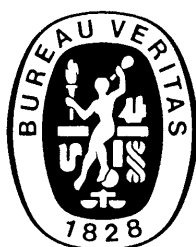




**BUREAU
VERITAS**

Rules for the Classification of High Speed Craft

These rules have been established jointly by



BUREAU
VERITAS



GERMANISCHER
LLOYD



REGISTRO
ITALIANO NAVALE

as Members of
EEIG UNITAS

NR 396 UNITAS R02 E

February 2002

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ARTICLE 1

1.1. - BUREAU VERITAS is a Society the purpose of whose Marine Division (the "Society") is the classification (« Classification ») of any ship or vessel or structure of any type or part of it or system therein collectively hereinafter referred to as a "Unit" whether linked to shore, river bed or sea bed or not, whether operated or located at sea or in inland waters or partly on land, including submarines, hovercrafts, drilling rigs, offshore installations of any type and of any purpose, their related and ancillary equipment, subsea or not, such as well head and pipelines, mooring legs and mooring points or otherwise as decided by the Society.

The Society:

- prepares and publishes Rules for classification, Guidance Notes and other documents (« Rules »);
- issues Certificates, Attestations and Reports following its interventions (« Certificates »);
- publishes Registers.

1.2. - The Society also participates in the application of National and International Regulations or Standards, in particular by delegation from different Governments. Those activities are hereafter collectively referred to as « Certification ».

1.3. - The Society can also provide services related to Classification and Certification such as ship and company safety management certification; training activities; all activities and duties incidental thereto such as documentation on any supporting means, software, instrumentation, measurements, tests and trials on board.

1.4. - The interventions mentioned in 1.1., 1.2. and 1.3. are referred to as « Services ». The party and/or its representative requesting the services is hereinafter referred to as the « Client ».

The Services are prepared and carried out on the assumption that the Clients are aware of the International Maritime and/or Offshore Industry (the "Industry") practices.

1.5. - The Society is neither and may not be considered as an Underwriter, Broker in ship's sale or chartering, Expert in Unit's valuation, Consulting Engineer, Controller, Naval Architect, Manufacturer, Shipbuilder, Repair yard, Charterer or Shipowner who are not relieved of any of their expressed or implied obligations by the interventions of the Society.

ARTICLE 2

2.1. - Classification is the appraisal given by the Society for its Client, at a certain date, following surveys by its Surveyors along the lines specified in Articles 3 and 4 hereafter on the level of compliance of a Unit to its Rules or part of them. This appraisal is represented by a class entered on the Certificates and periodically transcribed in the Society's Register.

2.2. - Certification is carried out by the Society along the same lines as set out in Articles 3 and 4 hereafter and with reference to the applicable National and International Regulations or Standards.

2.3. - It is incumbent upon the Client to maintain the condition of the Unit after surveys, to present the Unit for surveys and to inform the Society without delay of circumstances which may affect the given appraisal or cause to modify its scope.

2.4. - The Client is to give to the Society all access and information necessary for the performance of the requested Services.

ARTICLE 3

3.1. - The Rules, procedures and instructions of the Society take into account at the date of their preparation the state of currently available and proven technical knowledge of the Industry. They are not a code of construction neither a guide for maintenance or a safety handbook.

Committees consisting of personalities from the Industry contribute to the development of those documents.

3.2. - The Society only is qualified to apply its Rules and to interpret them. Any reference to them is void unless it involves the Society's intervention.

3.3. - The Services of the Society are carried out by professional Surveyors according to the Code of Ethics of the Members of the International Association of Classification Societies (IACS).

3.4. - The operations of the Society in providing its Services make use of random inspections and are absolutely exclusive of any monitoring and thorough verification.

ARTICLE 4

4.1. - The Society, acting by reference to its Rules:

- reviews the construction arrangements of the Units as shown on the documents presented by the Client;
- conducts surveys at the place of their construction;
- classes Units and enters their name in its Register;
- surveys periodically the Units in service to note that the requirements for the maintenance of class are met.

The Client is to inform the Society without delay of circumstances which may cause the date or the extent of the surveys to be changed.

ARTICLE 5

5.1. - The Society acts as a provider of services. This cannot be construed as an obligation bearing on the Society to obtain a result or in a warranty.

5.2. - The certificates issued by the Society pursuant to 5.1. here above are a statement on the level of compliance of the Unit to its Rules or to the documents of reference for the Services provided for.

In particular, the Society does not engage in any work relating to the design, building, production or repair checks, neither in the operation of the Units or in their trade, neither in any advisory services, and cannot be held liable on those accounts. Its certificates cannot be construed as an implied or express warranty of safety, fitness for the purpose, seaworthiness of the Unit or of its value for sale, insurance or chartering.

5.3. - The Society does not declare the acceptance or commissioning of a Unit, that being the exclusive responsibility of its owner.

5.4. - The Services of the Society cannot create any obligation bearing on the Society or constitute any warranty of proper operation, beyond any representation set forth in the Rules, of any Unit, equipment or machinery, computer software of any sort or other comparable concepts that has been subject to any survey by the Society.

ARTICLE 6

6.1. - The Society accepts no responsibility for the use of information related to its Services which was not provided for the purpose by the Society or with its assistance.

6.2. - If the Services of the Society cause to the Client a damage which is proved to be the direct and reasonably foreseeable consequence of an error or omission of the Society, its liability towards the Client is limited to ten times the amount of fee paid for the Service having caused the damage. This limit is subject to a minimum of fifty thousand (50.000) French francs, and to a maximum which is the greater of five millions (5.000.000) French francs and one and a half times the above mentioned fee.

The Society bears no liability for indirect or consequential loss such as e.g. loss of revenue, loss of profit, loss of production, loss relative to other contracts and indemnities for termination of other agreements.

6.3. - All claims are to be presented to the Society in writing and on pain of debarment by right, within three months of the date the Services were supplied or of the date the events which are taken advantage of were first known.

ARTICLE 7

7.1. - Requests for Services are to be in writing.

7.2. - Either the Client or the Society can terminate as of right the requested Services by prior written notice according to paragraph 7.3., for convenience, and without prejudice to the provisions in Article 8 hereunder.

7.3. - The notice due by the Society to the Client to exercise the possibility under 7.2. is of three calendar months and conversely, of ten banking days.

7.4. - The class granted to the concerned Units and the previously issued certificates remain valid until the date of effect of the notice issued according to 7.2. hereabove subject to compliance with 2.3. hereabove and Article 8 hereunder.

ARTICLE 8

8.1. - The Services of the Society, whether completed or not, involve the payment of fee upon receipt of the invoice and the reimbursement of the expenses incurred.

8.2. - The class of a Unit may be suspended in the event of non-payment of fee after a first unfruitful notification to pay.

ARTICLE 9

9.1. - The documents and data provided to or prepared by the Society for its Services, and the information available to the Society, are treated as confidential. However:

- Clients have access to the data they have provided to the Society and to the reports and certificates which have been prepared for them;
- copy of the documents made available for the classification of the Unit can be handed over to another Classification Society Member of the International Association of Classification Societies (IACS) in case of the Unit's transfer of class;
- the data relative to the evolution of the Register, to the class suspension and to the survey status of the Units are passed on to IACS according to the association working rules;
- technical records and history related to specific class notations may be transferred to the new owner in case of change of ownership;
- the certificates, documents and information relative to the Units classed with the Society are passed on upon order of the flag authorities of the Unit or of a Court having jurisdiction.

The documents and data are subject to a file management plan.

ARTICLE 10

10.1. - Any delay or shortcoming in the performance of its Services by the Society arising from an event not reasonably foreseeable by or beyond the control of the Society shall be deemed not to be a breach of contract.

ARTICLE 11

11.1. - The Society may designate another Surveyor at the request of the Client in case of diverging opinions during surveys.

11.2. - Disagreements of a technical nature between the Client and the Society can be submitted by the Society to the advice of its Classification Committee.

ARTICLE 12

12.1. - Disputes over the Services carried out by delegation of Governments are assessed within the framework of the applicable agreements with the States, international Conventions and national rules.

12.2. - Disputes arising out of the payment of the Society's invoices by the Client are submitted to the Court of Nanterre, France.

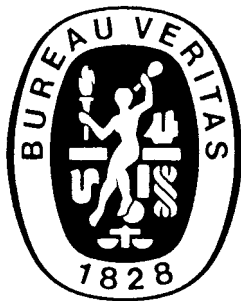
12.3. - Other disputes over the present General Conditions or over the Services of the Society are exclusively submitted to arbitration in London according to the London arbitration procedural rules in force. English law applies.

ARTICLE 13

13.1. - These General Conditions constitute the sole contractual obligations binding together the Society and the Client, to the exclusion of all other representation, statements, terms, conditions whether express or implied. They may be varied in writing by mutual agreement.

13.2. - The invalidity of one or more stipulations of the present General Conditions does not affect the validity of the remaining provisions.

13.3. - The definitions herein take precedence over any definitions serving the same purpose which may appear in other documents issued by the Society.



RULES FOR THE CLASSIFICATION OF HIGH SPEED CRAFT

Premise

Preamble of the International Code of Safety for High-Speed Craft, 2000

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Chapter	3	Structures
Chapter	4	Accommodation and Escape Measures
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February 2002

Unless otherwise specified, these rules apply to ships for which contracts are signed after April 30th, 2002. The Society may refer to the contents hereof before April 30th, 2002 at the special request of the party applying for classification.

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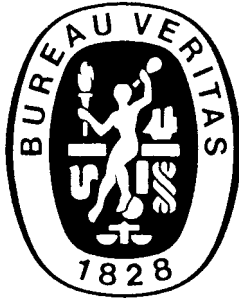
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RULES FOR THE CLASSIFICATION OF HIGH SPEED CRAFT

PREMISE

P.1 General

P.1.1

.1 These rules incorporate the text in full of the “International Code of Safety for High Speed Craft” (“HSC Code”) adopted by the IMO Maritime Safety Committee, at its 73rd session, in December 2000, through Resolution MSC. 97(73). This text is printed in *italics*.

.2 Classification requirements additional to the provisions of the HSC Code are printed in the Roman characters used for this item .2 and the relevant number is prefixed by the letter C.

In Chapter 10, which is subdivided into Parts, additional classification requirements not directly related to a particular HSC Code item are numbered as follows: prefix C, Chapter number, letter indicating the Part concerned and an incremental figure starting from 1. These additional requirements are inserted at the end of the relevant Part of the Chapter.

Where necessary, additional explanatory notes are given at the beginning of each Chapter.

.3 Parts of the HSC Code not applicable for the purpose of classification are identified by a vertical line placed in the margin of the text.

.4 Equipment and arrangements dealt with in the parts of the Code mentioned in item .3, such as those concerning life-saving appliances and radiocommunications, which are not subject to control by the Society, are intended to be covered by the relevant certification.

P.1.2 In those provisions of the HSC Code that are being used for classification purposes the words “Administration” and “Code”, wherever mentioned, are to be understood as equivalent to the words “Society” and “Rules”, respectively.

The Rules for the construction and classification of ships are referred to below simply as “Society Rules”.

P.2 Application

P.2.1 Craft for which classification only is requested

These craft are to comply in full with the requirements of these rules, except for those identified by a vertical line placed in the margin of the text (see P.1.1.3).

P.2.2 Craft for which both classification and the IMO Certification are requested

These craft are to comply in full with the requirements of these rules.

P.3 Class notation

Craft complying with the classification requirements of these Rules are assigned the notation **HSC** or **High Speed Craft**, completed as specified in the Society Rules.

P.4 Compliance with other rules

For any items not expressly stipulated or modified for classification purposes by these Rules, the requirements of the Society Rules are to apply wherever relevant.

Classification of a craft with the Society, or more generally any Society actions and decisions, do not absolve the interested parties from compliance with additional and/or more stringent requirements and provisions for their application, issued by the Administration of the State whose flag the craft is entitled to fly and/or of the State where the base port from which the craft is intended to operate is situated.

P.5 Novel or unusual features

Craft presenting novel or unusual arrangements for items such as systems, apparatuses and devices, described in these rules, to which the requirements of these rules do not apply directly, either in whole or on part, may be classed on an individual basis, at the discretion of the Society.

PREAMBLE OF THE INTERNATIONAL CODE OF SAFETY FOR HIGH-SPEED CRAFT, 2000

1 *The international conventions ratified in respect of conventional ships and the regulations applied as a consequence of such conventions have largely been developed having in mind the manner in which conventional ships are constructed and operated. Traditionally, ships have been built of steel and with the minimum of operational controls. The requirements for ships engaged on long international voyages are therefore framed in such a way that, providing the ship is presented for survey and a Ship Safety Certificate is issued, the ship may go anywhere in the world without any operational restrictions being imposed. Providing the ship is not involved in a casualty, all that is needed is that it is made available to the Administration for the purpose of a satisfactory resurvey before the Ship Safety Certificate expires and the Certificate will be reissued.*

2 *The traditional method of regulating ships should not be accepted as being the only possible way of providing an appropriate level of safety. Nor should it be assumed that another approach, using different criteria, could not be applied. Over a long period of time, numerous new designs of marine vehicles have been developed and have been in service. While these do not fully comply with the provisions of the international conventions relating to conventional ships built of steel, they have demonstrated an ability to operate at an equivalent level of safety when engaged on restricted voyages under restricted operational weather conditions and with approved maintenance and supervision schedules.*

3 *The High-Speed Craft Code 1994 (1994 HSC Code) was derived from the previous Code of Safety for Dynamically Supported Craft (DSC Code) adopted by IMO in 1977, recognizing that safety levels can be significantly enhanced by the infrastructure associated with regular service on a particular route, whereas the conventional ship safety philosophy relies on the ship being self-sustaining with all necessary emergency equipment being carried on board.*

4 *The safety philosophy of this Code is based on the management and reduction of risk as well as the traditional philosophy of passive protection in the event of an accident. Management of risk through accommodation arrangement, active safety systems, restricted operation, quality management and human factors engineering should be considered in evaluating safety equivalent to current conventions. Application of mathematical analysis should be encouraged to assess risk and determine the validity of safety measures.*

5 *This Code takes into account that a high-speed craft is of a light displacement compared with a conventional ship. This displacement aspect is the essential parameter to obtain fast and competitive sea transportation and consequently this Code allows for use of non-conventional shipbuilding materials, provided that a safety standard at least equivalent to conventional ships is achieved.*

6 *To clearly distinguish such craft, criteria based on speed and volumetric Froude number have been used to delineate those craft to which this Code applies from other, more conventional, craft.*

7 *The Code requirements also reflect the additional hazards which may be caused by the high speed compared with conventional ship transportation. Thus, in addition to the normal requirements (including life-saving appliances, evacuation facilities, etc.) provided in case of an accident occurring, further emphasis is placed on reducing the risk of hazardous situations arising. Some advantages result from the high-speed craft concept, i.e. the light displacement provides a large reserve buoyancy in relation to displacement, reducing the hazards addressed by the International Convention on Load Lines, 1966. The consequences of other hazards, such as of collision at high speed, are balanced by more stringent navigational and operational requirements and specially developed accommodation provisions.*

8 *The above-mentioned safety concepts were originally reflected in the DSC Code and in the 1994 HSC Code. The development of novel types and sizes of craft has led to the development of pressures within the maritime industry for craft which are not dynamically supported cargo craft or passenger craft carrying larger numbers of passenger or operating further afield than permitted by that Code to be certified according to those concepts. Additionally, improvements of maritime safety standards since 1994 were required to be reflected in the revisions of the 1994 HSC Code to maintain safety equivalence with conventional ships.*

9 *Accordingly, two differing principles of protection and rescue were embodied in the 1994 HSC Code.*

10 *The first of these recognizes the craft which were originally foreseen at the time of development of the DSC Code. Where rescue assistance is readily available and the total number of passengers is limited, a reduction in passive and active protection may be permitted. Such craft are called "assisted craft" and form the basis for "category A passenger craft" of this Code.*

11 *The second concept recognizes the further development of high-speed craft into larger craft. Where rescue assistance is not readily available or the number of passengers is unlimited, additional passive and active safety precautions are required. These additional requirements provide for an area of safe refuge on board, redundancy of vital systems, increased watertight and structural integrity and full fire-extinguishing capability. Such craft are called "unassisted craft" and form the basis for "cargo craft" and "category B passenger craft" of this Code.*

12 *These two concepts have been developed as a unified document on the basis that an equivalent level of safety to that normally expected on ships complying with the International Convention for the Safety of Life at Sea, 1974 is achieved. Where the application of new technology or design indicates an equivalent safety level to the strict application of this Code, the Administration is permitted to formally recognize such equivalence.*

13 *It is important that an Administration, in considering the suitability of a high-speed craft under this Code, should apply all sections of the Code because non-compliance with any part of the Code could result in an imbalance which would adversely affect the safety of the craft, passengers and crew. For a similar reason, modifications to existing craft, which may have an effect on safety, should be approved by the Administration.*

14 *In developing this Code, it has been considered desirable to ensure that high-speed craft do not impose unreasonable demands on existing users of the environment or conversely suffer unnecessarily through lack of reasonable accommodation by existing users. Whatever burden of compatibility there is, it should not necessarily be laid wholly on the high-speed craft.*

15 *Paragraph 1.15.1 of the 1994 HSC Code states that it should be reviewed by the Organization at intervals preferably not exceeding 4 years to consider revision of existing requirements to take account of new developments in design and technology. Experience gained with the application of the 1994 HSC Code since it entered into force in 1996 has led to the recognition that it needed to be revised and updated. Subsequent work in the Organization has resulted in the development of the present Code to ensure that safety is not compromised as a result of continuous introduction of state-of-the-art technology and innovative developments into the new and generally much larger and faster high-speed craft.*

CHAPTER 1

GENERAL COMMENTS AND REQUIREMENTS

1.1 General comments

This Code shall be applied as a complete set of comprehensive requirements. It contains requirements for the design and construction of high-speed craft engaged on international voyages, the equipment which shall be provided and the conditions for their operation and maintenance. The basic aim of the Code is to set levels of safety which are equivalent to those of conventional ships required by the International Convention for the Safety of Life at Sea, 1974, as amended, (SOLAS Convention) and the International Convention on Load Lines, 1966, (Load Line Convention) by the application of constructional and equipment standards in conjunction with strict operational controls.

Note: Refer to MSC/Circ.652 on Application of the 1966 LL Convention to high-speed craft.

C1.1(a) The attention of Shipowners, Shipdesigners and Flag Administrations is drawn to the innovative aspects of designs of High Speed Craft.

The present Rules may need to be adapted to cover particular designs.

It is assumed as a condition precedent to classification that the craft are operated with professional care and normal prudent seamanship.

C1.1(b) Craft satisfying the requirements of these Rules are assigned the notation HSC or High Speed Craft.

1.2 General requirements

The application of the provisions of this Code is subject to the following general requirements that:

- .1** *the Code will be applied in its entirety;*
- .2** *the management of the company operating the craft exercises strict control over its operation and maintenance by a quality-management system*

Note: Refer to the International Safety Management (ISM) Code adopted by the Organization by resolution A.741(18), as may be amended.

- .3** *the management ensures that only persons qualified to operate the specific type of craft used on the intended route are employed;*

- .4** *the distances covered and the worst intended conditions in which high-speed craft operations are permitted will be restricted by the imposition of operational limits;*

- .5** *the craft will at all times be in reasonable proximity to a place of refuge, having due regard to the provisions of 1.3.4;*

- .6** *adequate communications facilities, weather forecasts and maintenance facilities are available within the area of craft operation;*

- .7** *in the intended area of operation suitable rescue facilities will be readily available;*

- .8** *areas of high fire risk, such as machinery spaces and special category spaces, are protected with fire-resistant materials and fire-extinguishing systems to ensure, as far as is practicable, containment and rapid extinguishing of fire;*

- .9** *efficient facilities are provided for the rapid and safe evacuation of all persons into survival craft;*

- .10** *all passengers and crew are provided with seats;*

- .11** *no enclosed sleeping berths for passengers are provided.*

C1.2 (a) With reference to 1.2.2, craft managed by companies operating with a Safety Management System complying with the Society Rules are assigned a special notation. To this effect, the relevant requirements of Chapters 18 and 19 are to be checked. This notation is entered in the Class Certificate and the Register Book.

C1.2 (b) The limitations on navigation indicated in 1.2.4 and 1.2.5 are subject to specific navigation/restriction notations in Society Rules.

1.3 Application

- 1.3.1** *This Code applies to high speed craft as specified in 1.3.4 engaged in international voyages the keels of which are laid or which are at a similar stage of construction on or after 1 July 2002.*

C1.3.1 In addition to the craft specified in 1.3.1, these Rules also apply to high speed craft engaged in national voyages. Exemptions from some of the requirements of the Rules may be granted when particular circumstances (e.g. restricted services) warrant this, in the opinion of the Society Head Office.

1.3.2 For the purpose of this Code, the term “a similar stage of construction” means the stage at which:

- .1** construction identifiable with a specific craft begins; and
- .2** assembly of that craft has commenced comprising at least 50 tonnes or three per cent of the estimated mass of all material used in the structure, including super-structure and deckhouse, whichever is less.

1.3.3 For the purpose of this Code:

- .1** the expression “craft constructed” means craft the keels of which are laid or which are at a similar stage of construction; and
- .2** a cargo craft, whenever built, which is converted to a passenger craft shall be treated as a passenger craft constructed on the date on which such a conversion commences.

1.3.4 This Code applies to:

- .1** passenger craft which do not proceed in the course of their voyage more than four hours at operational speed from a place of refuge; and
- .2** cargo craft of 500 gross tonnage and upwards which do not proceed in the course of their voyage more than 8 h at operational speed from a place of refuge when fully laden.

C1.3.4 In addition to the cargo craft specified in 1.3.4.2, these Rules also apply as far as appropriate to cargo craft of less than 500 tons gross tonnage.

1.3.5 This Code, unless expressly provided otherwise, does not apply to:

- .1** craft of war and troopcraft;
- .2** craft not propelled by mechanical means;
- .3** wooden craft of primitive build;
- .4** pleasure craft not engaged in trade; and
- .5** fishing craft.

C1.3.5 However, classification may be considered for craft referred to in 1, 2, 4 and 5 above.

1.3.6 This Code does not apply to craft solely navigating the Great Lakes of North America and the River St. Lawrence as far east as a straight line drawn from Cap des Rosiers to West Point, Anticosti Island and, on the north side of Anticosti Island, the 63rd meridian.

1.3.7 The application of this Code shall be verified by the Administration and be acceptable to the Governments of the States to which the craft will be operating.

C1.3.7 The Classification of a craft, or more generally any Society acts and decisions, do not absolve the interested parties from compliance with any additional and/or more stringent requirements issued by the Administration of the State whose flag the craft is entitled to fly, and provisions for their application.

1.4 Definitions

For the purpose of this Code, unless expressly provided otherwise, the terms used therein have the meanings defined in the following paragraphs. Additional definitions are given in the general parts of the various chapters.

1.4.1 “Administration” means the Government of the State whose flag the craft is entitled to fly.

1.4.2 “Air-cushion vehicle (ACV)” is a craft such that the whole or a significant part of its weight can be supported, whether at rest or in motion, by a continuously generated cushion of air dependent for its effectiveness on the proximity of the surface over which the craft operates.

1.4.3 “Anniversary date” means the day and the month of each year which will correspond to the date of expiry of the relevant certificate.

1.4.4 “Assembly station” is an area where passengers can be gathered in the event of an emergency, given instructions and prepared to abandon the craft, if necessary. The passenger spaces may serve as assembly stations if all passengers can be instructed there and prepared to abandon the craft.

1.4.5 “Auxiliary machinery spaces” are spaces containing internal combustion engines of power output up to and including 110 kW driving generators, sprinkler, drencher or fire pumps, bilge pumps, etc., oil filling stations, switchboards of aggregate capacity exceeding 800 kW, similar spaces and trunks to such spaces.

1.4.6 “Auxiliary machinery spaces having little or no fire risk” are spaces containing machinery such as refrigerating, stabilizing, ventilation and air conditioning machinery, switchboards of aggregate capacity 800 kW or less, similar spaces and trunks to such spaces.

1.4.7 “Base port” is a specific port identified in the route operational manual and provided with:

.1 appropriate facilities providing continuous radio communications with the craft at all times while in ports and at sea;

.2 means for obtaining a reliable weather forecast for the corresponding region and its due transmission to all craft in operation;

.3 for a category A craft, access to facilities provided with appropriate rescue and survival equipment; and

.4 access to craft maintenance services with appropriate equipment.

C1.4.7 It is the owner's responsibility to propose a base port to the Administration for approval.

1.4.8 “Base port State” means the State in which the base port is located.

1.4.9 “Breadth (B)” means breadth of the broadest part of the moulded watertight envelope of the rigid hull, excluding appendages, at or below the design waterline in the displacement mode with no lift or propulsion machinery active.

1.4.10 “Cargo craft” is any high-speed craft other than passenger craft, and which is capable of maintaining the main functions and safety systems of unaffected spaces, after damage in any one compartment on board.

1.4.11 “Cargo spaces” are all spaces other than special category spaces and ro-ro spaces used for cargo and trunks to such spaces. For the purposes of Chapter 7, part D, “cargo spaces” include ro-ro spaces, special category spaces and open deck spaces.

1.4.12 “Category A craft” is any high-speed passenger craft:

.1 operating on a route where it has been demonstrated to the satisfaction of the flag and port States that there is a high probability that in the event of an evacuation at any point of the route, all passengers and crew can be rescued safely within the least of:

- the time to prevent persons in survival craft from exposure causing hypothermia in the worst intended conditions,
- the time appropriate with respect to environmental conditions and geographical features of the route, or
- 4 hours; and

.2 carrying not more than 450 passengers.

1.4.13 “Category B craft” is any high-speed passenger craft other than a category A craft, with machinery and safety systems arranged such that, in the event of any essential machinery and safety systems in any one compartment being disabled, the craft retains the capability to navigate safely. The damage scenarios considered in chapter 2 should not be inferred in this respect.

C1.4.13 With reference to 1.4.13, the term “navigate safely” means that the craft can reach the port of refuge within the period of weather forecast validity.

1.4.14 “Company” means the company as defined in chapter IX of the Convention.

1.4.15 “Continuously manned control station” is a control station which is continuously manned by a responsible member of the crew while the craft is in normal service.

1.4.16 “Control stations” are those spaces in which the craft's radio or navigating equipment or the emergency source of power and emergency switchboard are located, or where the fire recording or fire control equipment is centralized, or where other functions essential to the safe operation of the craft such as propulsion control, public address, stabilization systems, etc., are located.

1.4.17 “Convention” means the International Convention for the Safety of Life at Sea, 1974, as amended.

1.4.18 “Crew accommodation” are those spaces allocated for the use of the crew, and include cabins, sick bays, offices, lavatories, lounges and similar spaces.

1.4.19 “Critical design conditions” means the limiting specified conditions, chosen for design purposes, which the craft shall keep in displacement mode. Such conditions shall be more severe than the “worst intended conditions” by a suitable margin to provide for adequate safety in the survival condition.

1.4.20 “Datum” means a watertight deck or equivalent structure of a non-watertight deck covered by a weathertight structure of adequate strength to maintain the weathertight integrity and fitted with weathertight closing appliances.

1.4.21 “Design waterline” means the waterline corresponding to the maximum operational weight of the craft with no lift or propulsion machinery active and is limited by the requirements of chapters 2 and 3.

1.4.22 “Displacement mode” means the regime, whether at rest or in motion, where the weight of the craft is fully or predominantly supported by hydrostatic forces.

1.4.23 “Failure Mode and Effect Analysis (FMEA)” is an examination, in accordance with annex 4, of the craft’s system and equipment to determine whether any reasonably probable failure or improper operation can result in a hazardous or catastrophic effect.

1.4.24 “Fire Test Procedures Code (FTP Code)” means the International Code for Application of Fire Test Procedures, as defined in chapter II-2 of the Convention.

1.4.25 “Flap” means an element formed as integrated part of, or an extension of, a foil, used to adjust the hydrodynamic or aerodynamic lift of the foil.

1.4.26 “Flashpoint” means a flashpoint determined by a test using the closed-cup apparatus referenced in the International Maritime Dangerous Goods (IMDG) Code.

1.4.27 “Foil” means a profiled plate or three dimensional construction at which hydrodynamic lift is generated when the craft is under way.

1.4.28 “Fully submerged foil” means a foil having no lift components piercing the surface of the water in the foil-borne mode.

1.4.29 “Galleys” are those enclosed spaces containing cooking facilities with exposed heating surfaces, or which have any cooking or heating appliances each having a power of more than 5 kW.

1.4.30 “High-speed craft” is a craft capable of maximum speed, in metres per second (m/s), equal to or exceeding:

$$3.7 \nabla^{0.1667}$$

where:

∇ : volume of displacement corresponding to the design waterline (m³)

excluding craft the hull of which is supported completely clear above the water surface in non-displacement mode by aerodynamic forces generated by ground effect.

1.4.31 “Hydrofoil craft” is a craft the hull of which is supported completely clear above the water surface in non-displacement mode by hydrodynamic forces generated on foils.

1.4.32 “Length (L)” means the overall length of the underwater watertight envelope of the rigid hull, excluding appendages, at or below the design waterline in the displacement mode with no lift or propulsion machinery active.

1.4.33 “Lightweight” is the displacement of the craft in tonnes without cargo, fuel, lubricating oil, ballast water, fresh water and feedwater in tanks, consumable stores, passengers and crew and their effects.

1.4.34 “Life-Saving Appliances Code (LSA Code)” means the International Life-Saving Appliance Code as defined in chapter III of the Convention.

1.4.35 “Machinery spaces” are spaces containing internal combustion engines with aggregate total power output of more than 110 kW, generators, oil fuel units, propulsion machinery, major electrical machinery and similar spaces and trunks to such spaces.

1.4.36 “Maximum operational weight” means the overall weight up to which operation in the intended mode is permitted by the Administration.

1.4.37 “Maximum speed” is the speed achieved at the maximum continuous propulsion power for which the craft is certified at maximum operational weight and in smooth water.

1.4.38 “Non-displacement mode” means the normal operational regime of a craft when non-hydrostatic forces substantially or predominantly support the weight of the craft.

1.4.39 “Oil fuel unit” includes any equipment for the preparation of oil fuel and delivery of oil fuel, heated or not, to boilers and engines (including gas turbines) at a pressure of more than 0,18 N/mm².

1.4.40 “Open ro-ro spaces” are those ro-ro spaces:

.1 to which any passengers carried have access; and

.2 either:

.2.1 are open at both ends; or

.2.2 have an opening at one end and are provided with permanent openings distributed in the side plating or deckhead or from above, having a total area of at least 10% of the total area of the space sides.

1.4.41 “Operating limitations” means the craft limitations in respect of handling, controllability and performance and the craft operational procedures within which the craft is to operate.

1.4.42 “Operating compartment” means the enclosed area from which the navigation and control of the craft is exercised.

1.4.43 “Operating station” means a confined area of the operating compartment equipped with necessary means for navigation, manoeuvring and communication, and from where the functions of navigating, manoeuvring, communication, commanding, conning and lookout are carried out.

1.4.44 “Operational speed” is 90% of maximum speed.

1.4.45 “Organization” means the International Maritime Organization.

1.4.46 “Passenger” is every person other than:

.1 the master and members of the crew or other persons employed or engaged in any capacity on board a craft on the business of that craft; and

.2 a child under one year of age.

1.4.47 “Passenger craft” is a craft which carries more than twelve passengers.

1.4.48 “Place of refuge” is any naturally or artificially sheltered area which may be used as a shelter by a craft under conditions likely to endanger its safety.

1.4.49 “Public spaces” are those spaces allocated for the passengers and include bars, refreshment kiosks, smoke rooms, main seating areas, lounges, dining rooms, recreation rooms, lobbies, lavatories and similar spaces, and may include sales shops.

1.4.50 “Refreshment kiosks” are those spaces which are not enclosed, serving refreshments and containing food warming equipment having a total power of 5 kW or less and with an exposed heating surface temperature not above 150 °C.

1.4.51 “Ro-ro craft” is a craft fitted with one or more ro-ro spaces.

1.4.52 “Ro-ro spaces” are spaces not normally subdivided in any way and normally extending to either a substantial length or the entire length of the craft in which motor vehicles with fuel in their tanks for their own propulsion and/or goods (packaged or in bulk, in or on rail or road cars, vehicles (including road or rail tankers), trailers, containers, pallets, demountable tanks or in or on similar stowage units or other receptacles) can be loaded and unloaded, normally in a horizontal direction.

1.4.53 “Service spaces” are those enclosed spaces used for pantries containing food warming equipment but no cooking facilities with exposed heating surfaces, lockers, sales shops, store-rooms and enclosed baggage rooms.

1.4.54 “Significant wave height” is the average height of the one third highest observed wave heights over a given period.

1.4.55 “Special category spaces” are those enclosed ro-ro spaces to which passengers have access. Special category spaces may be accommodated on more than one deck provided that the total overall clear height for vehicles does not exceed 10 m.

1.4.56 “Surface-effect ship” (SES) is an air-cushion vehicle whose cushion is totally or partially retained by permanently immersed hard structures.

1.4.57 “Transitional mode” means the regime between displacement and non-displacement modes.

1.4.58 “Watertight” in relation to a structure means capable of preventing the passage of water through the structure in any direction under the head of water likely to occur in the intact or damaged condition.

1.4.59 “Weather deck” is a deck which is completely exposed to the weather from above and from at least two sides.

1.4.60 “Weathertight” means that water will not penetrate into the craft in any wind and wave conditions up to those specified as critical design conditions.

1.4.61 “Worst intended conditions” means the specified environmental conditions within which the intentional operation of the craft is provided for in the certification of the craft. This shall take into account parameters such as the worst conditions of wind force allowable, significant wave height (including unfavourable combinations of length and direction of waves), minimum air temperature, visibility and depth of water for safe operation and such other parameters as the Administration may require in considering the type of craft in the area of operation.

C1.4.62 “Approved type” means the status conferred by the Society on a particular and clearly identified material, item of equipment or process, shown by design assessment to meet all the stipulations of Society Rules for the specified application(s).

C1.4.63 “Small waterplane area twin hull” (SWATH) is a craft for which the weight is substantially supported by a submerged twin hull connected to the emerging part of the craft by struts with a small waterplane area.

1.5 Surveys

1.5.1 Each craft shall be subject to the surveys specified below:

.1 an initial survey before the craft is put in service or before the Certificate is issued for the first time;

.2 a renewal survey at intervals specified by the Administration but not exceeding 5 years except where 1.8.5 or 1.8.10 is applicable;

.3 a periodical survey within three months before or after each anniversary date of the Certificate; and

.4 an additional survey as the occasion arises.

C1.5.1 For the purpose of Classification, the renewal (special) survey and periodical (annual) survey include a bottom survey in dry condition.

Other surveys (e.g. tailshaft surveys, boiler surveys, surveys of additional class notations) are required according to Society Rules.

1.5.2 The surveys referred to in 1.5.1 shall be carried out as follows:

.1 the initial survey shall include:

.1.1 an appraisal of the assumptions made and limitations proposed in relation to loadings, environment, speed and manoeuvrability;

.1.2 an appraisal of the data supporting the safety of the design, obtained, as appropriate, from calculations, tests and trials;

.1.3 a failure mode and effect analysis as required by this Code;

.1.4 an investigation into the adequacy of the various manuals to be supplied with the craft; and

.1.5 a complete inspection of the structure, safety equipment, radio installations and other equipment, fittings, arrangements and materials to ensure that they comply with the requirements of the Code, are in satisfactory condition and are fit for the service for which the craft is intended;

.2 the renewal and periodical surveys shall include a complete inspection of the structure, including the outside of the craft's bottom and related items, safety equipment, radio installations and other equipment as referred to in 1.5.2.1 to ensure that they comply with the requirements of the Code, are in satisfactory condition and are fit for the service for which the craft is intended. The inspection of the craft's bottom shall be conducted with the craft out of the water under suitable conditions for close-up examination of any damaged or problem areas; and

.3 an additional survey, either general or partial according to the circumstances, shall be made after a repair resulting from investigations prescribed in 1.7.3, or wherever any important repairs or renewals are made. The survey shall be such as to ensure that the necessary repairs or renewals have been effectively made, that the material and workmanship of such repairs or renewals are in all respects satisfactory, and that the craft complies in all respects with the requirements of the Code.

C1.5.2 (a) With reference to 1.5.2.1.4, for classification, also refer to manuals required by it.

C1.5.2 (b) With reference to 1.5.2.1.5, for classification, refer to Society Rules.

C1.5.2 (c) With reference to 1.5.2.2, for classification, the periodical (annual) survey consists in a complete inspection of external and accessible parts of the structure.

C1.5.2 (d) With reference to 1.5.2.3, as regards the classification, such additional surveys also apply to any other circumstances liable to affect classification of the craft. Relevant inspections are to ensure that the necessary repairs/replacements are satisfactory for the purpose of classification.

All surveys are to be made by Society Surveyors at the request of the Owner.

1.5.3 The periodical surveys referred to in 1.5.1.3 shall be endorsed on the High-Speed Craft Safety Certificate.

C1.5.3 Procedures for issue or endorsement of classification certificates are stipulated in Society Rules.

1.5.4 The inspection and survey of the craft, so far as regards the enforcement of the provisions of the Code, shall be carried out by officers of the Administration. The Administration may, however, entrust the inspections and surveys either to surveyors nominated for the purpose or to organizations recognized by it.

1.5.5 An Administration nominating surveyors or recognizing organizations to conduct inspections and surveys as set forth in 1.5.4 shall, as a minimum, empower any nominated surveyor or recognized organization to:

.1 require repairs to a craft; and

.2 carry out inspections and surveys if requested by the appropriate authorities of a port State.

The Administration shall notify the Organization of the specific responsibilities and conditions of the authority delegated to nominated surveyors or recognized organizations.

1.5.6 When a nominated surveyor or recognized organization determines that the condition of the craft or its equipment does not correspond substantially with the particulars of the Certificate or is such that the craft is not fit to operate without danger to the craft or persons on board, the surveyor or organization shall immediately ensure that corrective action is taken and shall, in due course, notify the Administration. If such corrective action is not taken, the Certificate shall be withdrawn and the Administration shall be notified immediately; and, if the craft is in an area under the jurisdiction of another Government, the appropriate authorities of the port State shall be notified immediately. When an officer of the Administration, a nominated surveyor or a recognized organization has notified the appropriate authorities of the port State, the Government of the port State concerned shall give such officer, surveyor or organization any necessary assistance to carry out their obligations under this section. When applicable, the Government of the port State concerned shall ensure that the craft shall not continue to operate until it can do so without danger to the craft or the persons on board.

C1.5.6 With reference to 1.5.6, conditions for validity of class of craft are stipulated in the Society's Rules.

1.5.7 In every case, the Administration shall fully guarantee the completeness and efficiency of the inspection and survey, and shall undertake to ensure the necessary arrangements to satisfy this obligation.

1.6 Approvals

The owner of a craft shall accept the obligation to supply sufficient information to enable the Administration to fully assess the features of the design. It is strongly recommended that the Company and the Administration and, where appropriate, the port State or States shall commence discussions at the earliest possible stage so that the Administration may fully evaluate the design in determining what additional or alternative requirements shall be applied to the craft, to achieve the required level of safety.

C1.6.1 Conditions of design review of the craft, for classification purposes, are stipulated in the Society's Rules.

1.7 Maintenance of conditions after survey

1.7.1 The condition of the craft and its equipment shall be maintained to conform with the provisions of this Code to ensure that the craft in all respects will remain fit to operate without danger to the craft or the persons on board.

C1.7.1 With reference to 1.7.1, the above responsibility lies with the Owner of the craft (or his representative).

1.7.2 After any survey of the craft under section 1.5 has been completed, no change shall be made to structure, equipment, fittings, arrangements and materials covered by the survey, without the sanction of the Administration.

1.7.3 Whenever an accident occurs to a craft or a defect is discovered, either of which affects the safety of the craft or the efficiency or completeness of structure, equipment, fittings, arrangements and materials, the person in charge or owner of the craft shall report at the earliest opportunity to the Administration, the nominated surveyor or recognized organization responsible, who shall cause investigations to be initiated to determine whether a survey, as required by section 1.5, is necessary. If the craft is in an area under the jurisdiction of another Government, the person in charge or the owner shall also report immediately to the appropriate authorities of the port State and the nominated surveyor or recognized organization shall ascertain that such a report has been made.

C1.7.3 With reference to 1.7.2 and 1.7.3, it is the Owner's responsibility to inform the Society of any modification, damage or repair affecting the class of the craft.

1.8 High-Speed Craft Safety Certificate

1.8.1 A Certificate called a High-Speed Craft Safety Certificate is issued after completion of an initial or renewal survey to a craft which complies with the requirements of the Code. The Certificate shall be issued or endorsed either by the Administration or by any person or organization recognized by it. In every case, that Administration assumes full responsibility for the Certificate.

1.8.2 A Contracting Government to the Convention may, at the request of the Administration, cause a craft to be surveyed and, if satisfied that the requirements of the Code are complied with, shall issue or authorise the issue of a Certificate to the craft and, where appropriate, endorse or authorise the endorsement of a Certificate on the craft in accordance with the Code. Any Certificate so issued shall contain a statement to the effect that it has been issued at the request of the Government of the State the flag of which the craft is entitled to fly, and it shall have the same force and receive the same recognition as a Certificate issued under 1.8.1.

1.8.3 The Certificate shall be that of the model given in the annex 1 to the Code. If the language used is not English, French or Spanish, the text shall include a translation into one of these languages.

1.8.4 The High-Speed Craft Safety Certificate shall be issued for a period specified by the Administration which shall not exceed 5 years.

1.8.5 Notwithstanding the requirements of 1.8.4, when the renewal survey is completed within three months before the expiry date of the existing Certificate, the new Certificate shall be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of expiry of the existing Certificate.

1.8.6 When the renewal survey is completed after the expiry date of the existing Certificate, the new Certificate shall be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of expiry of the existing Certificate.

1.8.7 When the renewal survey is completed more than 3 months before the expiry date of the existing Certificate, the new Certificate shall be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of completion of the renewal survey.

1.8.8 If a Certificate is issued for a period of less than 5 years, the Administration may extend the validity of the Certificate beyond the expiry date to the maximum period specified in 1.8.4, provided that the surveys when a Certificate is issued for a period of 5 years are carried out.

1.8.9 If a renewal survey has been completed and a new Certificate cannot be issued or placed on board the craft before the expiry date of the existing Certificate, the person or organization authorized by the Administration may endorse the existing Certificate and such a Certificate shall be accepted as valid for a further period which shall not exceed 5 months from the expiry date.

1.8.10 If a craft, at the time when a Certificate expires, is not in the place in which it is to be surveyed, the Administration may extend the period of validity of the Certificate but this extension shall be granted only for the purpose of allowing the craft to proceed to the place in which it is to be surveyed, and then only in cases where it appears proper and reasonable to do so. No Certificate shall be extended for a period longer than one month, and a craft to which an extension is granted shall not, on its arrival in the place in which it is to be surveyed, be entitled by virtue of such extension to leave that place without having a new Certificate. When the renewal survey is completed, the new Certificate shall be valid to a date not exceeding 5 years from the date of expiry of the existing Certificate before the extension was granted.

1.8.11 In special circumstances, as determined by the Administration, a new Certificate need not be dated from the date of expiry of the existing Certificate as required by 1.8.6 or 1.8.10. In these circumstances, the new Certificate shall be valid to a date not exceeding 5 years from the date of completion of the renewal survey.

1.8.12 If a periodical survey is completed before the period specified in section 1.5 then:

.1 the anniversary date shown on the relevant Certificate shall be amended by endorsement to a date which shall not be more than 3 months later than the date on which the survey was completed;

.2 the subsequent periodical survey required by section 1.5 shall be completed at the intervals prescribed by 1.5 using the new anniversary date; and

.3 the expiry date may remain unchanged provided one or more periodical surveys are carried out so that the maximum intervals between the surveys prescribed by 1.5.1.3 are not exceeded;

1.8.13 A Certificate issued under 1.8.1 or 1.8.2 shall cease to be valid in any of the following cases:

.1 if the relevant surveys are not completed within the periods specified in 1.5.1;

.2 if the Certificate is not endorsed in accordance with 1.5.3;

.3 upon transfer of the craft to the flag of another State. A new Certificate shall only be issued when the Government issuing the new Certificate is fully satisfied that the craft is in compliance with the requirements of 1.7.1 and 1.7.2. In the case of a transfer between Governments that are Contracting Governments to the Convention if requested within 3 months after the transfer has taken place, the Government of the State whose flag the craft was formerly entitled to fly shall, as soon as possible, transmit to the Administration a copy of the Certificate carried by the craft before the transfer and, if available, copies of the relevant survey reports.

C1.8.13 With reference to 1.8.13.2, for classification purpose, the Society's Rules apply.

Conditions for validity of class are stipulated in the Society's Rules.

1.8.14 The privileges of the Code may not be claimed in favour of any craft unless it holds a valid Certificate.

1.9 Permit to Operate High-Speed Craft

1.9.1 The craft shall not operate commercially unless a Permit to Operate High-Speed Craft is issued and valid in addition to the High-Speed Craft Safety Certificate. Transit voyage without passengers or cargo may be undertaken without the Permit to Operate High-Speed Craft.

1.9.2 The Permit to Operate High-Speed Craft shall be issued by the Administration to certify compliance with 1.2.2 to 1.2.7 and stipulate conditions of the operation of the craft and drawn up on the basis of the information contained in the route operational manual specified in chapter 18 of this Code.

1.9.3 Before issuing the Permit to Operate, the Administration shall consult with each port State to obtain details of any operational conditions associated with operation of the craft in that State. Any such conditions imposed shall be shown by the Administration on the Permit to Operate and included in the route operational manual.

1.9.4 A port State may inspect the craft and audit its documentation for the sole purpose of verifying its compliance with the matters certified by and conditions associated with the Permit to Operate. Where deficiencies are shown by such an audit, the Permit to Operate ceases to be valid until such deficiencies are corrected or otherwise resolved.

1.9.5 The provisions of 1.8 shall apply to the issue and the period of validity of the Permit to Operate High-Speed Craft.

1.9.6 The Permit to Operate High-Speed Craft shall be that of the model given in annex 2 to this Code. If the language used is not English, French or Spanish, the text shall include a translation into one of these languages.

1.10 Control

1.10.1 The provisions of regulation I/19 of the Convention shall be applied to include the Permit to Operate High-Speed Craft in addition to the Certificate issued under 1.8.

1.11 Equivalents

1.11.1 Where this Code requires that a particular fitting, material, appliance or apparatus, or type thereof, shall be fitted or carried in a craft, or that any particular provision shall be made, the Administration may allow any other fitting, material, appliance or apparatus, or type thereof, to be fitted or carried, or any other provision to be made in the craft, if it is satisfied by trial thereof or otherwise that such fitting, material, appliance or apparatus, or type thereof, or provision, is at least as effective as that required by this Code.

C1.11.1 With reference to 1.11.1, for classification purpose, the Society's Rules apply.

1.11.2 Where compliance with any of the requirements of this Code would be impractical for the particular designs of the craft, the Administration may substitute those with alternative requirements provided that equivalent safety is achieved. The Administration which allows any such substitution shall communicate to the Organization particulars of these substitutions and the reasons therefore, which the Organization shall circulate to its Member Governments for their information.

1.12 Information to be made available

1.12.1 The Administration shall ensure that the management of the company operating the craft has provided the craft with adequate information and guidance in the form of manuals to enable the craft to be operated and maintained safely. These manuals shall include a route operational manual, craft operating manual, maintenance manual and servicing schedule. Such information shall be updated as necessary.

1.12.2 The manuals shall contain at least the information specified in chapter 18, and shall be in a language understood by the crew. Where this language is not English, a translation into English shall be provided of at least the route operational manual and the craft operating manual.

C1.12 With reference to 1.12, the operating manual is to be considered as a class matter.

1.13 Further developments

1.13.1 It is recognized that there is much ongoing research and development in the design of high-speed craft and that new types may emerge which have different geometry to that envisaged during the formulation of this Code. It is important that this Code does not restrict this progress and the development of new designs.

1.13.2 A design may be produced which cannot comply with the provisions of this Code. In such a case the Administration shall determine the extent to which the provisions of the Code are applicable to the design and, if necessary, develop additional or alternative requirements to provide an equivalent level of safety for the craft.

1.13.3 The foregoing shall be considered by the Administration when assessing the granting of equivalents under the Code.

1.14 *Circulation of safety information*

1.14.1 *In the event that an Administration has cause to investigate an accident involving a craft to which this Code applies, that Administration shall provide a copy of the official report to the Organization, which will invite Member States to note the existence of the report and to obtain a copy.*

1.14.2 *In the event that operational experience reveals structural or equipment failures affecting the safety of a design, craft owners shall inform the Administration.*

1.15 *Review of the code*

1.15.1 *The Code shall be reviewed by the Organization at intervals preferably not exceeding four years to consider revision of existing requirements to take account of new developments in design and technology.*

1.15.2 *Where a new development in design and technology has been found acceptable to an Administration, that Administration may submit particulars of such development to the Organization for consideration for incorporation into the Code during periodical review.*

CHAPTER 2

BUOYANCY, STABILITY AND SUBDIVISION

Part A General

C2.0 Documents to be submitted

C2.0.1 The following drawings and documents are to be submitted in triplicate for approval where appropriate (in A4-size where possible). The Society reserves the right to ask for supplementary copies if deemed necessary in particular cases.

- .1 Hull, plotted and numerically;
- .2 Side contour, plotted and numerically;
- .3 Coordinates of non-watertight and non-weather-tight openings;
- .4 Hydrostatic tables;
- .5 Cross curve tables;
- .6 Data of boundaries of all subcompartments and a plan in which these compartments are stated;
- .7 Damage stability investigation, complete input and output data including initial loading conditions;
- .8 Damage control plan;
- .9 Inclining test report;
- .10 Intact stability booklet.

C2.0.2 Further documentation may be required if deemed necessary by the Society.

2.1 General

2.1.1 A craft shall be provided with:

- .1 *stability characteristics and stabilization systems adequate for safety when the craft is operated in the non-displacement mode and during the transitional mode;*
- .2 *buoyancy and stability characteristics adequate for safety where the craft is operated in the displacement mode, both in the intact condition and the damaged condition; and*
- .3 *stability characteristics in the non-displacement and transitional modes adequate to transfer the craft*

safely to displacement mode in case of any system malfunction.

2.1.2 *Account shall be taken of the effect of icing in the stability calculations. An example of established practice for ice accretion allowances is given in annex 5 for the guidance of the Administration.*

2.1.3 *For the purpose of this and other chapters, unless expressly defined otherwise, the following definitions apply:*

.1 *“Downflooding point” means any opening through which flooding of the spaces which comprise the reserve buoyancy could take place while the craft is in the intact or damaged condition, and inclines to an angle past the angle of equilibrium.*

.2 *“Fully submerged foil” means a foil having no lift components piercing the surface of the water in the foil-borne mode.*

.3 *“Monohull craft” means any craft which is not a multihull craft.*

.4 *“Multihull craft” means a craft which in any normally achievable operating trim or heel angle, has a rigid hull structure which penetrates the surface of the sea over more than one discrete area.*

.5 *“Permeability” of a space means the percentage of the volume of that space which can be occupied by water.*

.6 *“Skirt” means a downwardly extending, flexible structure used to contain or divide an air cushion.*

2.1.4 *Other means of demonstrating compliance with the requirements of any part of this Chapter may be accepted, provided that the method chosen can be shown to provide an equivalent level of safety. Such methods may include:*

- .1 *mathematical simulation of dynamic behaviour;*
- .2 *scale model testing; and*
- .3 *full-scale trials.*

2.1.5 *Model or full-scale tests and/or calculations (as appropriate) shall also include consideration of the following known stability hazards to which high-speed craft are known to be liable, according to craft type:*

.1 *directional instability, which is often coupled to roll and pitch instabilities;*

.2 *broaching and bow diving in following seas at speeds near to wave speed, applicable to most types;*

.3 *bow diving of planing monohulls and catamarans due to dynamic loss of longitudinal stability in relatively calm seas;*

.4 *reduction in transverse stability with increasing speed of monohulls;*

.5 *porpoising of planing monohulls, being coupled pitch and heave oscillations, which can become violent;*

.6 *chine tripping, being a phenomenon of planing monohulls occurring when the immersion of a chine generates a strong capsizing moment;*

.7 *plough-in of air-cushion vehicles, either longitudinal or transverse, as a result of bow or side skirt tuck-under or sudden collapse of skirt geometry, which, in extreme cases, can result in capsize;*

.8 *pitch instability of SWATH (small waterplane area twin hull) craft due to the hydrodynamic moment developed as a result of the water flow over the submerged lower hulls;*

.9 *reduction in effective metacentric height (roll stiffness) of surface effect ship (SES) in high speed turns compared to that on a straight course, which can result in sudden increases in heel angle and/or coupled roll and pitch oscillations; and*

.10 *resonant rolling of SES in beam seas, which, in extreme cases, can result in capsize.*

2.1.6 *Suitable calculations shall be carried out and/or tests conducted to demonstrate that, when operating within approved operational limitations, the craft will, after a disturbance causing roll, pitch, heave or heel due to turning or any combination thereof, return to the original attitude.*

C2.1.7 Number and location of bulkheads

.1 At least the following watertight bulkheads are to be fitted in all craft:

- one collision bulkhead,
- one afterpeak bulkhead,
- one bulkhead at each end of the machinery space.

.2 The distance, in m, of the collision bulkhead from the forward perpendicular is to be between $0,05 L$ and $0,05 L + 3$.

.3 The collision bulkhead is to be fitted at least in places used for providing the reserve of buoyancy used for proving compliance with the intact and damage stability requirements of the present HSC Rules. The collision bulkhead is to extend vertically up to 0,5 of the worst intended significant wave height above the most unfavourable damage waterline.

2.2 Intact buoyancy and watertight and weathertight integrity

2.2.1 Intact buoyancy

2.2.1.1 All craft shall have a sufficient reserve of buoyancy at the design waterline to meet the intact and damage stability requirements of this chapter. The Administration may require a larger reserve of buoyancy to permit the craft to operate in any of its intended modes. This reserve of buoyancy shall be calculated by including only those compartments that are:

.1 watertight and situated below the datum, or watertight or weathertight and situated above the datum.

In considering the stability after damage, flooding shall be assumed to occur until limited by watertight boundaries in the equilibrium condition, and weathertight boundaries in intermediate stages of flooding and within the range of positive righting lever required to satisfy the residual stability requirements.

Craft built in conformity with the requirements of organizations recognised by the Administration, in accordance with regulation XI/1 of the Convention may be considered to possess adequate strength and integrity.

2.2.1.2 Arrangements shall be provided for checking the watertight or weathertight integrity of those compartments taken into account in 2.2.1.1, and the details incorporated in the Craft Operating Manual required by 18.2.1.

2.2.2 Openings in watertight divisions

2.2.2.1 The number of openings in watertight bulkheads shall be reduced to the minimum compatible with the design and proper working of the craft, and all such doors shall be closed prior to departure of the craft from the berth.

2.2.2.2 Doors in watertight bulkheads may be hinged or sliding. They shall be shown by suitable testing to be capable of maintaining the watertight integrity of the bulkhead. Such testing shall be carried out for both sides of the door and shall apply a pressure head 10% greater than

that determined from the minimum permissible height of a downflooding opening. Testing may be carried out either before or after the door is fitted into the craft but, where shore testing is adopted, satisfactory installation in the craft shall be verified by inspection and hose testing.

2.2.2.3 Type approval may be accepted in lieu of testing individual doors, provided the approval process includes pressure testing to a head equal to, or greater, than the required head (refer to 2.2.2.2).

2.2.2.4 All watertight doors shall be capable of being operated when the craft is inclined up to 15°, and shall be fitted with means of indication in the operating compartment showing whether they are open or closed. All such doors shall be capable of being opened and closed locally from each side of the bulkhead.

2.2.2.5 Watertight doors shall remain closed when the craft is at sea, except that they may be opened for access. A notice shall be attached to each door to the effect that it is not to be left open.

2.2.2.6 Watertight doors shall be capable of being closed by remote control from the operating compartment in not less than 20 s and not more than 40 s, and shall be provided with an audible alarm, distinct from other alarms in the area, which will sound for at least 5 s but no more than 10 s before the doors begin to move whenever the door is closed remotely by power, and continue sounding until the door is completely closed. The power, control and indicators shall be operable in the event of main power failure, as required by regulation II-1/15.7.3 of the Convention. In passenger areas and areas where the ambient noise exceeds 85 dB(A) the audible alarm shall be supplemented by an intermittent visual signal at the door. If the Administration is satisfied that such doors are essential for the safe work of the craft, hinged watertight doors having only local control may be permitted for areas to which crew only have access, provided they are fitted with remote indicators as required by 2.2.2.4.

2.2.2.7 Where pipes, scuppers, electric cables, etc. are carried through watertight divisions, the arrangements for creating a watertight penetration shall be of a type which has been prototype tested under hydrostatic pressure equal to or greater than that required to be withstood for the actual location in the craft in which they are to be installed. The test pressure shall be maintained for at least 30 min and there must be no leakage through the penetration arrangement during this period. The test pressure head shall be 10% greater than that determined from the minimum permissible height of a downflooding opening. Watertight bulkhead penetrations which are effected by continuous welding do not require prototype testing. Valves on scuppers from weathertight compartments, included in the stability calculations, shall have arrangements for remote closing from the operating station.

2.2.2.8 Where a ventilation trunk forms part of a watertight boundary, the trunk shall be capable of withstanding the water pressure that may be present taking into account the maximum inclination angle allowable during all stages of flooding.

C.2.2.2.9 No doors, manholes, or access openings are generally permitted in the collision bulkhead below the datum. The society may authorize a single manhole in the collision bulkhead, in each hull for catamaran, if deemed necessary.

2.2.3 Inner bow doors

2.2.3.1 Where ro-ro craft are fitted with bow loading openings, an inner bow door shall be fitted abaft such openings, to restrict the extent of flooding in the event of failure of the outer closure. This inner bow door, where fitted, shall be:

- .1** weathertight to the deck above, which deck shall itself be weathertight forward to the bow loading opening;
- .2** so arranged as to preclude the possibility of a bow loading door causing damage to it in the case of damage to, or detachment of, the bow loading door;
- .3** forward of all positions on the vehicle deck in which vehicles are intended to be carried; and
- .4** part of a boundary designed to prevent flooding into the remainder of the craft.

2.2.3.2 A craft shall be exempted from the requirement for such an inner bow door where one of the following applies:

- .1** the vehicle loading deck at the inner bow door position is above the design waterline by a height more than the significant wave height corresponding to the worst intended conditions;
- .2** it can be demonstrated using model tests or mathematical simulations that when the craft is proceeding at a range of speeds up to the maximum attainable speed in the loaded condition at all headings in long crested seas of the greatest significant wave height corresponding to the worst intended conditions, either:
 - .1** the bow loading door is not reached by waves; or
 - .2** having been tested with the bow loading door open to determine the maximum steady state volume of water which accumulates, it can be shown by static analysis that, with the same volume of water on the vehicle deck(s) the residual stability requirements of 2.6.11 and 2.13 or 2.15 are satisfied. If the model tests or mathematical simulations are unable to show that the

volume of water accumulated reaches a steady state, the craft shall be considered not to have satisfied the conditions of this exemption.

Where mathematical simulations are employed they shall already have been verified against full-scale or model testing;

.3 bow loading openings lead to open ro-ro spaces provided with guard-rails or having freeing ports complying with 2.2.3.2.4;

.4 the deck of the lowest ro-ro space above the design waterline is fitted on each side of the deck with freeing ports evenly distributed along the sides of the compartment. These shall either be proven to be acceptable using tests according to 2.2.3.2.2 above or comply with the following:

- .1** $A \geq 0.3\ell$
where:
 A : the total area of freeing ports on each side of the deck in m^2 ;
 ℓ : the length of the compartment in m;
- .2** the craft shall maintain a residual freeboard to the deck of the ro-ro space of at least 1 m in the worst condition;
- .3** such freeing ports shall be located within the height of 0.6 m above the deck of the ro-ro space, and the lower edge of the ports shall be within 0.02 m above the deck of the ro-ro space; and
- .4** such freeing ports shall be fitted with closing devices or flaps to prevent water entering the deck of the ro-ro space whilst allowing water which may accumulate on the deck of the ro-ro space to drain.

2.2.4 Other provisions for ro-ro craft

2.2.4.1 All accesses in the ro-ro space that lead to spaces below the deck shall have a lowest point which is not less than the height required from the tests conducted according to 2.2.3.2.2 or 3 m above the design waterline.

2.2.4.2 Where vehicle ramps are installed to give access to spaces below the deck of the ro-ro space, their openings shall be capable of being closed weathertight to prevent ingress of water below.

2.2.4.3 Accesses in the ro-ro space that lead to spaces below the ro-ro deck and having a lowest point which is less than the height required from the tests conducted according to 2.2.3.2.2 or 3 m above the design waterline may be permitted provided they are watertight and are closed before the craft leaves the berth on any voyage and remain closed until the craft is at its next berth.

2.2.4.4 The accesses referred to in 2.2.4.2 and 2.2.4.3 above shall be fitted with alarm indicators in the operating compartment.

2.2.4.5 Special category spaces and ro-ro spaces shall be patrolled or monitored by effective means, such as television surveillance, so that any movement of vehicles in adverse weather conditions and unauthorised access by passengers thereto can be detected whilst the craft is under-way (refer to 7.8.3.1).

2.2.5 Indicators and surveillance

2.2.5.1 Indicators

Indicators shall be provided in the operating compartment for all shell doors, loading doors and other closing appliances which, if left open or not properly secured, could lead to major flooding in the intact and damage conditions. The indicator system shall be designed on the fail-safe principle and shall show by visual alarms if the door is not fully closed or if any of the securing arrangements are not in place and fully locked, and by audible alarms if such door or closing appliance becomes open or the securing arrangements become unsecured. The indicator panel in the operating compartment shall be equipped with a mode selection function "harbour/sea voyage" so arranged that an audible alarm is given in the operating compartment if the craft leaves harbour with the bow doors, inner doors, stern ramp or any other side shell doors not closed or any closing device not in the correct position. The power supply for the indicator systems shall be independent of the power supply for operating and securing the doors.

2.2.5.2 Television surveillance

Television surveillance and a water leakage detection system shall be arranged to provide an indication to the operating compartment and to the engine control station of any leakage through inner and outer bow doors, stern doors or any other shell doors which could lead to major flooding.

2.2.6 Integrity of superstructure

2.2.6.1 Where entry of water into structures above the datum would significantly influence the stability and buoyancy of the craft, such structures shall be:

- .1** of adequate strength to maintain the weathertight integrity and fitted with weathertight closing appliances; or
- .2** provided with adequate drainage arrangements; or
- .3** an equivalent combination of both measures.

2.2.6.2 Weathertight superstructures and deck-houses located above the datum shall in the outside

boundaries have means of closing openings with sufficient strength such as to maintain weathertight integrity in all damage conditions where the space in question is not damaged. Furthermore, the means of closing shall be such as to maintain weathertight integrity in all operational conditions.

2.2.7 Doors, windows, etc., in boundaries of weathertight spaces

2.2.7.1 Doors, windows, etc., and any associated frames and mullions in weathertight superstructures and deckhouses shall be weathertight and shall not leak or fail at a uniformly applied pressure less than that at which adjacent structure would experience permanent set or fail. Conformity with the requirements of organizations recognized by the Administration in accordance with regulation XI/1 of the Convention may be considered to possess adequate strength.

2.2.7.2 For doors in weathertight superstructures, hose tests shall be carried out with a water pressure from the outside in accordance with specifications at least equivalent to those acceptable to the Organization

Note: Refer to ISO 6042–Ships and Marine Technology–Weather-tight single-leaf steel doors, or a similar standard.

2.2.7.3 The height above the deck of sills to doorways leading to exposed decks shall be as high above the deck as is reasonable and practicable, particularly those located in exposed positions. Such sill heights shall in general not be less than 100 mm for doors to weathertight spaces on decks above the datum, and 250 mm elsewhere. For craft of 30 m in length and under, sill heights may be reduced to the maximum which is consistent with the safe working of the craft.

2.2.7.4 Windows shall not be permitted in the boundaries of special category spaces or ro-ro spaces or below the datum. If required by restrictions in the Permit to Operate, forward facing windows, or windows which may be submerged at any stage of flooding shall be fitted with hinged or sliding storm shutters ready for immediate use.

2.2.7.5 Side scuttles to spaces below the datum shall be fitted with efficient hinged deadlights arranged inside so that they can be effectively closed and secured watertight.

2.2.7.6 No side scuttle shall be fitted in a position so that its sill is below a line drawn parallel to and one metre above the design waterline.

2.2.8 Hatchways and other openings

2.2.8.1 Hatchways closed by weathertight covers

The construction and the means for securing the weathertightness of cargo and other hatchways shall comply with the following:

.1 coaming heights shall in general not be less than 100 mm for hatches to weathertight spaces on decks above the datum, and 250 mm elsewhere. For craft of 30 m in length and under, coaming heights may be reduced to the maximum which is consistent with the safe working of the craft;

.2 the height of these coamings may be reduced, or the coamings omitted entirely, on condition that the Administration is satisfied that the safety of the ship is not thereby impaired in any sea conditions up to the worst intended conditions. Where coamings are provided, they shall be of substantial construction; and

.3 the arrangements for securing and maintaining weathertightness shall ensure that the tightness can be maintained in any sea conditions up to the worst intended conditions.

2.2.8.2 Machinery space openings

2.2.8.2.1 Machinery space openings shall be properly framed and efficiently enclosed by casings of ample strength and, where the casings are not protected by other structures, their strength shall be specially considered. Access openings in such casings shall be fitted with weathertight doors.

2.2.8.2.2 Heights of sills and coaming shall, in general, not be less than 100 mm for openings to weathertight spaces on decks above the datum, and 380 mm elsewhere. For craft of 30 m in length and under, these heights may be reduced to the maximum which is consistent with the safe working of the craft.

2.2.8.2.3 Machinery space ventilator openings shall comply with the requirements of 2.2.8.4.2.

2.2.8.3 Miscellaneous openings in exposed decks

2.2.8.3.1 Manholes and flush scuttles on the datum or within superstructures other than enclosed superstructures shall be closed by substantial covers capable of being made watertight. Unless secured by closely spaced bolts, the covers shall be permanently attached.

2.2.8.3.2 Service hatches to machinery, etc. may be arranged as flush hatches provided that the covers are secured by closely spaced bolts, are kept closed at sea, and are equipped with arrangements for portable guardrails.

2.2.8.3.3 Openings in exposed decks leading to spaces below the datum or enclosed superstructures other than hatchways, machinery space openings, manholes and flush scuttles shall be protected by an enclosed superstructure, or by a deckhouse or companionway of equivalent strength and weathertightness.

2.2.8.3.4 The height above the deck of sills to the doorways in companionways shall, in general, not be less than 100 mm for doors to weathertight spaces on decks above the datum, and 250 mm elsewhere. For craft of 30 m in length and under sill heights may be reduced to the maximum which is consistent with the safe working of the craft.

2.2.8.4 Ventilators

2.2.8.4.1 Ventilators to spaces below the datum or decks of enclosed superstructures shall have substantially constructed coamings efficiently connected to the deck. Coaming heights shall in general not be less than 100 mm for ventilators to weathertight spaces on decks above the datum, and 380 mm elsewhere. For craft of 30 m in length and under, coaming heights may be reduced to the maximum which is consistent with the safe working of the craft.

2.2.8.4.2 Ventilators the coamings of which extend to more than one metre above the deck or which are fitted to decks above the datum need not be fitted with closing arrangements unless they face forward or are specifically required by the Administration.

2.2.8.4.3 Except as provided in 2.2.8.4.2, ventilator openings shall be provided with efficient weathertight closing appliances.

2.2.8.4.4 Ventilator openings shall face aft or athwartships wherever practicable.

2.2.9 Scuppers, inlets and discharges

2.2.9.1 Discharges led through the shell either from spaces below the datum or from within superstructures and deckhouses fitted above the datum shall be fitted with efficient and accessible means for preventing water from passing inboard. Normally each separate discharge shall have one automatic non-return valve with a positive means of closing it from a position above the datum. Where, however, the vertical distance from the design waterline to the inboard end of the discharge pipe exceeds 0.01 L, the discharge may have two automatic non-return valves without positive means of closing, provided that the inboard valve is always accessible for examination under service conditions. Where that vertical distance exceeds 0.02 L, a single automatic non-return valve without positive means of closing may be accepted. The means for operating the positive action valve shall be readily accessible and provided with an indicator showing whether the valve is open or closed.

2.2.9.2 Valves on scuppers from weathertight compartments included in the stability calculations shall be operable from the operating compartment.

2.2.9.3 In manned machinery spaces, main and auxiliary sea inlets and discharges in connection with the operation of machinery may be controlled locally. Such controls shall be readily accessible and shall be provided with indicators showing whether the valves are open or closed. In unmanned machinery spaces, main and auxiliary sea inlets and discharges in connection with the operation of machinery shall be operable from the operating compartment.

2.2.9.4 Scuppers leading from superstructures or deckhouses not fitted with weathertight doors shall be led overboard.

2.2.9.5 All shell fittings and the valves required by this Code shall be of a suitable ductile material. Valves of ordinary cast iron or similar material shall not be acceptable.

2.2.10 Air pipes

2.2.10.1 Main storage tanks containing flammable liquids or tanks which can be pumped or filled from the sea shall have air pipes which do not terminate in enclosed spaces.

2.2.10.2 All air pipes extending to exposed decks shall have a height from the deck to the point where water may have access below of at least 300 mm where the deck is less than 0.05 L above the design waterline, and 150 mm on all other decks.

2.2.10.3 Air pipes may discharge through the side of the superstructure provided that this is at a height of at least 0.02 L above any waterline when the intact craft is heeled to an angle of 15°, or 0.02 L above the highest waterline at all stages of flooding as determined by the damaged stability calculations, whichever is higher.

2.2.10.4 All air pipes shall be equipped with weathertight closing devices that close automatically.

2.2.11 Freeing ports

2.2.11.1 Where bulwarks on weather decks form wells, ample provision shall be made for rapidly freeing the decks of water and for draining them. The minimum freeing port area (A) on each side of the craft for each well on the weather deck of the main hull(s) shall be:

.1 where the length of bulwark (ℓ) in the well is 20 m or less:

$$A = 0.7 + 0.035 \ell \text{ (m}^2\text{); and}$$

.2 where ℓ exceeds 20 m:

$$A = 0.07 \ell \text{ (m}^2\text{),}$$

and, in no case, ℓ need be taken as greater than 0.7 L.

If the bulwark is more than 1.2 m in average height, the required area shall be increased by 0.004 square metres per metre of length of well for each 0.1 metre difference in height. If the bulwark is less than 0.9 m in average height, the required area shall be decreased by 0.004 square metres per metre of length of well for each 0.1 metre difference in height.

2.2.11.2 Such freeing ports shall be located within the height of 0.6 m above the deck and the lower edge shall be within 0.02 m above the deck.

2.2.11.3 All such openings in the bulwarks shall be protected by rails or bars spaced approximately 230 mm apart. If shutters are fitted to freeing ports, ample clearance shall be provided to prevent jamming. Hinges shall have pins or bearings of non-corrodible material. If shutters are fitted with securing appliances, these appliances shall be of approved construction.

2.2.11.4 Craft, having superstructures which are open in front or both ends, shall comply with the provisions of 2.2.11.1.

2.2.11.5 In craft, having superstructures which are open at the aft end, the minimum freeing port area shall be: $A = 0.3 b \text{ (m}^2\text{)}$ where:

b : the breadth of the craft at the exposed deck (m).

2.2.11.6 Ro-ro craft fitted with bow loading openings leading to open vehicle spaces shall comply with the provisions of 2.2.3.

2.3 Intact stability in the displacement mode

2.3.1 Hydrofoil craft fitted with surface-piercing foils and/or fully submerged foils shall have sufficient stability under all permitted cases of loading to comply with the relevant provisions of annex 6 and specifically maintain a heel angle of less than 10° when subjected to the greater of the heeling moments in 1.1.2 and 1.1.4 of that annex.

2.3.2 Subject to 2.3.4, multihull craft other than hydrofoil craft shall meet the relevant requirements of annex 7 in all permitted cases of loading.

2.3.3 Subject to 2.3.4, monohull craft other than hydrofoil craft shall meet the relevant requirements of annex 8 in all permitted conditions of loading.

2.3.4 Where the characteristics of multihull craft are inappropriate for application of annex 7 or the characteristics of monohull craft are inappropriate for application

of annex 8, the Administration may accept alternative criteria equivalent to those stipulated, as appropriate to the type of craft and area of operation. The requirements of annexes 7 and 8 may be applied as indicated in Table 2.3.4, where:

- B_{WL} : maximum waterline beam at the design waterline (m); for multihull, this shall be taken to the outside of sidehulls
- A_{WP} : waterplane area at the design waterline (m²)
- ∇ : volume of displacement at the design waterline (m³)
- GM_T : transverse metacentric height in the loading condition corresponding to the design waterline, corrected for free surface effects (m).

Table 2.3.4 - Table showing application of annexes 7 and 8 to monohull and multihull craft

GM_T	$B_{WL} \cdot A_{WP} / \nabla$	
	≤ 7	> 7
≤ 3.0	annex 8	annex 8 or annex 7
> 3.0	annex 8 or annex 7	annex 7

2.4 Intact stability in the non-displacement mode

2.4.1 The requirements of this section and section 2.12 shall be applied on the assumption that any stabilisation systems fitted are fully operational.

2.4.2 The roll and pitch stability on the first and/or any other craft of a series shall be qualitatively assessed during operational safety trials as required by chapter 18 and annex 9. The results of such trials may indicate the need to impose operational limitations.

2.4.3 Where craft are fitted with surface-piercing structure or appendages, precautions shall be taken against dangerous attitudes or inclinations and loss of stability subsequent to a collision with a submerged or floating object.

2.4.4 In designs where periodic use of cushion deformation is employed as a means of assisting craft control, or periodic use of cushion air exhausting to atmosphere for purposes of craft manoeuvring, the effects upon cushion-borne stability shall be determined, and the limitations on the use by virtue of craft speed or attitude shall be established.

2.4.5 In the case of an air cushion vehicle fitted with flexible skirts, it shall be demonstrated that the skirts remain stable under operational conditions.

2.5 Intact stability in the transitional mode

2.5.1 Under weather conditions up to the worst intended conditions, the time to pass from the displacement mode to the non-displacement mode and vice versa shall be minimised unless it is demonstrated that no substantial reduction of stability occurs during this transition.

2.5.2 Hydrofoil craft shall comply with the relevant provisions of annex 6.

2.6 Buoyancy and stability in the displacement mode following damage

2.6.1 The requirements of this section apply to all permitted conditions of loading.

2.6.2 For the purpose of making damage stability calculations, the volume and surface permeabilities shall be, in general, as given in Table 2.6.2.

Table 2.6.2

Spaces	Permeability
Appropriated to cargo or stores	60
Occupied by accommodation	95
Occupied by machinery	85
Intended for liquids	0 or 95 (1)
Appropriated for cargo vehicles	90
Void spaces	95
(1) whichever results in the more severe requirements	

2.6.3 Notwithstanding 2.6.2, permeability determined by direct calculation shall be used where a more onerous condition results, and may be used where a less onerous condition results from that provided according to 2.6.2.

2.6.4 The Administration may permit the use of low-density foam or other media to provide buoyancy in void spaces, provided that satisfactory evidence is provided that any such proposed medium is the most suitable alternative and is:

- .1 of closed-cell form if foam, or otherwise impervious to water absorption;
- .2 structurally stable under service conditions;

.3 chemically inert in relation to structural materials with which it is in contact or other substances with which the medium is likely to be in contact (reference is made to 7.4.3.7); and

.4 properly secured in place and easily removable for inspection of the void spaces.

2.6.5 The Administration may permit void bottom spaces to be fitted within the watertight envelope of the hull without the provision of a bilge system or air pipes provided that:

.1 the structure is capable of withstanding the pressure head after any of the damages required by this section;

.2 when carrying out a damage stability calculation in accordance with the requirements of this section, any void space adjacent to the damaged zone shall be included in the calculation and the criteria in 2.6, 2.13 and 2.15 complied with;

.3 the means by which water which has leaked into the void space is to be removed shall be included in the craft operating manual required by chapter 18; and

.4 adequate ventilation is provided for inspection of the space under consideration as required by 2.2.1.2.

2.6.6 Any damage of a lesser extent than that postulated in 2.6.7 to 2.6.10, as applicable, which would result in a more severe condition shall also be investigated. The shape of the damage shall be assumed to be a parallelepiped.

2.6.7 Extent of side damage

The following side damages shall be assumed anywhere on the periphery of the craft:

.1 the longitudinal extent of damage shall be: $0.75 \nabla^{1/3}$, or $(3 \text{ m} + 0.225 \nabla^{1/3})$, or 11 m, whichever is the least;

.2 the transverse extent of penetration into the craft shall be $0.2 \nabla^{1/3}$. However, where the craft is fitted with inflated skirts or with non-buoyant side structures, the transverse extent of penetration shall be at least $0.12 \nabla^{1/3}$ into the main buoyancy hull or tank structure; and

.3 the vertical extent of damage shall be taken for the full vertical extent of the craft, where:

∇ : volume of displacement corresponding to the design waterline (m^3).

2.6.8 Extent of bottom damage in areas vulnerable to raking damage

2.6.8.1 Application

.1 Any part of the surface of the hull(s) is considered to be vulnerable to raking damage if:

- .1** it is in contact with the water at operational speed in smooth water, and
- .2** it also lies below two planes which are perpendicular to the craft centreline plane and at heights as shown in Figure 2.6.8.1, where:

T : maximum draught of the hull (each hull considered individually in the case of multihulls) to the design waterline, excluding any non-buoyant structure

For multihulls, individual hulls shall be considered separately.

.2 Raking damage shall be assumed to occur along any fore-and-aft line on the surface of the hull(s) between the keel and the upper limit defined in the figure below:

.3 Damage shall not be applied at the same time as that defined in 2.6.7 or 2.6.9.

2.6.8.2 Extent

.1 Two different longitudinal extents shall be considered separately:

- .1.1** 55% of the length L , measured from the most forward point of the underwater buoyant volume of each hull; and
- .1.2** a percentage of the length L , applied anywhere in the length of the craft, equal to 35% for craft where $L = 50$ m and over and equal to $(L/2 + 10)\%$ for craft where L is less than 50m.

.2 Except as provided below, the penetration normal to the shell shall be $0.04 \nabla^{1/3}$ or 0.5 m, whichever is the lesser, in association with a girth along the shell equal to $0.1 \nabla^{1/3}$, where ∇ is the volume of displacement corresponding to the design waterline (m^3). However this penetration or girth shall under no circumstances extend above the vertical extent of the vulnerable area as specified in 2.6.8.1.1.

2.6.9 Extent of bottom damage in areas not vulnerable to raking damage

2.6.9.1 Application

This applies to all parts of the hull(s) which are not defined as vulnerable to raking damage in 2.6.8.1. Damage shall not be applied at the same time as that defined in 2.6.7 or 2.6.8.

2.6.9.2 Extent

The following extent of damage shall be assumed:

.1 the length of damage in the fore-and-aft direction shall be $0.75 \nabla^{1/3}$, or $(3 \text{ m} + 0.225 \nabla^{1/3})$, or 11 m whichever is the least;

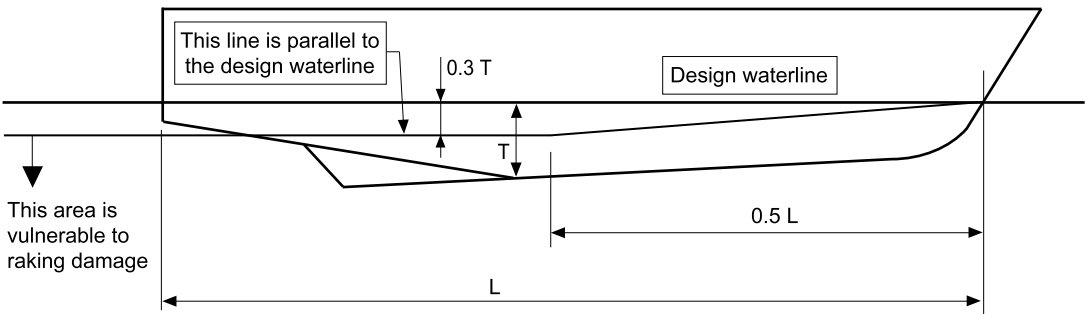
.2 the athwartships girth of damage shall be $0.2 \nabla^{1/3}$, and

.3 the depth of penetration normal to the shell shall be $0.02 \nabla^{1/3}$, where:

∇ : volume of displacement corresponding to the design waterline (m^3).

2.6.10 In applying 2.6.8 and 2.6.9 to multihull craft, an obstruction at or below the design waterline of up to 7 m width shall be considered in determining the number of hulls damaged at any one time. The requirement of 2.6.6 shall also be applied.

Figure 2.6.8.1



2.6.11 Following any of the postulated damages detailed in 2.6.6 to 2.6.10, the craft in still water shall have sufficient buoyancy and positive stability to simultaneously ensure that:

.1 for all craft other than amphibious air-cushion vehicles, after flooding has ceased and a state of equilibrium has been reached, the final waterline is below the level of any opening through which further flooding could take place by at least 50% of the significant wave height corresponding to the worst intended conditions;

.2 for amphibious air-cushion vehicles, after flooding has ceased and a state of equilibrium has been reached, the final waterline is below the level of any opening through which further flooding could take place by at least 25% of the significant wave height corresponding to the worst intended conditions;

.3 there is a positive freeboard from the damage waterline to survival craft embarkation positions;

.4 essential emergency equipment, emergency radios, power supplies and public address systems needed for organizing the evacuation remain accessible and operational;

.5 the residual stability of craft meets the appropriate criteria as laid out in annexes 7 and 8 according to table 2.3.4. Within the range of positive stability governed by the criteria of annexes 7 or 8, no unprotected opening shall be submerged.

2.6.12 Downflooding openings referred to in 2.6.11.1 and 2.6.11.2 shall include doors and hatches which are used for damage control or evacuation procedures, but may exclude those which are closed by means of weathertight doors and hatch covers and not used for damage control or evacuation procedures.

2.7 Inclining and stability information

2.7.1 Every craft, on completion of build, shall be inclined and the elements of its stability determined. When an accurate inclining is not practical, the lightweight displacement and centre of gravity shall be determined by a lightweight survey and accurate calculation.

2.7.2 The master shall be supplied by the owner with reliable information relating to the stability of the craft in accordance with the following provisions of this paragraph. The information relating to stability shall, before issued to the master, be submitted to the Administration for approval, together with a copy thereof for their retention, and shall incorporate such additions and amendments as the Administration may in any particular case require.

2.7.3 Where any alterations are made to a craft so as significantly to affect the stability information supplied to the master, amended stability information shall be provided. If necessary the craft shall be re-inclined.

2.7.4 A report of each inclining or lightweight survey carried out in accordance with this chapter and of the calculation therefrom of the lightweight condition particulars shall be submitted to the Administration for approval, together with a copy for their retention. The approved report shall be placed on board the craft by the owner in the custody of the master and shall incorporate such additions and amendments as the Administration may in any particular case require. The amended lightweight condition particulars so obtained from time to time shall be used by the master in substitution for such previously approved particulars when calculating the craft's stability.

2.7.5 Following any inclining or lightweight survey, the master shall be supplied with amended stability information if the Administration so requires. The information so supplied shall be submitted to the Administration for approval, together with a copy thereof for their retention, and shall incorporate such additions and amendments as the Administration may in any particular case require.

2.7.6 Stability information demonstrating compliance with this chapter shall be furnished in the form of a stability information book which shall be kept on board the craft at all times in the custody of the master. The information shall include particulars appropriate to the craft and shall reflect the craft loading conditions and mode of operation. Any enclosed superstructures or deck-houses included in the cross curves of stability and the critical downflooding points and angles shall be identified. At the operating station there shall be plans showing clearly for each deck and hold the boundaries of the watertight compartments, the openings therein with their means of closure and position of any controls thereof.

2.7.7 Every craft shall have scales of draughts marked clearly at the bow and stern. In the case where the draught marks are not located where they are easily readable, or operational constraints for a particular trade make it difficult to read the draught marks, then the craft shall also be fitted with a reliable draught-indicating system by which the bow and stern draughts can be determined.

2.7.8 The owner or builder, as appropriate, shall ensure that the positions of the draught marks are accurately determined and that the marks are located on the hull in a permanent manner. Accuracy of the draught marks shall be demonstrated to the Administration prior to the inclining experiment.

2.8 Loading and stability assessment

On completion of loading of the craft and prior to its departure on a voyage, the master shall determine the trim and stability of the craft and also ascertain and record that the craft is in compliance with stability criteria of the relevant requirements. The Administration may accept the use of an electronic loading and stability computer or equivalent means for this purpose.

2.9 Marking and recording of the design waterline

2.9.1 The design waterline shall be clearly and permanently marked on the craft's outer sides by the load line mark described below. This and the reference line described in 2.9.2.2 below shall be recorded in the High-Speed Craft Safety Certificate. For craft where this is not practical, e.g. amphibious air-cushion vehicles fitted with peripheral skirts, defined deck reference points shall be provided, from which the freeboard can be measured, and hence the draughts obtained.

2.9.2 Load line mark

2.9.2.1 The load line mark shall consist of a ring with an outside diameter of 300 mm and width of 25 mm which is intersected by a horizontal line of length 450 mm and having a breadth of 25 mm, the upper edge of which passes through the centre of the ring. The centre of the ring shall be placed at the longitudinal centre of flotation in the displace-

ment mode and at a height corresponding to the design waterline.

2.9.2.2 To assist in verifying the position of the load line mark, a reference line shall be marked on the hull at the longitudinal centre of flotation by a horizontal bar having a length of 300 mm and a breadth of 25 mm and having the upper edge corresponding to the reference line.

2.9.2.3 Where practicable, the reference line should be related to the uppermost deck at side. Where it is not possible, the position of the reference line should be defined from the underside of keel at the longitudinal centre of flotation.

2.9.2.4 The mark of the Authority by whom the load lines are assigned may be indicated alongside the load line ring above the horizontal line which passes through the centre of the ring, or above and below it. This mark shall consist of not more than four initials to identify the Authority's name, each measuring approximately 115 mm in height, and 75 mm in width.

2.9.2.5 The ring, lines and letters shall be painted in white or yellow on a dark ground or in black on a light ground, and permanently marked. The marks shall be plainly visible.

2.9.3 Verification

The High-Speed Craft Safety Certificate shall not be delivered until the Administration has verified that the marks are correctly and permanently indicated on the sides of the craft.

Part B Requirements for passenger craft

2.10 General

2.10.1 Where compliance with this chapter requires consideration of the effects of passenger weight, the following information shall be used:

- .1** The distribution of passengers is 4 persons per square metre.
- .2** Each passenger has a mass of 75 kg.
- .3** Vertical centre of gravity of seated passengers is 0.3 m above seat.
- .4** Vertical centre of gravity of standing passengers is 1.0 m above deck.
- .5** Passengers and luggage shall be considered to be in the space normally at their disposal.
- .6** Passengers shall be distributed on available deck areas towards one side of the craft on the decks where assembly stations are located and in such a way that they produce the most adverse heeling moment.

2.11 Intact stability in the displacement mode

The craft shall have sufficient intact stability that, when in still water conditions, the inclination of the craft from the horizontal would not exceed 10° (under all permitted cases of loading and uncontrolled passenger movements as may occur).

2.12 Intact stability in the non-displacement mode

2.12.1 The total heel angle in still water due to the effect of passenger movements or due to beam wind pressure as per 1.1.4 of annex 6 shall not to exceed 10°. Passenger movement need not be considered where passengers are required to be seated whenever the craft is operating in the non-displacement mode.

2.12.2 In all loading conditions, the outward heel due to turning shall not exceed 8°, and the total heel due to beam wind pressure as per 1.1.4 of annex 6 and due to turning shall not exceed 12° outward.

2.13 Buoyancy and stability in the displacement mode following damage

2.13.1 Following any of the postulated damages detailed in 2.6.6 to 2.6.10, in addition to satisfying the requirements of 2.6.11 and 2.6.12, the craft in still water shall have sufficient buoyancy and positive stability to simultaneously ensure that:

- .1** the angle of inclination of the craft from the horizontal does not normally exceed 10° in any direction. However, where this is clearly impractical, angles of inclination up to 15° immediately after damage but reducing to 10° within 15 min shall be permitted provided that efficient non-slip deck surfaces and suitable holding points, e.g., holes, bars, etc., are provided; and
- .2** any flooding of passenger compartments or escape routes which might occur will not significantly impede the evacuation of passengers.

2.13.2 In addition to the requirements in 2.13.1, category B craft shall also satisfy the following criteria after sustaining raking damage of 100% of length L, having the girth and penetration given in 2.6.8.2.2, to any part of the surface of the hull(s) defined in 2.6.8.1:

- .1** The angle of inclination of the craft from the horizontal shall not exceed 20° in the equilibrium condition;
- .2** the range of positive righting lever shall be at least 15° in the equilibrium condition;
- .3** the positive area under the righting lever curve shall be at least 0.015 m-rad in the equilibrium condition;
- .4** the requirements of 2.6.11.3 and 2.13.1.2 are satisfied; and
- .5** in intermediate stages of flooding, the maximum righting lever shall be at least 0.05 m and the range of positive righting lever shall be at least 7°.

In complying with the above, the righting lever curve shall be terminated at the angle of downflooding, and only one free surface need be assumed.

2.14 Inclining and stability information

2.14.1 At periodical intervals not exceeding 5 years, a lightweight survey shall be carried out on all passenger craft to verify any changes in lightweight displacement and longitudinal centre of gravity. The passenger craft shall be

re-inclined whenever, in comparison with the approved stability information, a deviation from the lightweight displacement exceeding 2%, or a deviation of the longitudinal centre of gravity exceeding 1% of L is found or anticipated.

2.14.2 A report of each inclining or lightweight survey carried out in accordance with paragraph 2.7.1 and of the calculation therefrom of the lightweight condition particulars shall be submitted to the Administration for approval, together with a copy for their retention. The approved report shall be placed on board the craft by the owner in the custody of the master and shall incorporate

such additions and amendments as the Administration may in any particular case require. The amended lightweight condition particulars so obtained from time to time shall be used by the master in substitution for such previously approved particulars when calculating the craft's stability.

2.14.3 Following any inclining or lightweight survey, the master shall be supplied with amended stability information if the Administration so requires. The information so supplied shall be submitted to the Administration for approval, together with a copy thereof for their retention, and shall incorporate such additions and amendments as the Administration may in any particular case require.

Part C *Requirements for cargo craft*

2.15 ***Buoyancy and stability in the displacement mode following damage***

Following any of the postulated damages detailed in 2.6.6 to 2.6.10, in addition to satisfying the requirements of 2.6.11 and 2.6.12, the craft in still water shall have sufficient buoyancy and positive stability to simultaneously ensure that the angle of inclination of the craft from the horizontal does not normally exceed 15° in any direction. However, where this is clearly impractical, angles of inclination up to 20° immediately after damage but reducing to 15° within 15 minutes may be permitted provided that efficient non-slip deck surfaces and suitable holding points are provided.

2.16 ***Inclining***

Where it is satisfied by lightweight survey, weighing or other demonstration that the lightweight of a craft is closely similar to that of another craft of the series to which 2.7.1 has been applied, the Administration may waive the requirement of 2.7.1 for craft to be inclined. In this regard, a craft which lies within the parameters of 2.14.1, when compared with a craft of the series which has been inclined, shall be regarded as being closely similar to that craft.

CHAPTER 3

STRUCTURES

C3.0	Documents to be submitted	C3.0.2	Additional information for fibre-reinforced plastic (FRP) craft
C3.0.1	General		
.1	Table C3.0.1 lists the structural plans that are to be submitted to the Society, in triplicate, for examination and approval.	.1	For FRP craft, the drawing and documents to be submitted for examination and listed in C3.0.1 are to contain the following additional information:
.2	In addition, information relative to the following is to be submitted:		
	- longitudinal weight distribution and position of the longitudinal centre of gravity of the craft - design loading conditions including: - still water bending moments (SWBM) distribution - shear force (SF) distribution - description of corresponding loading cases - draught and trim of the craft at sea, at rest and at its maximum speed in calm water (for SES, in both off-cushion and on-cushion conditions) - any direct calculations performed - results of model tests and full-scale measurements.		- arrangement of laminate for the various structural elements: thickness, definition of successive layers of reinforcement, mass per square metre in layers of reinforcement, proportion in mass of reinforcement for each layer, directions of roving layers and unidirectional reinforcements, decreasing in thickness between layers, - direction of laminate in relation to craft structure, - structure of oil tanks or other liquid tanks which are integrated into the hull, - details of connection among various structural elements and details of attachment to the hull of supplementary reinforcing elements, - pillars.
		.2	Suppliers' technical specifications with indication of types, trademarks and references of resins and gel-coats, reinforcements and core materials are to be supplied.

Table C3.0.1

Plan	Containing information relevant to:
Midship section Main sections	- moulded dimensions, maximum service speed V, design acceleration a_{CG} and, if known, limit wave height (see C3.3.4) - materials - typical structural details
Longitudinal sections	
Decks	- openings - deck loads, if different from Rule loads
Shell expansion	openings
Machinery space structure	machinery mass and position of centre of gravity
Watertight bulkheads	- openings - position of air vents - typical structural details
Deckhouses	details of connections between different materials
Rudder	rudder stock material
Propeller shaft brackets	material
Equipment	
Testing plan	position of air vents

These specifications are to give the following information:

- resins: type (orthophthalic or isophthalic), specific gravity, Young's modulus, Poisson's ratio, breaking strength and elongation at break,
- reinforcements (mats, woven rovings, unidirectional reinforcements): quality (glass or other material, with specific gravity, breaking strength of the elementary fibre, Young's modulus and Poisson's ratio), mass per square metre, thickness and possibly weft-warp distribution,
- core materials: type and quality; specific gravity; tensile, compressive and shear strength and elasticity moduli.

3.1 General

This chapter covers those elements of hull and superstructure which provide longitudinal and other primary and local strength of the craft as a whole and also other important components such as foils and skirts which are directly associated with the hull and superstructure.

3.2 Materials

Materials used for the hull and superstructure and the other features referred to in 3.1 should be adequate for the intended use of the craft.

3.3 Structural strength

The structure should be capable of withstanding the static and dynamic loads which can act on the craft under all operating conditions in which the craft is permitted to operate, without such loading resulting in inadmissible deformation and loss of watertightness or interfering with the safe operation of the craft.

3.4 Cyclic loads

Cyclic loads, including those from vibrations (see note), which can occur on the craft should not:

- *impair the integrity of structure during the anticipated service life of the craft or the service life agreed with the Administration;*
- *hinder normal functioning of machinery and equipment; and*
- *impair the ability of the crew to carry out its duties.*

Note: In scope of classification, the structural strength against vibrations is not checked.

The vibration check shall be performed during the sea trials of the craft. Where deemed necessary, the Society may require vibration

measurements to be carried out using suitable instruments; where appropriate, remedial measures may be required to adequately eliminate situations deemed unacceptable.

3.5 Design criteria

The Administration should be satisfied that the choice of design conditions, design loads and accepted safety factors corresponds to the intended operating conditions for which certification is sought.

3.6 Trials

If the Administration consider it necessary it should require full-scale trials to be undertaken in which loadings are determined. Cognizance should be taken of the results where these indicate that loading assumptions of structural calculations have been inadequate.

C3.1 General

C3.1.1 Introductory comments

.1 This Chapter C3 contains the requirements for structural scantlings of the craft to which these Rules apply, i.e. to craft for which $V \geq 7,16 \Delta^{1/6}$. Craft for which $V \geq 10 L^{0.5}$ shall be individually considered by the Society (V in knots, Δ in tonnes).

For what concerns multihull craft, this Chapter provides the requirements for scantlings of twin-hull craft. Other craft will be considered in each separate case by the Society.

.2 The requirements for scantlings of hydrofoils and air-cushion vehicles are contained in Appendices C3A1 and C3A2. Unless otherwise specified, the requirements of this Chapter apply to such craft only as far as the provisions regarding limit operating conditions, materials and construction criteria are concerned.

.3 The scantlings indicated in the following paragraphs apply to craft constructed of steel, aluminium alloy or fibre reinforced plastic, as specified in C3.2.

C3.1.2 Direct calculations

.1 The Society may require direct calculations to be carried out, if deemed necessary according to the provisions of C3.6.

Such calculations are to be carried out based on structural modelling, loading and checking criteria described in C3.6. Calculations based on other criteria may be accepted if deemed equivalent to those laid down by the Society.

C3.1.3 Units

.1 Unless otherwise specified, the following units are used in the Rules:

- thickness of plating, in mm,
- section modulus of stiffeners, in cm^3 ,
- shear area of stiffeners, in cm^2 ,
- span and spacing of stiffeners, in m,
- stresses, in N/mm^2 ,
- concentrated loads, in kN,
- distributed loads, in kN/m or kN/m^2 .

C3.1.4 Definitions and symbols

.1 The definitions of the following terms and symbols are applicable throughout this Chapter and its Appendices and are not, as a rule, repeated in the different paragraphs. Definitions applicable only to certain paragraphs are specified therein.

- “Moulded base line”: The line parallel to the summer load waterline, crossing the upper side of keel plate or the top of skeg at the middle of length L .
- “Hull”: The hull is the outer boundary of the enclosed spaces of the craft, except for the deckhouses, as defined below.
- “Chine”: For hulls that do not have a clearly identified chine, the chine is the hull point at which the tangent to the hull is inclined 50° to the horizontal.
- “Bottom”: The bottom is the part of the hull between the keel and the chines.
- “Main deck”: The main deck is the uppermost complete deck of the hull. It may be stepped.
- “Side”: The side is the part of the hull between the chine and the main deck.
- “Deckhouse”: The deckhouse is a decked structure located above the main deck, with lateral walls inboard of the side of more than 4 per cent of the local breadth. Structure located on the main deck and whose walls are not in the same longitudinal plane as the under side shell may be regarded as a deckhouse.
- “Cross-deck”: For twin-hull craft, the cross-deck is the structure connecting the two hulls.
- “Deadrise angle α_d ”: For hulls that do not have a clearly identified deadrise angle, α_d is the angle between the horizontal and a straight line joining the keel and the chine. For catamarans with non-symmetrical hulls (where inner and outer deadrise angles are different), α_d is the lesser angle.
- “Fore end”: Hull region forward of $0,9 L$ from the aft perpendicular.
- “Aft end”: Hull region abaft of $0,1 L$ from the aft perpendicular.
- “Midship area”: Hull region between $0,3 L$ and $0,7 L$ from the aft perpendicular.

L	: Rule length, in m, equal to L_{WL} where L_{WL} is the waterline measured with the craft at rest in calm water and, for SESS, in the off-cushion condition
FP	: forward perpendicular, i.e. the perpendicular at the intersection of the waterline at draught T and the foreside of the stem
AP	: aft perpendicular, i.e. the perpendicular located at a distance L abaft of the forward perpendicular
B	: the greatest moulded breadth, in m, of the craft
B_w	: the greatest moulded breadth, in m, measured on the waterline at draught T ; for catamarans, B_w is the breadth of each hull
B_{wm}	: the greatest moulded breadth, in m, measured below or on the waterline at draught T ; for catamarans, B_{wm} is the breadth of each hull
D	: depth, in m, measured vertically in the transverse section at the middle of length L from the moulded base line of the hull(s) to the top of the deck beam at one side of the main deck (if the main deck is stepped, D will be defined in each separate case at the discretion of the Society)
T	: draught of the craft, in m, measured vertically on the transverse section at the middle of length L , from the moulded base line of the hull(s) to the full load waterline, with the craft at rest in calm water and, for SESS, in the off-cushion condition
Δ	: moulded displacement at draught T , in sea water (mass density = $1,025 \text{ t/m}^3$), in tonnes
C_B	: total block coefficient, defined as follows: $C_B = \frac{\Delta}{(1,025 \cdot L \cdot B_w \cdot T)}$ For catamarans, C_B is to be calculated for a single hull, assuming Δ equal to one half of the craft's displacement
V	: maximum service speed, in knots
g	: acceleration of gravity, equal to $9,81 \text{ m/s}^2$
LCG	: longitudinal centre of gravity of the craft.

C3.1.5 Protection against corrosion

.1 Scantlings stipulated in C3.7 assume that the materials used are chosen and protected in such a way that the strength lost by corrosion is negligible.

.2 The Shipyard is to give the Society a document specifying all the arrangements made to protect the material against corrosion at the construction stage: coating types, number and thickness of layers, surface preparation, application conditions, control after completion, anodic protection, etc.

.3 This document must also include maintenance arrangements to be made in service to restore and maintain the efficiency of this protection, whatever the reasons of its weakening, whether incidental or not.

.4 All such maintenance operations are to be listed in a book shown to the Society surveyor at each visit.

C3.1.6 Rounding-off

.1 Values for thickness as deduced from formulae are to be rounded off to the nearest standard value, without such a reduction exceeding 3 per cent.

C3.2 Materials and connections

C3.2.1 General requirements

.1 Materials to be used in hull and equipment construction, in delivery condition, are to comply with these requirements or with specific requirements applicable to individual cases; they are to be tested in compliance with the applicable provisions. Quality and testing requirements for materials covered here are outlined in relevant Society Rules.

.2 These requirements presume that welding and other cold or hot manufacturing processes are carried out in compliance with current sound working practice and relevant Society provisions. The latter, in particular, may include requirements concerning welding operations and techniques and other manufacturing processes (e.g., specific preheating before welding and/or welding or other cold or hot manufacturing processes followed by an appropriate heat treatment).

.3 Welding processes shall be approved for the specified type of material for which they are intended and with limits and conditions as stated in the applicable Society requirements.

C3.2.2 Steel structures

C3.2.2.1 Steels for hull structures, forgings and castings

.1 The provisions of the relevant Society Rules apply.

C3.2.2.2 Under thickness tolerances

.1 The following requirements apply to the under-thickness tolerances of steel plates and wide flats.

.2 The maximum permissible under thickness tolerance for structural hull plates and wide flats for both normal and high strength steels is 0,3 mm.

.3 The thickness is to be measured at random locations located at least 25 mm from an edge. Local surface depressions resulting from imperfections and ground areas resulting from the elimination of defects may be disregarded.

.4 Responsibility for maintaining the required tolerances rests with the Manufacturer, who is to carry out the necessary measurements.

C3.2.2.3 Material factor K for scantlings of structural members made of high strength steel

.1 The value of the material factor K to be introduced into formulae to check structures given in this Chapter and in the various Appendices is a function of the minimum yield stress R_{eH} value specified for the steel to be used.

.2 Table C3.2.1 shows the values of the material factor K to be taken depending on the R_{eH} value of the various high strength steels for hull structures for which $R_{eH} \leq 390 \text{ N/mm}^2$.

Table C3.2.1

$R_{eH} \text{ (N/mm}^2\text{)}$	K
235	1,00
315	0,78
355	0,72
390	0,70

.3 The use of steels for which $R_{eH} > 355 \text{ N/mm}^2$ will be considered in each separate case by the Society, which may stipulate special acceptance conditions.

.4 If, for special structures, the use of steels for which $R_{eH} < 235 \text{ N/mm}^2$, has been accepted by the Society, the material factor is to be determined by:

$K = 235 / R_{eH}$

.5 In the case where the use of steels with R_{eH} values which are intermediate between those indicated in Table C3.2.1 is allowed, the values of the material factor K may be determined by means of linear interpolation.

C3.2.3 Aluminium alloy structures

C3.2.3.1 Aluminium alloys for hull structures, forgings and castings

.1 The designation of aluminium alloys used here complies with the numerical designation used in RRIAD (Registration Record of International Alloy Designation).

Table C3.2.2 - Aluminium alloys for welded construction

Guaranteed mechanical characteristics (1)							
Aluminium alloy				Unwelded condition		Welded condition	
Alloy (2)	Temper (2)	Products	Thickness (mm)	R _{p 0,2} (N/mm ²) (4)	R _m (N/mm ²) (5)	R _{p 0,2} ' (N/mm ²) (4)	R _m ' (N/mm ²) (5)
5083	0 / H111	rolled	t ≤ 50	125	275	125	275
	H 321	rolled	t ≤ 40	215	305	125	275
	0	extruded	all	110	270	110	270
5086	0 / H111	rolled	all	100	240	100	240
	H 321	rolled	all	185	275	100	240
	0	extruded	all	95	240	95	240
5383	0 / H111	rolled	t ≤ 40	145	290	145	290
	H 321	rolled	t ≤ 40	220	305	145	290
5059	0 / H111	rolled	t ≤ 40	155	300	155	300
	H 321	rolled	t ≤ 20	270	370	155	300
		rolled	20 < t ≤ 40	260	360	155	300
5454	0 / H111	rolled	all	85	215	85	215
	F	rolled	all	100	210	100	210
5754	0 / H111	rolled	t ≤ 6	80	190	80	190
			t > 6	70	190	70	190
6005	T5 / T6	closed extrusions	t ≤ 6	215	255	105	165
			6 < t ≤ 25	200	250	100	165
		open extrusions	t ≤ 10	215	260	95	165
			10 < t ≤ 25	200	250	80	165
6060 (3)	T5	extruded	t ≤ 6	150	190	65	115
			6 < t ≤ 25	130	180	65	110
6061	T6	extruded	t ≤ 25	240	260	115	155
6082	T6	extruded	t ≤ 15	255	310	115	170
6106	T5	extruded	t ≤ 6	195	240	65	130
6351	T5	extruded	t ≤ 25	240	260	140	165
(1) The guaranteed mechanical characteristics in this Table correspond to general standard values. For more information, refer to the minimum values guaranteed by the product supplier. Higher values may be accepted on the basis of welding tests including recurrent workmanship test at the shipyard only. (2) Other grades or tempers may be considered, subject to the Society's agreement. (3) 6060 alloy is not to be used for structural members sustaining impact loads (e.g. bottom longitudinals). The use of alloy 6106 is recommended in that case. (4) R_{p 0,2} and R_{p 0,2} ' are the minimum guaranteed yield stresses at 0,2% in unwelded and welded condition respectively. (5) R_m and R_m ' are the minimum guaranteed tensile strengths in unwelded and welded condition respectively.							

.2 The characteristics of aluminium alloys to be used in the construction of aluminium craft are to comply with the relevant requirements of the Society Rules.

.3 As a rule, series 5000 aluminium-magnesium alloys or series 6000 aluminium-magnesium-silicon alloys (see Table C3.2.2) shall be used.

.4 The use of series 6000 alloys or extruded platings, for parts which are exposed to sea water atmosphere, will be considered in each separate case by the Society, also taking into account the protective coating applied.

.5 The list of aluminium alloys given in Table C3.2.2 is not exhaustive. Other aluminium alloys may be considered, provided the specification (manufacture, chemical composition, temper, mechanical properties, welding, etc.) and the scope of application be submitted to the Society for review.

.6 In the case of welded structures, alloys and welding processes are to be compatible and appropriate, to the satisfaction of the Society and in compliance with the relevant Rules.

.7 For forgings or castings, requirements for chemical composition and mechanical properties are to be defined in each separate case by the Society.

.8 In the case of structures subjected to low service temperatures or intended for other particular applications, the alloys to be employed are to be defined in each separate case by the Society which is to state the acceptability requirements and conditions.

.9 Unless otherwise specified, the Young's modulus for aluminium alloys is equal to 70000 N/mm² and the Poisson's ratio equal to 0,33.

C3.2.3.2 Extruded platings

.1 Extrusions with built-in plating and stiffeners, referred to as extruded plating, may be used.

.2 In general, the application is limited to decks and deckhouses. Other uses may be permitted at the discretion of the Society.

.3 Extruded plating is preferably to be oriented so that the stiffeners be parallel to the direction of main stresses.

.4 Connections between extruded plating and primary members are to be given special attention.

C3.2.3.3 Tolerances

.1 The under-thickness tolerances of plates and rolled sections are to be in accordance with Table C3.2.3.

Table C3.2.3

As-built thickness (mm)	Under-thickness tolerance (mm)
t ≤ 8	0,3
8 < t ≤ 12	0,5
12 < t ≤ 20	0,7
t > 20	1,0

.2 The under-thickness tolerances of extruded platings are to be in accordance with Table C3.2.4, but not taken greater than 7% of the as-built thickness. Otherwise, the reduced plate thickness has to be considered.

Table C3.2.4

As-built thickness (mm)	Under-thickness tolerance (mm)
t ≤ 6	0,3
6 < t ≤ 10	0,4

.3 The responsibility for maintaining the required tolerances lies with the manufacturer, who shall also inspect the surface condition.

C3.2.3.4 Influence of welding on mechanical characteristics

.1 Welding heat input lowers locally the mechanical strength of aluminium alloys hardened by work hardening (series 5000 other than condition 0 or H111) or by heat treatment (series 6000).

.2 Consequently, where necessary, a drop in mechanical characteristics of welded structures is to be considered in the heat-affected zone, with respect to the mechanical characteristics of the parent material.

.3 The heat-affected zone may be taken to extend 25 mm on each side of the weld axis.

.4 Aluminium alloys of series 5000 in 0 condition (annealed) or in H111 condition (annealed flattened) are not subject to a drop in mechanical strength in the welded areas.

.5 Aluminium alloys of series 5000 other than condition 0 or H111 are subjected to a drop in mechanical strength in the welded areas. The mechanical characteristics to consider in welded condition are, normally, those of condition 0 or H111, except otherwise indicated in Table C3.2.2. Higher mechanical characteristics may be taken into account, provided they are duly justified.

.6 Aluminium alloys of series 6000 are subject to a drop in mechanical strength in the vicinity of the welded areas. The mechanical characteristics to be considered in welded condition are, normally, to be indicated by the supplier, if not indicated in Table C3.2.2.

C3.2.3.5 Material factor K for scantlings of structural members made of aluminium alloy

.1 The value of the material factor K to be introduced into formulae for checking scantlings of structural members, given in this Chapter and the various Appendices, is determined by the following equation:

$$K = \frac{100}{R'_{lim}}$$

where:

R'_{lim} : minimum guaranteed yield stress of the parent metal in welded condition $R'_{p0,2}$, in N/mm², but not to be taken greater than 70% of the minimum guaranteed tensile strength of the parent metal in welded condition R'_m , in N/mm² (see Table C3.2.2).

.2 For welded constructions in hardened aluminium alloys (series 5000 other than condition 0 or H111 and series 6000), greater characteristics than those in welded condition may be considered, provided that welded connections are located in areas where stress levels are acceptable for the alloy considered in annealed or welded condition.

.3 In case of welding of two different aluminium alloys, the material factor K to be considered for the scantlings of welds is to be the greater material factor of the aluminium alloys of the assembly.

C3.2.3.6 Strength of welding

.1 The effective length in mm of the lines of welding is given by:

$$d_e = d - 20$$

where d is the actual length in mm of the line of welding.

C3.2.3.7 Riveted connections for aluminium alloy hulls

.1 Use of rivets for connecting structures is limited, in principle, only to members which do not contribute to the overall strength of the hull. Exceptions are to be supported by experimental evidence or good in-service performance.

.2 The conditions for riveted connection acceptability are to be individually stated in each particular case, depending on the type of member to be connected and the rivet material.

.3 Whenever riveted connections are to be employed, a detailed plan, illustrating the process, as well as the dimensions and location of rivets and holes, together with the mechanical and metallurgical properties of the rivets, is to be submitted for approval.

.4 The Society may, at its discretion, require tension, compression and shear tests to be carried out on specimens of riveted connections constructed under the same conditions as during actual hull construction, to be witnessed by a Society surveyor.

.5 The Society reserves the right to accept the results of tests performed by recognized bodies or other Societies.

C3.2.4 Welding connections

C3.2.4.1 General requirements

.1 For welding, the requirements of relevant Society Rules apply. In particular, these provisions make the adoption of welding procedures dependent on their previous qualification by the Society. In addition, individual builders are to hold an authorization by the Society to use these procedures, employing welders qualified by the Society.

.2 For welds design and throat thicknesses, the requirements of relevant Society Rules apply. In addition, intermittent welds are not allowed in following zones:

- structure in way of waterjets or propellers
- structure in way of stabilisation devices such as foils, interceptors or tabs
- structure submitted to water impact

C3.2.4.2 Accessibility and edge preparation

.1 For correct execution of welded joints, sufficient accessibility is necessary, depending on the welding process adopted and the welding position.

.2 Edge cutting, to be carried out in general by machining, is to be regular and without burrs or cuts.

.3 The structural parts to be welded as well as those adjacent, even if they have been previously pickled, are to be cleaned carefully before welding, using suitable mechanical means, such as stainless steel wire brushes, so as to eliminate oxides, grease or other foreign bodies which could give rise to welding defects.

.4 Edge preparation, alignment of joints, spot-welding methods and root chipping are to be appropriate to the type of joint and welding position, and comply with Society Rule requirements for the welding procedures adopted.

C3.2.4.3 Inspections

.1 Inspections of welded connections by the Society surveyors are, in general, those specified in (a) to (e) below. The extent of inspection will be defined by the Society on a case by case basis.

- (a) Inspection of base materials for compliance with the requirements this Article and of structures with the approved plans.
- (b) Inspection of the use and application conditions of welding procedures for compliance with those approved and verification that qualified welders are employed.
- (c) Visual examination of edge preparations, root chipping and execution of welds in way of structural connections.
- (d) Examination of radiographs of welded joints (radiographing is to be performed, if necessary, depending on the extent of the examinations), and inspection of performance of execution of the ultrasonic or magnetic particle examinations, which may be required.
- (e) Inspection of any repairs, to be performed with procedures and inspection methods at the discretion of the Society surveyor.

.2 Irrespective of the extent of such inspections, it is the responsibility of the builder to ensure that the manufacturing procedures, processes and sequences are in compliance with relevant Society requirements, approved plans and sound working practice. For this purpose, the shipyard is to have its own production control organization.

C3.2.4.4 Welding processes for light alloys

.1 In general, the welding of the hull structures is to be performed with the MIG (metal-arc inert gas) and TIG (tungsten-arc inert gas) processes using welding consumables recognized as suitable for the base material to be used. Welding processes and filler materials other than those above are to be individually considered by the Society at the time of the approval of welding procedures.

.2 For the authorization to use welding procedures in production, the following details are to be stated:

- (a) grade and temper of parent and filler materials
- (b) weld execution procedures: type of joint (e.g. butt-joint, fillet joint); edge preparation (e.g. thicknesses, bevelling, right angle edges); welding position (e.g. flat, vertical, horizontal) and other parameters (e.g. voltage, amperage, gas flow capacity)
- (c) welding conditions (e.g. cleaning procedures of edges to be welded, protection from environmental atmosphere)
- (d) special operating requirements for butt-joints, for example for plating: welding to be started and completed on end pieces outside the joint, back chipping, arrangements for repairs consequent to possible arc restarts
- (e) type and extent of controls during production.

C3.2.5 Corrosion protection - heterogeneous steel/aluminium alloy assembly

.1 Connections between aluminium alloy parts, and between aluminium alloy and steel parts, if any, are to be protected against corrosion by means of coatings applied by suitable procedures agreed by the Society.

.2 In any case, any direct contact between steel and aluminium alloy is to be avoided (e.g. by means of zinc or cadmium plating of the steel parts and application of a suitable coating on the corresponding light alloy parts).

.3 Any heterogeneous jointing system is subject to the Society's agreement.

.4 The use of transition joints made of aluminium/steel-cladded plates or profiles is subject to the Society's agreement.

.5 Transition joints are to be type-approved.

.6 Qualifications tests for welding procedures are to be carried out for each joint configuration.

.7 A welding booklet giving preparations and various welding parameters for each type of assembly is to be submitted for review.

C3.2.6 Fibre-reinforced plastic (FRP) structures**C3.2.6.1 Raw materials**

.1 The main raw materials are to be homologated by the Society.

It may be accepted as equivalent that main raw materials should be individually inspected by the Society. In such a case, each batch being used is submitted to tests, the conditions and scope of which are stipulated by the Society's surveyor.

.2 Reinforcement fibres

- (a) Fibres for reinforcement may be textile glass or aramid or carbon fibres or other fibres.
- (b) Products laid on a surface, such as size, binder and coupling finish, are to ensure cohesion between fibres and resins.
- (c) During manufacturing, the shipyard is to ensure that reinforcement materials are to be free from scrap matter and without defects, detrimental to their use.

.3 Resins

- (a) Resins are to be capable of withstanding ageing in marine environments and industrial atmospheres.
- (b) Resins are to be used within the limits fixed by the manufacturer. In this respect, the surveyor may ask for any relevant proof.

.4 Core materials for sandwich laminates

- (a) Expanded foams contributing to sandwich laminate strength are to be of the closed cell type and compatible with the resins used.
- (b) Expanded polystyrenes may be used only as filling or buoyancy materials.

.5 Additives

- (a) Fillers and pigments are to affect neither the conditions of polymerisation of the impregnation resin nor its mechanical characteristics. The percentage of both of them is not to exceed, as a rule, 10% of the mass of resin, with a maximum of 2% for thixotropic agents and 5% for flame retarders.

The use of microspheres is subject to special examination.

- (b) The type and proportions of catalyst and accelerator are to be adjusted in any case to the conditions of work (production rate) and ambient atmosphere (temperature).

In order to ensure complete curing, the builder is to respect the indications of the resin manufacturer, particularly for the ratio of catalyst.

.6 Materials for integrated structures

- (a) These are elements entirely covered with laminate, and used for reinforcement, moulding, or as lamination support for stiffeners, for example.
- (b) The metals used are withstand seawater and fuel corrosion; they are to be of good quality and must not have any influence on resin curing.
They are to undergo appropriate preparation to improve bonding with the resin.
- (c) As a rule, wood reinforcements are to be of a plywood type with good seawater resistance. The use of timber is subject to a special examination.

C3.2.6.2 Tests on laminates

.1 General

- (a) The shipyard has to make samples representative of shell materials and possibly of other parts of the structure, taking into account the type and size of ship.
- (b) If sister ships are built at the same shipyard, and provided that raw materials are not changed, the frequency of samples for testing is determined by the Society.
- (c) These test samples are to be submitted to a laboratory approved by the Society to undergo mechanical and physicochemical tests, as defined below.
- (d) In general, tests are to be carried out according to the standards indicated below, or other recognized standards previously agreed upon with the Society.
- (e) These tests must show that laminate characteristics are at least equivalent to the theoretical values given by direct calculation following the method given in C3.2.6.3. Otherwise, supplementary tests may be required.
- (f) The Society reserves the right to require tests different from those defined below, if particular materials or unusual manufacturing process are used.
- (g) Tests are to be carried out on a panel, the composition of which is to be the same as that of a shell plating area, without gel-coat.
- (h) Identification of the panel is given by the following elements:
 - exact name of the resin, with its specific gravity, elasticity modulus, and breaking stress in curing state,
 - description of elementary layers,
 - characteristics of the laminate (e.g. layer type, direction),
 - direction of the panel in respect of longitudinal axis of the ship and indication of direction for warp and weft for the rovings in respect of the same axis.
- (i) Conditioning of laminate panels, preparation of testpieces, dimensional measurement of testpieces and the tests defined below are to be carried out according to recognized standards.
- (j) Tests are to be carried out on testpieces taken out of the panel in two perpendicular directions. The number of testpieces for each direction is given by the standard used for the particular test.
- (k) For each group of testpieces and for each result, the value to consider is the average obtained from the number of tested pieces, provided that the minimum value is not less than 0,9 times the mean value. Otherwise, the value to consider is determined by the Society, taking testing conditions and dispersion of results into account.
- (l) Mechanical characteristics are to be obtained from dry testpieces, i.e. not conditioned in water.
- (m) In general, the following tests are to be carried out:
 - single skin laminates: tensile tests, bending tests (three-point method), measurement of specific gravity and percentage of reinforcement in mass,
 - sandwich laminates: bending tests (four-point method), and, for each skin, tensile tests, measurement of specific gravity and percentage of reinforcement in mass.
- (n) Bending tests are to be carried out with the load applied either on the gel-coat side or on the opposite side. The choice of the side is to be decided in accordance with the Society, so that the failure mode of the testpiece is representative of the case of scantlings of the plating.
- (o) Test results are to be shown in a test report, mentioning the tests in C3.2.6.22 to C3.2.6.24.

.2 Tensile tests

- (a) In general, these tests are to be carried out for single skin laminates and the skins of sandwich laminates.
- (b) The applicable standard is:
ISO 3268.
- (c) For each testpiece, the test report is to provide the following information:
 - reference of the standard used for the test,
 - widths and thicknesses of the test-piece, in mm,
 - length between fixed ends, in mm,
 - load (in N) - elongation curve (in mm),
 - breaking load, in N,
 - tensile breaking stress, in N/mm²,
 - tangential initial elasticity modulus, in N/mm²,
 - other items of information required by the standard, if necessary.
- (d) If breaking occurs in several steps, the value taken into account is the first break obtained from the load-elongation curve.
- (e) The test report is also to indicate the mean value of the breaking load, breaking tensile strength and tangential initial elasticity modulus.

.3 **Bending tests**

- (a) In general, bending tests using the three-point method are to be carried out only for the single skin laminates.
The applicable standard is:
ISO 178.
- (b) In general, bending tests using the four-point method are to be carried out only for sandwich laminates.
The applicable standard is:
ASTM C 393.
- (c) For each testpiece, the test report is to provide the following information:
- reference of the standard used for the test,
 - widths and thicknesses of the testpiece, in mm,
 - length of the span between supports, in mm,
 - for the four-point method: location of the points where the load is applied,
 - load (in N) - deflection (in mm) curve,
 - breaking load, in N, and failure mode,
 - bending breaking strength, in N/mm², for single skin laminate tests,
 - bending breaking strength of skin and shear breaking strength of core for sandwich laminate tests, both in N/mm²,
 - other items of information required by the standard, if necessary.
- (d) If breaking occurs in several steps, the value taken into account is the first break obtained from the load-deflection curve.
- (e) The test report is also to indicate the mean value of the breaking load and breaking strength.

.4 **Specific gravity and percentage of reinforcement**

- (a) In general, these tests are to be carried out for single skin laminates and the skins of sandwich laminates.
- (b) The applicable standards are:
ASTM D 792,
ASTM D 3171.
- (c) For each testpiece, the test report is to provide the following information:
- reference of the standard used for the test,
 - dimensions, in mm, of the test-piece,
 - mass of the test-piece, in g,
 - mass by unit of area of the test-piece, in g/m²,
 - specific density, in g/m³,
 - mass of reinforcement of the test-piece, in g,

- mass of reinforcement by unit of area, in g/m²,
 - percentage of reinforcement in mass,
 - other items of information required by the standard, if necessary.
- (d) The test report is also to indicate the mean value of the mass by unit of area, in g/m², specific gravity, in g/m³, mass of reinforcement by unit of area, in g/m², and percentage of reinforcement in mass.

C3.2.6.3 Estimation of mechanical characteristics of FRP materials

.1 The meanings of the symbols used below are as follows:

- Ψ : content in mass of reinforcement in a layer,
- φ : content in volume of reinforcement in a layer, defined in C3.2.6.32 below,
- μ_0 : vacuum content, equal to 0, if there is no available information,
- E_1 : Young's modulus of a layer with unidirectional fibres, parallel to fibres, in N/mm², defined in C3.2.6.32 below,
- E_2 : Young's modulus of a layer with unidirectional fibres, perpendicular to fibres, in N/mm², defined in C3.2.6.32 below,
- ν_{12}, ν_{21} : Poisson's ratios of a layer with unidirectional fibres, defined in C3.2.6.32 below,
- G_{12} : Coulomb's modulus of a layer with unidirectional fibres, in N/mm², defined in C3.2.6.32 below,
- ρ_v : specific gravity of reinforcement, in g/cm³,
- ρ_r : specific gravity of resin, in g/cm³,
- E_{1v} : Young's modulus of reinforcement in the direction parallel to fibres, in N/mm²,
- E_{2v} : Young's modulus of reinforcement in the direction perpendicular to fibres, in N/mm²,
- E_r : Young's modulus of resin, in N/mm²,
- ν_v : Poisson's ratio of reinforcement,
- ν_r : Poisson's ratio of resin,
- G_r : Coulomb's modulus of resin, in N/mm², defined in C3.2.6.32 below,
- G_v : Coulomb's modulus of the reinforcement, in N/mm², as given in Table C3.2.7.

When there is no available information, the values given in Table C3.2.7 may be considered.