INTERNATIONAL STANDARD

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Small craft — Hull construction and scantlings —

Part 3: Materials: Steel, aluminium alloys, wood, other materials

Petits navires — Construction de coques et échantillons —
Partie 3: Matériaux: Acier, alliages d'aluminium, bois, autres matériaux

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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 12215 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12215-3 was prepared by Technical Committee ISO/TC 188, *Small craft*.

ISO 12215 consists of the following parts, under the general title *Small craft — Hull construction and scantlings*:

— *Part 1: Materials: Thermosetting resins, glass-fibre reinforcement, reference laminate*

— *Part 2: Materials: Core materials for sandwich construction, embedded materials*

— *Part 3: Materials: Steel, aluminium alloys, wood, other materials*

— *Part 4: Workshop and manufacturing*

— *Part 5: Design pressures, design stresses, scantling determination*

— *Part 6: Structural arrangements and details*

Annex A forms a normative part of this part of ISO 12215.

Small craft — Hull construction and scantlings —

Part 3:
Materials: Steel, aluminium alloys, wood, other materials

1 Scope

This part of ISO 12215 specifies requirements for materials intended for use in the construction of the hull, superstructure and appendages, in particular:

— weldable normal and higher strength hot-rolled steel plates, wide flats, sections and bars;

— austenitic stainless steels, fabricated in the form of plates or profiles;

— wrought aluminium alloys fabricated as plates, sections and extruded profiles;

— wood in the form of solid timber, plywood or veneer;

— other suitable materials.

NOTE 1 Other materials may be used in the construction of small craft if adequate suitability and durability for the intended purpose can be demonstrated.

This part of ISO 12215 applies to small craft with a length hull (L_H) according to ISO 8666 of up to 24 m.

NOTE 2 The underlying reason for preparing this part of ISO 12215 is that the choice of materials for the construction of a small craft has a significant influence on short-term and long-term durability under the expected loads and environmental conditions.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 12215. 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 12215 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 8666: —[1)] , *Small craft — Principal data*

ISO 12215-4:2002, *Small craft — Hull construction and scantlings — Part 4: Workshop and manufacturing*

3 Terms and definitions

For the purposes of this part of ISO 12215, the following terms and definitions apply.

1) To be published.

3.1
durability
naturally inherent property of a wood species to indicate the service time of the heartwood used in the open air without any preservation

NOTE The designation of durability of wood is given in Table 1.

3.2
veneer
solid wood with a thickness of no more than 5 mm in its finished state

4 Requirements for metal

4.1 Properties of materials

Materials covered by this part of ISO 12215 are dealt with by many international and national standards, also classification societies, active in the survey of ships and small craft. The properties of all metal used in the construction of small craft shall be suitable for marine use and the intended methods of construction. The metal shall comply with a relevant International or National Standard, classification society rule or be supported by documentation to validate its suitability for marine use.

4.2 Selection of materials

The choice of materials shall take into account the manufacturing conditions in the boat yard, environmental limitations, the anticipated manufacturing process, the competence of welders and the welding equipment being used, as specified in ISO 12215-4.

4.3 Material combinations

4.3.1 When combining metals of different type or composition, the galvanic potential difference must be considered in order to avoid contact corrosion.

NOTE The rate of contact corrosion may be influenced by environmental conditions, heat treatment, welding and forming.

4.3.2 The negative effect on certain timber by adjacent metals and vice versa shall be taken into account when selecting the materials to be in contact or shall be neutralized, e.g. by shielding or insulation.

NOTE These may be wood species containing chemical substances, or composites using electrically conductive material, e.g. carbon fibre.

4.4 Freedom from defects

The metal used shall have a suitable finish for the intended application and shall be free from surface defects prejudicial to use for the intended application.

4.5 Identification of materials

The manufacturer or supplier of the material shall adopt a system of identification, e.g. by colour coding or stamping, that will enable the material to be traced to its original manufacture.

4.6 Steel

4.6.1 General

Steel used for the construction of small craft shall be normal strength steel (mild steel) in accordance with 4.6.2 or higher strength steel in accordance with 4.6.3.

4.6.2 Normal strength steel

The minimum mechanical properties of normal strength steel shall be

— yield strength: R_{eH} = 235 N/mm^2, and

— tensile strength: R_m = 340 N/mm^2.

Mild steels should be the preferred choice for the construction of small craft, because of their ductility, ease of welding and reduced likelihood regarding possible loss of mechanical properties by welding.

4.6.3 Higher strength steel

Higher strength steel may be used in the construction of small craft provided it is taken into consideration that, when fatigue load is present, the effective fatigue strength of a welded joint may not be greater than a welded joint in normal strength steels. Before subjecting steels produced by thermo-mechanical rolling to further heating for forming or stress relieving, or using high heat-input welding, account shall be taken of the possibility of a subsequent reduction in mechanical properties.

The mechanical properties of higher strength steels shall be

— yield strength: R_{eH} = 315 N/mm^2 to 390 N/mm^2, and

— tensile strength: R_m = 440/570 N/mm^2 to 510/660 N/mm^2.

4.6.4 Austenitic stainless steels may be used for construction in small craft subject to giving consideration to

— the environmental conditions to which the small craft may be subjected,

— any intended combination of different metals, the means of insulation from each other and surface protection or coating, and

— the detail design to reduce the possibility of pitting and/or crevice corrosion.

NOTE This group of steels comprises low-carbon austenitic steels which achieve their resistance to corrosion in fresh and sea water by additions of chromium (Cr), nickel (Ni), molybdenum (Mo), and may additionally be stabilized for a stable after-welding condition by titanium (Ti) and niobium (Nb).

Alloys suitable for marine use are in general those with a minimum mass fraction of 12 % chromium and a pitting resistance equivalent (W) exceeding 25 (W = % Cr + 3,3 % Mo).

4.7 Aluminium alloys

4.7.1 General

The following types of aluminium alloys may be used for construction in small craft:

— non-heat-treatable alloys;

— heat-treatable alloys.

Both groups comprise types of alloys that are resistant to sea water.

Both groups are delivered in different temper conditions, having a significant effect on the mechanical properties.

It should be recognized that the mechanical properties of treated alloys may be reduced after welding.

4.7.2 Non-heat-treatable aluminium alloys

The major alloy component for this material group, regarded as sea water resistant, is magnesium (Mg). Additionally manganese (Mn) or silicon (Si) may be contained.

NOTE Typical applications for these alloys are rolled products, e.g. sheets, strips and plates.

4.7.3 Heat-treatable aluminium alloys

The major alloy component for this material group, regarded as sea water resistant, is silicon (Si). Additionally magnesium (Mg) and/or manganese (Mn) may be contained.

NOTE Typical applications for these alloys are extruded products, e.g. sections, shapes, bars and closed profiles.

4.7.4 Other aluminium alloys

Alloys of the aluminium-copper group and the aluminium-zinc group should not be used for the construction of small craft. They may be used for secondary purposes in small craft with special protection, e.g. anodizing, painting.

Aluminium-copper alloys may be used without protection for small boats that are intended to be used exclusively in fresh water surroundings. It is preferable that they are not of welded construction.

4.8 Other metals

Structural members of small craft may be built of other metals, e.g. copper- and nickel-based alloys. Those that are sensitive to crevice corrosion and pitting when not coated shall only be used with cathodic protection when submerged or subject to spray water.

5 Requirements for wood

5.1 Solid timber

5.1.1 Timber shall be suitable for use in the intended marine environment and shall be of durability classes 1, 2 or 3, (see Table 1) except where otherwise specified in this part of ISO 12215. A selection of such wood species is given in Table 2. Wood of lower durability classes may be used, as listed in Table 2, provided the mechanical properties are sufficient for scantlings, and suitable preservations are applied.

Table 1 — Designation of durability of wood

Durability class	Endurance (years)	Resistance
1	> 25	high resistance
2	15 to 25	resistant
3	10 to 15	moderate resistance
4	< 10	non-resistant

NOTE The categorization follows that published by the Forest Products Research Laboratory, Princes Risborough, U.K. taking into account the service life of untreated wood when used in the open atmosphere and in contact with the soil under normal central European climatic conditions, and the resistance against fungal and animal attack (except teredo navalis).

Table 2 — Wood designation and durability classes (selection)

Trade name	Botanical designation	Durability class
Teak	Tectona grandis	1
Iroko	Chlorophora excelsa	1
Macore	Tieghemelia heckelii	1
Sipo, Utile	Entandophragma utile	2
Mahogany	Swietenia macrophylla	2
Oak, European	Quercus robur	2
Red cedar, western	Thuja plicata	2
Khaya, Benin mahogany	Khaya ivorensis	2, 3
Agba	Gossweilerodendron balsamiferum	2, 3
Douglas fir, oregon pine	Pseudotsuga menziesii	3
Larch	Larix decidua	3
Pine	Pinus sylvestris	3
Fir	Abies alba	4
Fir, spruce	Picea abies	4
Spruce	Picea glauca	4

5.1.2 Timber for structural parts shall be free from defects that might impair the strength or durability of the small craft, e.g. blueing, brittleness, rot, cracks, knots and sapwood.

5.1.3 Timber used for planking of the hull shall be cut with consideration of warping, shrinkage and swelling in the as-assembled condition.

Timber intended to be used for planking of the hull should be quarter sawn (rift sawn), with an angle of the annular rings to the lower cut edge less than 45° for single-skin carvel construction, except for strip plank construction with small strip width.

5.1.4 The moisture content of the wood shall be within the limits required by the method of joining the parts (glueing, laminating, sheathing) and consideration of the dimensional stability of the structure.

Timber for structural purposes where encapsulated or over-laminated shall have an average moisture content not greater than 15 %.

5.2 Plywood

5.2.1 Plywood intended to be used for external structural members, e.g. hull, weather deck not sheathed by fibre reinforced plastics (FRP) laminate or similar, superstructures and deckhouses, shall be marine-grade plywood. Where a craft is intended to be only temporarily used in the water and the hull is protected by a wood-penetrating medium (e.g. epoxy resin) other waterproof and boilproof external-grade plywood may be used.

5.2.2 Other members inside the hull may be made of waterproof and boilproof plywood which does not fully comply with marine-grade plywood. It shall be durable.

5.3 Veneers for moulded construction

Veneers used in the construction of the hull, deck and superstructure shall in general be of durability class 1 or 2. Exception: veneers of durability less than 2 may be used if adequately preserved by resin penetration or FRP sheathing.

