Wasserfahrzeuge –
Rumpfbauweise und Dimensionierung –
Teil 5: Entwurfsdrücke für Einrumpffahrzeuge, Entwurfsspannungen, Ermittlung der Dimensionierung (ISO 12215-5:2019);
Englische Fassung EN ISO 12215-5:2019,
Englische Übersetzung von DIN EN ISO 12215-5:2020-03

Petits navires –
Construction de coques et échantillonnage –
Partie 5: Pressions de conception pour monocoques, contraintes de conception, détermination de l'échantillonnage (ISO 12215-5:2019);
Version anglaise EN ISO 12215-5:2019,
Traduction anglaise de DIN EN ISO 12215-5:2020-03

Document comprises 138 pages

Translation by DIN-Sprachendienst.

In case of doubt, the German-language original shall be considered authoritative.

03.20 3146770

A comma is used as the decimal marker.

National foreword

The text of ISO 12215-5:2019 has been prepared by Technical Committee ISO/TC 188 "Small craft" and has been adopted as EN ISO 12215-5:2019 by Technical Committee CEN/SS T01 "Shipbuilding and maritime structures" (Secretariat: CCMC).

The responsible German body involved in its preparation was *DIN-Normenstelle Schiffs- und Meerestechnik* (DIN Standards Committee Shipbuilding and Marine Technology), Working Committee NA 132-08-01 AA "Small craft".

The DIN documents corresponding to the international documents referred to in this document are as follows:

ISO 178	DIN EN ISO 178
ISO 527-1	DIN EN ISO 527-1
ISO 527-2	DIN EN ISO 527-2
ISO 844	DIN EN ISO 844
ISO 845	DIN EN ISO 845
ISO 8666:2016	DIN EN ISO 8666:2016-12
ISO 12215-3	DIN EN ISO 12215-3
ISO 12215-6:2008	DIN EN ISO 12215-6:2019-05
ISO 12215-9:2012	DIN EN ISO 12215-9:2019-02
ISO 12216	DIN EN ISO 12216
ISO 12217-1:2015	DIN EN ISO 12217-1:2016-08
ISO 12217-2:2015	DIN EN ISO 12217-2:2016-03
ISO 12217-3:2015	DIN EN ISO 12217-3:2016-03

Amendments

This standard differs from DIN EN ISO 12215-5:2019-06 as follows:

a) the Scope and numerous definitions, dimensions and assessments have been clarified;

b) a theoretical height limit value Z_{SDT} for hull/deck has been defined in Table 3;

c) n_{GC} has been renamed as k_{DYN} in Table 7;

d) the values for k_L in the aft area of the craft in Table 8 have been lowered;

e) k_{AR} min in Table 9 has been deleted in order to take into consideration larger panels, in particular for sandwich construction;

f) the values for k_{SUP} in Table 10 have been improved;

g) the design pressures for motor and sailing craft in Table 12 and Table 13 have been amended;

h) the design stresses for the introduction of k_{BB} and k_{AM} factors in Tables 15 to 17 have been amended;

i) the requirements for workboats have been included in Table 2, Clause 12 and Annex J;

j) an option for using a wider range of assessment methods indicated in Table 18 has been included;

k) the former assessment method (now called “simplified method”) has been moved to Annex A;

l) the simplified method has been improved/clarified (panel assessment, hard chined sections, sections without chine, single and double sheets, installed panels, requirements for the core material etc.);

m) Annex C for the assessment of mechanical properties of composites has been developed;

n) in A.14, a reminder of requirements of ISO 12215-9 for the reinforcement of the hull for ballast keel junction has been included;

o) the new Annex I only recommends the minimum thicknesses of single skin and sandwich constructions which are no longer obligatory;

p) the new Annex J specifies different types of commercial craft and workboats and their requirements;

q) the new Annex K specifies loads induced by outboard engines;

r) the new Annex L proposes an application form for this document in order to explain how it has been used;

s) for clarification purposes, this edition generally uses tables for the presentation of formulas and requirements;

t) the standard has been editorially revised.

Previous editions

DIN EN ISO 12215-5: 2008-07, 2009-08, 2014-10, 2019-06

National Annex NA
(informative)

Bibliography

DIN EN ISO 178, *Plastics — Determination of flexural properties*

DIN EN ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

DIN EN ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

DIN EN ISO 844, *Rigid cellular plastics — Determination of compression properties*

DIN EN ISO 845, *Cellular plastics and rubbers — Determination of apparent density*

DIN EN ISO 8666:2016-12, *Small craft — Principal data (ISO 8666:2016)*

DIN EN ISO 12215-3, *Small craft — Hull construction and scantlings — Part 3: Materials: Steel, aluminium alloys, wood, other materials*

DIN EN ISO 12215-6:2019-05, *Small craft — Hull construction and scantlings — Part 6: Structural arrangements and details (ISO 12215-6:2008)*

DIN EN ISO 12215-9:2019-02, *Small craft — Hull construction and scantlings — Part 9: Sailing craft appendages (ISO 12215-9:2012)*

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

DIN EN ISO 12217-1:2016-08, *Small craft — Stability and buoyancy assessment and categorization — Part 1: Non-sailing boats of hull length greater than or equal to 6 m (ISO 12217-1:2015)*

DIN EN ISO 12217-2:2016-03, *Small craft — Stability and buoyancy assessment and categorization — Part 2: Sailing boats of hull length greater than or equal to 6 m (ISO 12217-2:2015)*

DIN EN ISO 12217-3:2016-03, *Small craft — Stability and buoyancy assessment and categorization — Part 3: Boats of hull length less than 6 m (ISO 12217-3:2015)*

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 12215-5

June 2019

ICS 47.080

Supersedes EN ISO 12215-5:2018

English Version

Small craft - Hull construction and scantlings - Part 5: Design pressures for monohulls, design stresses, scantlings determination (ISO 12215-5:2019)

Petits navires - Construction de coques et échantillonnage - Partie 5: Pressions de conception pour monocoques, contraintes de conception, détermination de l'échantillonnage (ISO 12215-5:2019)

Kleine Wasserfahrzeuge - Rumpfbauweise und Dimensionierung - Teil 5: Entwurfsdrücke für Einrumpffahrzeuge, Entwurfsspannungen, Ermittlung der Dimensionierung (ISO 12215-5:2019)

This European Standard was approved by CEN on 16 February 2019.

This European Standard was corrected and reissued by the CEN-CENELEC Management Centre on 02 October 2019.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN ISO 12215-5:2019 E

Contents

Page

European foreword ... **4**

Annex ZA (informative) **Relationship between this European Standard and the essential requirements of Directive 2013/53/EU aimed to be covered** ... **5**

Foreword ... **6**

Introduction ... **8**

1 Scope ... **9**

2 Normative references ... **10**

3 Terms and definitions ... **10**

4 Symbols ... **12**

5 General ... **14**
5.1 Materials ... 14
5.2 Overall procedure for scantlings determination ... 14

6 Main dimensions, data and areas ... **15**
6.1 Dimensions and data ... 15
6.2 Areas ... 15
6.2.1 General ... 15

7 Dimensions of panels and stiffeners ... **17**
7.1 General ... 17
7.2 Rectangular grid of panels and stiffeners ... 18
7.3 Non-rectangular panels ... 20
7.3.1 Trapezoidal or triangular panels ... 20
7.3.2 Other shapes ... 21
7.4 Pressure on a panel or a stiffener ... 22

8 Pressure adjusting factors ... **23**
8.1 General ... 23
8.2 Design category factor k_{DC} ... 23
8.3 Dynamic load factor k_{DYN} ... 23
8.4 Longitudinal pressure distribution factor k_L ... 24
8.5 Area pressure reduction factor k_{AR} ... 25
8.6 Superstructures and deckhouse pressure reduction factor k_{SUP} ... 26
8.7 Pressure correcting factor k_{SLS} for slamming of light and stable sailing craft ... 26

9 Design pressures ... **27**
9.1 Design pressure for motor craft ... 27
9.2 Design pressure for sailing craft ... 29
9.3 Watertight bulkheads and integral tank boundaries design pressure ... 30
9.3.1 General ... 30
9.3.2 Integral tanks wash plates ... 31
9.3.3 Collision bulkheads ... 31
9.3.4 Non-watertight or partial bulkheads ... 32
9.3.5 Centreboards of lifting keel wells ... 32
9.3.6 Transmission of pillar loads ... 32
9.3.7 Loads from outboard engines ... 32

10 Mechanical properties and design stresses ... **32**
10.1 Boat building quality factor k_{BB} ... 32
10.2 Assessment method factor k_{AM} ... 33
10.3 Design stresses according to material and calculation method ... 33

11 Methods for structural analysis and scantlings determination 35
11.1 The six available methods 35
11.2 Method 1: "Simplified" method 35
11.3 Method 2: "Enhanced" method (ply by ply analysis) 36
11.4 Method 3: "Developed" method for any laminate, including non-balanced laminates 36
11.5 Method 4: "Direct test method" 36
11.6 Method 5: "FEM" Finite Element Method 36
11.6.1 General considerations 36
11.6.2 General guidance for assessment by 3-D numerical procedures 37
11.6.3 Boundary assumptions and load application 37
11.6.4 Model idealisation 37
11.7 Method 6: Alternative test: Drop test 37
11.8 "Good practice" minimal thickness 38

12 Craft for professional use: Commercial craft and workboats 38

13 Owner's manual 38
13.1 General 38
13.2 Normal mode of operation 38
13.3 Information to take care of sandwich plating 38
13.4 Information required by Annex J for commercial craft and workboats 38

14 Application form 38

Annex A (normative) **Application of methods of analysis 1 to 3 of Table 18 ..... 39**

Annex B (normative) **Mechanical properties and design stress of metals 66**

Annex C (normative) **FRP laminates properties and calculations 69**

Annex D (normative) **Drop test for craft <6 m 81**

Annex E (normative) **Sandwich calculations 84**

Annex F (normative) **Wood/plywood laminate properties and calculations 88**

Annex G (normative) **Geometric properties of stiffeners 97**

Annex H (normative) **Laminate stack analysis for plating and stiffeners 109**

Annex I (informative) **"Good practice " values for minimum thickness or dry fibre mass 124**

Annex J (normative) **Commercial craft and workboats — Additional requirements 126**

Annex K (informative) **Loads induced by outboard engines 129**

Annex L (informative) **Application form of ISO 12215-5 ..... 131**

Bibliography 133

European foreword

This document (EN ISO 12215-5:2019) has been prepared by Technical Committee ISO/TC 188 "Small craft" in collaboration with CCMC.

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 December 2019, and conflicting national standards shall be withdrawn at the latest by June 2021.

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 12215-5:2018.

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 12215-5:2019 has been approved by CEN as EN ISO 12215-5:2019 without any modification.

Annex ZA
(informative)

Relationship between this European Standard and the essential requirements of Directive 2013/53/EU aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/542/C(2015) 8736 final to provide one voluntary means of conforming to essential requirements of Directive 2013/53/EU.

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 of Directive 2013/53/EU

Essential Requirements of Directive 2013/53/EU	Clause(s)/sub-clause(s) of this EN	Remarks/Notes
Annex I, Part A, 2.5 – Owner's Manual	13 except 13.4 A.7.4	A.7.4 provides advice to builders and designers to clearly explain the need to monitor cracking in panels and possible failure.
Annex I, Part A, 3.1 - Structure	All clauses except Clause 12 and Annex J	This document provides a means of demonstrating conformity with this requirement for recreational craft as defined in Article 3(2) of Directive 2013/53/EU to 24m hull length (L_H) only. (Hull length means the length of the hull measured in accordance with ISO 8666.) Workboats (craft for professional use as defined in Table J.1 of this document) are not within the scope of RCD 2013/53/EU, Article 2.1. This document considers all parts of the craft that are assumed to be watertight or weathertight when assessing stability, freeboard and buoyancy in accordance with ISO 12217.

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.

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 second edition cancels and replaces the first edition (ISO 12215-5:2008, including its amendment ISO 12215-5:2008/Amd 1:2014), which has been technically revised.

One of the main reasons to achieve this revision, after a decade implementing the first edition, was to allow other scantlings calculation methods than those given in the 2008 edition, noting the huge development of finite element analysis methods and software, and the trend already applied in ISO 12215-9 (keels and appendages) and ISO 12215-7 (multihulls).

Therefore, in this new edition, like in many other scantlings standards, the design pressure loads, and the design stresses are given in the main body of the standard and, where needed, the scantlings calculation methods are detailed in Annexes.

The main changes compared to the previous edition are as follows:

— clarification of the scope and of many definitions, dimensions, and assessment;

— definition of a theoretical hull/deck limit height Z_{SDT} in Table 3;

— renaming of n_{GC} into k_{DYN} in Table 7;

— lowering of the values of k_L in the aft part of the craft in Table 8;

— deletion of k_{AR} min, to better consider large panels, mainly sandwiches, in Table 9;

— improvement of the values of k_{SUP} in Table 10;

— modification of design pressures for motor and sailing craft in Tables 12 & 13;

— modification of design stresses introducing k_{BB} and k_{AM} factors in Tables 15 to 17;

— incorporation of requirements for work boats in Table 2, Clause 12 and Annex J;

— possibility to use a wider range of assessment methods detailed in Table 18;

— move of the previous assessment method (now called "simplified") in Annex A;

— improvements/clarification of the simplified method (panel assessment, hard chined sections, frameless sections, simple and double curvature, attached plating, requirements for core, etc.);

— development of Annex C for the determination of mechanical properties of composites;

— reminder in A.14 of the requirements of ISO 12215-9 on reinforcement of the hull in way of ballast keel attachment;

— new Annex I only recommending minimum thickness for single skin and sandwich that are no longer mandatory;

— new Annex J defining different types of commercial craft and workboats and their requirements;

— new Annex K defining loads induced by outboard engines;

— new Annex L proposing an application sheet of this document to explain how it has been used;

— for clarity, this edition generally uses tables to present formulas and requirements.

A list of all parts in the ISO 12215 series can be found in the ISO website.

NOTE The mechanical properties of ISO 12215-1 to -3 are largely superseded by the ones of this document.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.