PART II RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF VESSELS IDENTIFIED BY THEIR MISSIONS

TITLE 25 HIGH SPEED CRAFT

SECTION 1 NAVAL ARCHITECTURE

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A1. INCORPORATION OF THE INTERNATIONAL CODE OF SAFETY FOR HIGH SPEED VESSELS BY THE RBNA RULES

100. Incorporation of the Code

101. The present Part II, Title 25 of the Rules incorporate the International Code of Safety of High Speed Vessels in its entirety.

102. The original terminology of the Code has been maintained.

103. Under the conditions of A1.101 and A1.102 above and 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 RBNA “Rules for the Construction and Classification of Ships destined to Open Sea Navigation” are referred to below simply as “Society Rules”.

104. Equipment and arrangements dealt with in the parts of the Code such as those concerning life-saving appliances, radio communications and operational aspects, which are not subject to control by the Society, have been maintained to keep the integrity of the Code, and are to be covered by the relevant certification.

105. All the original texts from the code have been identified by a vertical line on the right side of the text, as demonstrated here.

106. Additional requirements and comments are inserted at the relevant Part of the Code are identified by the words “RBNA comment” before the text.

A2. PREAMBLE OF THE INTERNATIONAL CODE OF SAFETY FOR HIGH –SPEED CRAFT - 2000

100. Preamble

101. 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.

102. 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.

103. 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.

104. 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.

105. 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.

106. 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 infra-structure 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.

107. 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.

108. 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.

109. Application of mathematical analysis should be encouraged to assess risk and determine the validity of safety measures.

110. This Code takes into account that a high-speed craft is of a light displacement compared with a conventional ship.

111. 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.

112. 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.

113. The Code requirements also reflect the additional hazards which may be caused by the high speed compared with conventional ship transportation.

114. 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.

115. 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.

16. 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.

A3. GENERAL

100. 1.1 General comments

101. This Code shall be applied as a complete set of comprehensive requirements.

102. 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.

RBNA comment: the present Title 25 applies also to ships for open sea navigation of GT $\geq$ 500 engaged in national voyages in areas O1 and/or O2, as defined in Part I, Title 01, Section 1.

103. Thebasic 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 InternationalConvention on Load Lines, 1966, (Load Line Convention)by the application of constructional and equipment stand-
ards in conjunction with strict operational controls.

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

104. Craft satisfying the requirements of these Rules areassigned the notation HSC or High Speed Craft.

200. 1.2 General requirements

201. The application of the provisions of this Code is subject tothe following general requirements that:

a. the Code will be applied in its entirety;

b. the management of the company operatingthe craft exercises strict control over its operation and maintenance by a quality-management system

c. the management ensures that only personsqualified to operate the specific type of craft used on theintended route are employed;

d. the distances covered and the worstintended conditions in which high-speed craft operationsare permitted will be restricted by the imposition of operational limits;

e. the craft will at all times be in reasonableproximity to a place of refuge, having due regard to the provisions of A4.2014;

f. adequate communications facilities, weatherforecasts and maintenance facilities are available within thearea of craft operation;

g. in the intended area of operation suitable rescue facilities will be readily available;

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

i. efficient facilities are provided for the rapidand safe evacuation of all persons into survival craft;

j. all passengers and crew are provided withseats;

k. no enclosed sleeping berths for passengersare provided.

Guidance

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

End of guidance

A4. APPLICATION

100. Application for vessel with GT ≥ 500 engaged in international voyages

101. 1.4 This Code applies to high speed craft asspecified in A4.303 engaged in international voyages the keelsof which are laid or which are at a similar stage of construction on or after 1 July 2002.

200. Application for vessels with GT < 500 engaged in national or international voyages

201. 1.3.4 In addition to the craft specified in A5.130,these Rules also apply to:

a. high speed craft engaged innational voyages;

b. high speed craft having GT < 500.

202. RBNA comment: Exemptions from some of the requirements of the Rules may be granted when particularcircumstances (e.g. restricted services) warrant this, in theopinion of the RBNA.

300. 1.3 Special terms for the purpose of this Code

301. 1.3.3 For the purpose of this Code, the term "asimilar stage of construction" means the stage at which:

a. construction identifiable with a specific craftbegins; and

b. assembly of that craft has commenced comprising at least 50 tonnes or three per cent of the estimatedmass of all material used in the structure, including superstructure and deckhouse, whichever is less.

302. For the purpose of this Code:

a. the expression "craft constructed" meanscraft the keels of which are laid or which are at a similarstage of construction; and

b. a cargo craft, whenever built, which is converted to a passenger craft shall be treated as a passengercraft constructed on the date on which such a conversioncommences.

303. This Code applies to:

a. passenger craft which do not proceed in thecourse of their voyage more than four hours at operationalspeed from a place of refuge; and

b. cargo craft of 500 gross tonnage andupwards which do not proceed in the course of their voyage more than 8 h at operational speed from a place ofrefuge when fully laden.

304. RBNA comment: In addition to the cargo craft specified in A4.303.b, these Rules also apply as far as appropriate to cargocraft of less than 500 tons gross tonnage.

305. The application of this Code shall be verifiedby the Administration and be acceptable to the Governments of the States to which the craft will be operating.

Guidance

The verification in A4.305 above shall be carried out by RBNA for Brazilian Flag ships as authorized by the terms of Delegation Agreement signed between DPC and RBNA.

End of guidance

A5. DEFINITIONS

100. 1.4 Definitions

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

102. "**Administration**" means the Government ofthe State whose flag the craft is entitled to fly.

103. "**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.

104. "**Anniversary date**" means the day and the month of each year which will correspond to the date of expiry of the relevant certificate.

105. "**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.

106. "**Auxiliary machinery spaces" are space**s 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.

107. "**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.

108. "**Base port**" is a specific port identified in the route operational manual and provided with:

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

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

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

d. access to craft maintenance services with appropriate equipment.

109. "**Base port State**" means the State in which the base port is located.

110. "**Breadth (B)**" means breadth of the broadest part of the moulded water-tight envelope of the rigid hull, excluding appendages, at or below the design waterline in the displacement mode with no lift or propulsion machinery active.

111. "**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.

112. "**Cargo spaces**" are all spaces other than special category spaces and ro-ro spaces used for cargo and trunks to such spaces "Cargo spaces" include ro-ro spaces, special category spaces and open deck spaces.

113. "**Category A craft**" is any high-speed passenger craft:

a. 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:

a.1. the time to prevent persons in survival craft from exposure causing hypothermia in the worst intended

a.2. conditions,

a.3. the time appropriate with respect to environmental conditions and geographical features of the route, or

a.4. 4 hours; and

b. carrying not more than 450 passengers.

114. "**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 H should not be inferred in this respect.

115. "**Company**" means the company as defined in chapter IX of the Convention.

116. "**Continuously manned control statio**n" is a control station which is continuously manned by a responsible member of the crew while the craft is in normal service.

117. "**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.

118. "**Convention**" means the International Convention for the Safety of Life at Sea, 1974, as amended.

119. "**Crew accommodation**" are those spaces allocated for the use of the crew, and include cabins, sickbays, offices, lavatories, lounges and similar spaces.

120. "**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.

121. "**Datum**" means a water-tight deck or equivalent structure of a non-water-tight deck covered by aweathertight structure of adequate strength to maintain

the weathertight integrity and fitted with weathertight closing appliances.

122. "**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 Chapter H and Part II, Title 25, Section 2.

123. "**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.

124. "**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.

125. "**Procedures Code (FTP Code)**"means the International Code for Application of Fire Test Procedures, as defined in chapter II-2 of the Convention.

126. "**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.

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

128. "**Foil**" means a profiled plate or three dimensional construction at which hydrodynamic lift is generated when the craft is under way.

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

129. "**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.

130. "**High-speed craft**" is a craft capable of maximum speed, in metres per second (m/s), equal to or exceeding:

$$V \geq 3{,}7 * \nabla^{0{,}1667}$$

where:

∇ = volume of displacement corresponding to the design waterline (m^3),

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.

131. "**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.

132. **"Length (L)**" means the overall length of the underwater water-tight envelope of the rigid hull, excluding appendages, at or below the design waterline in the displacement mode with no lift or propulsion machinery active.

133. "**Lightweight**" is the displacement of the craft in tonnes without cargo, fuel, lubricating oil, ballast water, fresh water and feed water in tanks, consumable stores, passengers and crew and their effects.

134. "**Life-Saving Appliances Code (LSA Code)**"means the International Life-Saving Appliance Code as defined in chapter III of the Convention.

135. "**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.

136. "**Maximum operational weight**" means the overall weight up to which operation in the intended mode is permitted by the Administration.

137. "**Maximum speed**" is the speed achieved atthe maximum continuous propulsion power for which thecraft is certified at maximum operational weight and insmooth water.

138. "**Non-displacement mode**" means the normal operational regime of a craft when non-hydrostatic forces substantially or predominantly support the weight of the craft.

139. "**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/mm^2.

140. "**Open ro-ro spaces**" are those ro-ro spaces:

a. to which any passengers carried have access; and either:

b. are open at both ends; or

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

141. "**Operating limitations**" means the craft limitations in respect of handling, controllability and performance and the craft operational procedures with in which the craft is to operate.

142. "**Operating compartment**" means the enclosed area from which the navigation and control of the craft is exercised.

143. "**Operating station**" means a confined area of the operating compartment equipped with necessary means for navigation, manœuvring and communication, and from where the functions of navigating, manœuvring, communication, commanding, conning and lookout are carried out.

145. "**Operational speed**" is 90% of maximum speed.

146. "**Organization**" means the International Maritime Organization.

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147. "Passenger" is every person other than:

a. 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

b. a child under one year of age.

"Passenger craft" is a craft which carries more than twelve passengers.

148. "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.

149. "**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.

150. "**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.

151. "**Ro-ro craft**" is a craft fitted with one or more ro-ro spaces.

152. "**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.

153. "**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.

154. "**Significant wave height**" is the average height of the one third highest observed wave heights over a given period.

155. "**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.

156. "**Surface-effect ship**" (SES) is an air-cushion vehicle whose cushion is totally or partially retained by permanently immersed hard structures.

157. "**Transitional mode**" means the regime between displacement and non-displacement modes.

158. "**Water-tight**" 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.

159. "**Weather deck**" is a deck which is completely exposed to the weather from above and from at least two sides.

160. "**Weather-tight**" means that water will not penetrate into the craft in any wind and wave conditions up to those specified as critical design conditions.

161. "**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

A5. SURVEYS AND APPROVALS [IMO INTERNATIONAL CODE OF SAFETY FOR HIGH SPEED CRAFT 2000]

RBNA Note 1: the terminology of the Code has been maintained as far as possible. Therefore, the terms "Administration" and "Code" may be substituted by "RBNA" and "Rules". The item numbers of the Code have been maintained.

RBNA Note 2: The Subchapter A5 (Surveys and Approval) has been introduced in Part II, Title 25, Section 1 instead of in Part I of the Rules for the purpose of maintaining the integrity of the Code.

100. 1.5 Surveys

101. 1.5.1 Each craft shall be subject to the surveys specified below:

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

b. a renewal survey at intervals specified by the RBNA but not exceeding 5 years;

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

d. an additional survey as the occasion arises.

102. RBNA comment: tail shaft surveys, boiler surveys, surveys of additional class notations are required according to the RBNA Rules.

103. 1.5.2 The surveys referred to above shall be carried out as follows:

a. 1.5.2.1 the **initial survey** shall include:

a.1. an appraisal of the assumptions made and limitations proposed in relation to loadings, environment, speed and manœuvrability;

a.2. an appraisal of the data supporting the safety of the design, obtained, as appropriate, from calculations, tests and trials;

a.3. a failure mode and effect analysis as required by this Code;

a.4. an investigation into the adequacy of the various manuals to be supplied with the craft; and

a.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;

b. 1.5.2.2 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 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

c. 1.5.2.3 an **additional survey**, either general or partial according to the circumstances, shall be made after a repair resulting from investigations prescribed in A6.103, 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.

c.1. RBNA comment: 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.

104. RBNA comment: the above surveys are to be carried out referring to those required by the Rules.

106. 1.5.3 The periodical surveys shall be endorsed on the High-Speed Craft Safety Certificate.

105. 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.

(RBNA note: in case of Brazilian Flag vessels, RBNA is authorized to carry out such surveys by force of the Delegation Agreement signed with DPC).

107. 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.

108. 1.5.6 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.

108. 1.5.6 Conditions for validity of class of craft are stipulated in the Society’s Rules.

109. 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.

200. 1.6 Design approvals

201. The owner of a craft shall accept the obligation to supply sufficient information to enable the RBNA to fully assess the features of the design. It is strongly recommended that the Company and the rbna and, where appropriate, the port State or States shall commence discussions at the earliest possible stage so that the RBNA 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.

202. RBNA comment: Conditions of design review of the craft, for classification purposes, are stipulated in the Society's Rules.

A6. MAINTENANCE OF CONDITIONS AFTER SURVEY [IM INTERNATIONAL CODE OF SAFETY FOR HIGH SPEED CRAFT 2000]

RBNA Note 1: the terminology of the Code has been maintained as far as possible. Therefore, the terms "Administration" and "Code" may be substituted by "RBNA" and "Rules". The item numbers of the Code have been maintained.

RBNA Note 2: The Subchapter A6 (Maintenance of Class Conditions After Survey) has been introduced in Part II, Title 25, Section 1 instead of in Part I of the Rules for the purpose of maintaining the integrity of the Code.

100. 1.7 Maintenance of conditions after survey

101. 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.

102. RBNA comment: With reference to A6.101 the above responsibility lies with the Owner of the craft (or his representative).

103. 1.7.2 After any survey of the craft under Subchapter A5 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.

104. 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 Subchapter A5, 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.

105. RBNA comment: With reference to A6.102 and A6.103, it is the Owner's responsibility to inform the Society of any modification, damage or repair affecting the class of the craft.

A7. HIGH-SPEED CRAFT SAFETY CERTIFICATE [IMO INTERNATIONAL CODE OF SAFETY FOR HIGH SPEED CRAFT 2000]

RBNA Note 1: the terminology of the Code has been maintained as far as possible. Therefore, the terms "Administration" and "Code" may be substituted by "RBNA" and "Rules". The item numbers of the Code have been maintained.

RBNA Note 2: The Subchapter A7 (High Speed Craft Safety Certificate) has been introduced in Part II, Title 25, Section 1 instead of in Part I of the Rules for the purpose of maintaining the integrity of the Code.

100. 1.8 Certification

101. 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.

102. 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 compiled 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 A7.101 above.

103. 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.

104. 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.

105. 1.8.5 Notwithstanding the requirements of A7.104 above, 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 five (5) years from the date of expiry of the existing Certificate.

106. 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 five (5) years from the date of expiry of the existing Certificate.

107. 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 five (5) years from the date of completion of the renewal survey.

108. 1.8.8 If a Certificate is issued for a period of less than five (5) years, the Administration may extend the validity of the Certificate beyond the expiry date to the maximum period specified in A7.104 above, provided that the surveys when a Certificate is issued for a period of five (5) years are carried out.

109. 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.

110. 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 five (5) years from the date of expiry of the existing Certificate before the extension was granted.

111. 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 requiredby A7.106 or A7.110. 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.

112. 1.8.12 If a periodical survey is completed before the period specified in section 1.5 then:

a. 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;

b. the subsequent periodical survey required by Subchapter A5 shall be completed at the intervals prescribed by A5 using the new anniversary date; and

c. 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 A6.100 are not exceeded;

113. 1.8/.13 A Certificate issued under A7.101 or A7.102 shall cease to be valid in any of the following cases:

a. if the relevant surveys are not completed within the periods specified A5.;

b. if the Certificate is not endorsed in accordance with A51.106;

c. 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 A5.102 and A6.102. 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.

200. 1.9 Permit to Operate High-Speed Craft

201. 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 under-
taken without the Permit to Operate High-Speed Craft.

202. 1.9.2 The Permit to Operate High-Speed Craft shall be issued by the Administration to certify compliance with Part II, Title 25, Section 1, Chapter A, A3.201.a to A3.201.i,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 Part II, Title 25, Section 1, Chapter L.

203. 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.

204. 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.

205. 1.9.5 The provisions of A7.100 shall apply to the issue and the period of validity of the Permit to Operate High Speed Craft.

206. 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.

207. 1.9.7 Control: 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 A7.100.

208. 1.9.8 Equivalents: 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.

RBNA comment: for classification purpose, the Society's Rules apply.

209. 1.9.9 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.

A8. SPECIAL PROVISIONS [IMO INTERNATIONAL CODE OF SAFETY FOR HIGH SPEED CRAFT 2000]

RBNA Note 1: the terminology of the Code has been maintained as far as possible. Therefore, the terms "Administration" and "Code" may be substituted by "RBNA" and "Rules". The item numbers of the Code have been maintained.

RBNA Note 2: The Subchapter A8 (Special Provisions) has been introduced in Part II, Title 25, Section 1 instead of in Part I of the Rules for the purpose of maintaining the integrity of the Code.

100. 1.10 Control

101. 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 A7.100.

200. 1.11 Equivalents

201. 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.

RBNA note: With reference to A8.102 above, for classification purpose, the Society's Rules apply.

202. 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.

300. 1.12 Information to be made available

301. 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.

302. 1.12.2 The manuals shall contain at least the information specified in Chapter L below 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.

303. With reference to A8.200 above, the operating manual is to be considered as a class matter.

400. 1.13 Further developments

401. 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.

402. 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.

403. 1.13.3 The foregoing shall be considered by the Administration when assessing the granting of equivalents under the Code.

500. 1.14 Circulation of safety information

501. 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.

502. 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.

600. 1.15 Review of the code

601. 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.

602. 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.

700. Chapter19 – Inspection and maintenance requirements

For High-Speed Crafts constructed from 2002-07-01

701. 19.1 The Administration shall be satisfied with the operator' s organization or any organization on which he may call in the maintenance of his craft and shall specify the scope of the duties which any part of the organization may carry out, having regard to the number and competence of its staff, facilities available, arrangements for calling on specialist assistance should it be necessary, record-keeping, communication and allocation of responsibilities.

702. 19.2 The craft and equipment shall be maintained to the satisfaction of the Administration; in particular:

a. routine preventive inspection and maintenance shall be performed to a schedule approved by the Administration, which shall have regard at least in the first instance to the manufacturer' s schedule;

b. in the performance of maintenance tasks, due regard shall be paid to maintenance manuals, service bulletins acceptable to the Administration and to any additional instructions of the Administration in this respect;

c. all modifications shall be recorded and their safety aspects investigated. Where it could have any effect on safety, the modification, together with its installation, shall be to the satisfaction of the Administration;

d. appropriate arrangements shall be provided for informing the master of the serviceability state of his craft and its equipment;

e. the duties of the operating crew in respect of maintenance and repairs and the procedure for obtaining assistance with repairs when the craft is away from the base port shall be clearly defined;

f. the master shall report to the maintenance organization any defects and repairs which are known to have occurred during operations;

g. records of defects and their correction shall be maintained and those defects of recurrent nature, or those which adversely affect craft or personal safety, shall be reported to the Administration.

703. 19.3 The Administration shall be satisfied that arrangements are provided for ensuring adequate inspection, maintenance and recording of all life-saving appliances and distress signals carried.

CHAPTER B
DOCUMENTS, REGULATIONS AND STANDARDS

CHAPTER CONTENTS

B1. NAVAL ARCHITECTURE STANDARDS

100. Documents and specifications (RBNA)

101. The following drawings and documents are to be submitted in triplicate hard copies or in virtual files for approval where appropriate

a. Hull, plotted and numerically;

b. Side contour, plotted and numerically;

c. Coordinates of non-water-tight and non-weather-tight openings;

d. Hydrostatic tables;
e. Cross curve tables;

f. Data of boundaries of all subcompartments;

g. and a plan in which these compartments are stated;

h. Damage stability investigation, complete input and output data including initial loading conditions;

i. Damage control plan;

j. Inclining test report;

k. Intact stability booklet.

300. Construction documents

301. The construction documents are to be part of the ship's files to be assembled during construction and to be submitted to the surveyor. Those documents are part of RBNA final report for new buildings. See Part I, Title 01, Section 2, C5.700.

B2 REGULATIONS

100. Applicable Regulations (RBNA)

101. **Craft for which classification only is requested**
These craft are to comply in full with the requirements of the present Title 25 of the Rules, except for those identified otherwise identified as part of the Code but not applicable to classification.

102. **Craft for which both classification and the IMO Certification are requested**
These craft are to comply in full with the requirements of the present Title 25 and of the Code.

103. **Craft for which NORMAM 01 classification and the IMO Certification are requested**
For Brazilian Flag craft under 500 GT, the requirements of Title 25 of the Rules are to be complied with as far as possible, with exceptions wherever a requirement is not possible to apply due to the size of the craft and/or to the navigation conditions (e.g., very short crossings, small craft with a large passenger saloon, etc.).

For statutory purposes the applicable National statutory regulations are to be in accordance with NORMAM 01 for cargo or for passenger ships, although the Code recommends that its requirements be applicable to vessels under 500 GT.

104. **Craft for which NORMAM 01 classification and the IMO Certification are requested**

For foreign Flag craft under 500 GT, the requirements of Title 25 of the Rules are to be complied with, with exceptions wherever a requirement is not possible to apply due to the size of the craft and/or to the navigation conditions (e.g., very short crossings). The statutory regulations shall be in accordance with National Regulations or, in the absence of those, according to the IMO Code of Safety for High Speed Craft, 2000.

B3. TECHNICAL STANDARDS

100. Industrial Standards (RBNA)

101. The present Rules follow industrial standards where applicable to materials and equipment destined to be installed on board vessels classified by RBNA or other societies. Where this is the case, the applicable standards are indicated in the relevant Chapters of the Rules.

CHAPTER H
LOADING CONDITIONS, BUOYANCY AND STABILITY

CHAPTER CONTENTS

H1. LOAD LINE

100. Application

101. RBNA The present Subchapter H1 is applicable for craft which must comply with the Code of Safety for High Speed Craft.

102. RBNA The contents of the present Subchapter H1 are subject to National Regulations.

103. RBNA For craft under 500 GT of Brazilian Flag and not subject to classification, the present Subchapter H1 is not applicable. For such vessels, the regulations of NORMAM 01 Chapter 7 apply.

104. RBNA For craft under 500 GT of foreign flag, National Regulations apply or, in the absence of those, the regulations of the Code apply.

200. 2.9.2 Load line mark (for craft having GT ≥ 500)

201. 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 displacement mode and at a height corresponding to the design waterline.

202. 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.

203. 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.

204. 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.

205. 2.9.2.6 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.

207. 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.

300. 2.9 Marking and recording of the design waterline

301. 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 H1.202 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.

H4. INTACT BUOYANCY AND WATER-TIGHT AND WEATHER-TIGHT INTEGRITY

100. 2.2.1 Buoyant spaces

101. 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:

a. water-tight and situated below the datum, or

b. water-tight or weather-tight and situated above the datum.

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

103. Where a buoyant space may be subjected to increased fluid pressure in the equilibrium position after damage, the boundaries and associated openings and penetrations of that space shall be designed and constructed to prevent the passage of fluid under that pressure.

104. 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.

105. 2.2.1.2 Arrangements shall be provided for checking the water-tight or weather-tight integrity of those compartments taken into account in H4.101 above, and the details incorporated in the Craft Operating Manual required by L1.202.

200. 2.2.2 Openings in water-tight divisions

201. 2.2.2.1 The number of openings in water-tight 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.

202. 2.2.2.2 Doors in water-tight bulkheads may be hinged or sliding. They shall be shown by suitable testing to be capable of maintaining the water-tightintegrity 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.

203. 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 H4.201 above).

204. 2.2.2.4 Allwater-tight 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.

205. 2.2.2.5 Water-tight 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.

206. 2.2.2.6 Water-tight 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 water-tight 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 H4.204 above.

207. 2.2.2.7 Where pipes, scuppers, electric cables, etc. are carried through water-tight divisions, the arrangements for creating a water-tight 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.Water-tight bulkhead penetrations which are effected by continuous welding do not require prototype testing. Valves on scuppers from weather-tight compartments, included in the stability calculations, shall have arrangements for remote closing from the operating station.

208. 2.2.2.8 Where a ventilation trunk forms part of a water-tight 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.

300. 2.2.3 Inner bow doors

301. 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:

a. weather-tight to the deck above, which deck shall itself be weather-tight forward to the bow loading opening;

b. 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;

c. forward of all positions on the vehicle deck in which vehicles are intended to be carried; and

d. part of a boundary designed to prevent flooding into the remainder of the craft.

302. 2.2.3.2 A craft may be exempted from the requirement for such an inner bow door where one of the following applies:

a. 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;

b. 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:

b.1. the bow loading door is not reached by waves; or

b.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 H6.403 and H6.405 or H6.407 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;

c. bow loading openings lead to open ro-ro spaces provided with guard-rails or having freeing ports complying with H4.302.d;

d. 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 H4.302.b above or comply with the following:

4.1 $A \geq 0.3*l$

where :

A =the total area of freeing ports on each side of the deck;

l = length of the compartment, in metres

400. Other provisions for ro-ro craft

401. 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 H4,302.b or 3 m above the design waterline.

402. 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 weather-tight to prevent ingress of water below.

403. 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 H4,302.or 3 m above the design waterline may be permitted provided they are water-tight and are closed before the craft leaves the berth on any voyage and remain closed until the craft is at its next berth.

404. 2.2.4.4 The accesses referred to in H4.402 and H4.403 above shall be fitted with alarm indicators in the operating compartment.

405. 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 underway (refer to Part II, Title 25, Section 3, Chapter E).

500. 2.2.5 Indicators and surveillance

501. 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

502. 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.

600. 2.2.6 Integrity of superstructure

601. 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:

a. of adequate strength to maintain the weather-tight integrity and fitted with weather-tight closing appliances; or

b. provided with adequate drainage arrangements; or

c. an equivalent combination of both measures.

602. 2.2.6.2 Weather-tight superstructures and deckhouses located above the datum shall in the outside boundaries have means of closing openings with sufficient strength such as to maintain weather-tight integrity in all damage conditions where the space in question is not damaged. Furthermore, the means of closing shall be such as to maintain weather-tight integrity in all operational conditions.

700. 2.2.7 Doors, windows, etc., in boundaries of weather-tight spaces

701. 2.2.7.1 Doors, windows, etc., and any associated frames and mullions in weather-tight superstructures and deckhouses shall be weather-tight 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.

702. 2.2.7.2 For doors in weather-tight 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.

Guidance

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

End of guidance

703. 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 weather-tight 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.

704. 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.

705. 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 water-tight.

706. 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.

800. 2.2.8 Hatchways, other openings and machinery spaces

801. 2.2.8.1 Hatchways closed by weather-tight covers
The construction and the means for securing the weather-tightness of cargo and other hatchways shall comply with the following:

a. coaming heights shall in general not be less than 100 mm for hatches to weather-tight 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;

b. 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

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

802. **Machinery space openings**

a. 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 weather-tight doors.

b. Heights of sills and coaming shall, in general, not be less than 100 mm for openings to weather-tight 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.

c. Machinery space ventilator openings shall comply with the requirements of H4.804.b.

803. 2.2.8.3 **Miscellaneous openings in exposed decks**

a. 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 water-tight. Unless secured by closely spaced bolts, the covers shall be permanently attached.

b. 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.

c. 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 weather-tightness.

d. 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 weather-tight 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.

804. 2.2.8.4 **Ventilators**

a. 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 weather-tight 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.

b. 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.

c. 2.2.8.4.3 Except as provided in H4.804.b, ventilator openings shall be provided with efficient weather-tight closing appliances.

d. 2.2.8.4.4 Ventilator openings shall face aft or athwartships wherever practicable.

900. 2.2.9 Scuppers, inlets and discharges and air pipes, freeing ports

901. 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.

902. 2.2.9.2 Valves on scuppers from weather-tight compartments included in the stability calculations shall be operable from the operating compartment.

903. 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 inlet and discharge controls in connection with the operation of machinery shall either:

a. be located at least 50% of the significant wave height corresponding to the worst intended conditions above the deepest flooded waterline following damage specified in H6.100 to H6.500; or

b. be operable from the operating compartment.

904. 2.2.9.4 Scuppers leading from superstructures or deckhouses not fitted with weather-tight doors shall be led overboard.

905. 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.

905. 2.2.10 **Air pipes**

a. 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.

b. 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.

c. 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.

d. 2.2.10.4 All air pipes shall be equipped with weather-tight closing devices that close automatically.

906. 2.2.11 **Freeing ports**

a. 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:

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

$A = 0.7 + 0{,}035\ l\ (m^2)$; and

where l exceeds 20 m:

$A = 0{,}07\ l\ \ (m^2)$,

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

b. 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.

c. 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.

d. 2.2.11.4 Craft, having superstructures which are open in front or both ends, shall comply with the provisions of H4.906.

e. 2.2.11.5 In craft, having superstructures which are open at the aft end, the minimum freeing port area shall be:

$A = 0.3\ b\ \ (m^2)$

where:

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

f. 2.2.11.6 Ro-ro craft fitted with bow loading openings leading to open vehicle spaces shall comply with the provisions of H4.300.

H5. STABILITY

100. 2.1 General

101. 2.1.1 A craft shall be provided with:

a. stability characteristics and stabilization systems adequate for safety when the craft is operated in the non-displacement mode and during the transitional mode;

b. 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

c. stability characteristics in the non-displacement and transitional modes adequate to transfer the craft safely to displacement mode in case of any system malfunction.

102. 2.1.2 Account shall be taken of the effect of icing in the stability calculations.

103. 2.1.3 For the purpose of this and other chapters, unless expressly defined otherwise, the following definitions apply:

a. "**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.

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

c. "**Monohull craft**" means any craft which isnot a multihull craft.

d. "**Multihull craft**" means a craft which in anynormally achievable operating trim or heel angle, has a rigidhull structure which penetrates the surface of the sea overmore than one discrete area.

e. "Permeability" of a space means the percentageof the volume of that space which can be occupied bywater.

f. "**Skirt**" means a downwardly extending, flexiblestructure used to contain or divide an air cushion.

104. 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:

a. mathematical simulation of dynamic behaviour;

b. scale model testing; and

c. full-scale trials.

Guidance

Some mathematical simulation methods are not well suited to accurate modelling of extreme events. For safety level 3 or 4, it may be appropriate to use model testing as a precursor to, or instead of, full-scale testing.

End of guidance

105. 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:

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

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

c. bow diving of planing mono-hulls and catamarans due to dynamic loss of longitudinal stability in relatively calm seas;

d. reduction in transverse stability with increasing speed of mono-hulls;

e. porpoising of planing mono-hulls, being coupled pitch and heave oscillations, which can become violent;

Guidance

"Porpoising" is a term derived from a porpoise, a fish that jumps in the air and rebounds in the water surface, going up again and repeating the cycle.

End of guidance

f. chine tripping, being a phenomenon of planing mono-hulls occurring when the immersion of a chine generates a strong capsizing moment;

g. 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;

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

i. 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

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

106. 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.

200. 2.3 Intact stability in the displacement mode

201. 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 H7and specifically maintain a heel angle of less than 10° when subjected to the greater of the heeling moments in H7.202 and H7.204.

202. 2.3.2 Subject to H5.204, multihull craft other than hydrofoil craft shall meet the relevant requirements of H8 in all permitted cases of loading.

203. 2.3.3 Subject to H5.204, monohull craft other than hydrofoil craft shall meet the relevant requirements of H9 in all permitted conditions of loading.

204. 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 H9, the Administration may accept alternative criteria equivalent to those stipulated, as

appropriate to the type of craft and area of operation. The requirements of H8 and H9 may be applied as indicated in the table T.H5.204.1 below.

TABLE 2.3.4 T.H5.204.1- APPLICATION OF H8 AND H9 TO MONOHULL AND MULTIHULL CRAFT

GMT	Angle of maximum GZ	
	≤ 25°	> 25°
≤ 3 m	annex H8 or annex H9	H8
> 3 m	annex H8	H8 or H9

where:

GZ = righting lever
GM_T = transverse metacentric height in the loading condition corresponding to the design waterline, corrected for free surface effects (m)

300. 2.4Intact stability in the non-displacement mode

301. 2.4.1 The present requirements and H6.504 shall be applied on the assumption that any stabilisation systems fitted are fully operational.

302. 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 T1 and T2. The results of such trials may indicate the need to impose operational limitations.

303. 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

304. 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.

400. 2.5 Intact stability in the transitional mode

401. 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

402. 2.5.2 Hydrofoil craft shall comply with the relevant provisions of H7.

H6. DAMAGE STABILITY

100. 2.6 Buoyancy and stability in the displacement mode following damage

101. 2.6.1 The requirements of this section apply to all permitted conditions of loading.

102. 2.6.2 For the purpose of making damage stability calculations, the volume and surface permeabilities shall be, in general, as follows in Table T.H6.102.1:

TABLE T.H6.102.1 - VOLUME AND SURFACE PERMEABILTIES

Spaces	**Permeability**
Appropriated to cargo or stores	60
Occupied by accomodation	95
Occupied by machinery	85
Intended for liquids	0 or 95*
Appropiated for cargo vehicles	90
Void spaces	95

* whichever results in the more severe requirements

103. 2.6.3 Notwithstanding H6.102, 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 H6.102.

104. 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:

a. of closed-cell form if foam, or otherwise impervious to water absorption;

b. structurally stable under service conditions;

c. 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, and

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

105. 2.6.5 The Administration may permit void bottom spaces to be fitted within the water-tight envelope of the hull without the provision of a bilge system or air pipes provided that:

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

b. 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 H6.100, H10 and H11 complied with;

c. 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 L; and

d. adequate ventilation is provided for inspection of the space under consideration as required by H4.105.

e. void spaces filled with foam or modular buoyancy elements or any space without a venting system are considered to be void spaces for the purposes of this paragraph, provided such foam or elements fully comply with H6.1004.

106. 2.6.6 Any damage of a lesser extent than that postulated in H6.200 to H6.500, as applicable, which would result in a more severe condition shall also be investigated.

200. 2.6.7 Extent of side damage

201. The following side damage shall be assumed anywhere on the periphery of the craft:

a. 1 the longitudinal extent of damage shall be 0,75 ∇1/3, or (3 m + 0,225 ∇1/3), or 11 m, whichever is the least;

b. 2 the transverse extent of penetration into the craft shall be 0,2 ∇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 ∇1/3 into the main buoyancy hull or tank structure; and

c. 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).

202. The damages described in this paragraph shall be assumed to have the shape of a parallelepiped. Applying this to figure F.H6.202.1the inboard face at its mid-length shall be tangential to, or otherwise touching in a least 2 places, the surface corresponding to the specified transverse extent of penetration, as illustrated in figure F.H6.202.1.

FIGURES F.H6.202.1, F.H6.202.2 and F.H6.202.3 – EXTENT OF DAMAGE.

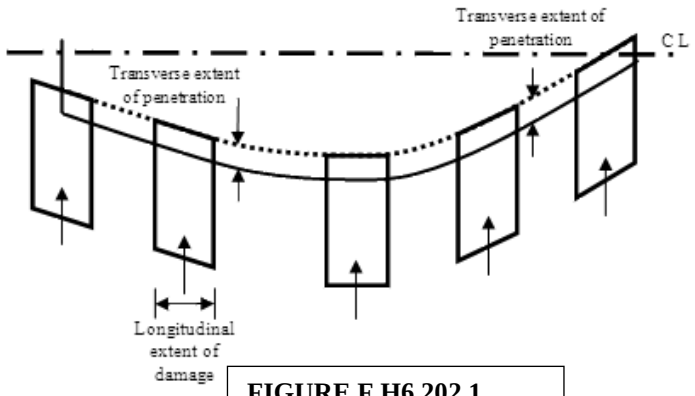


FIGURE F.H6.202.1

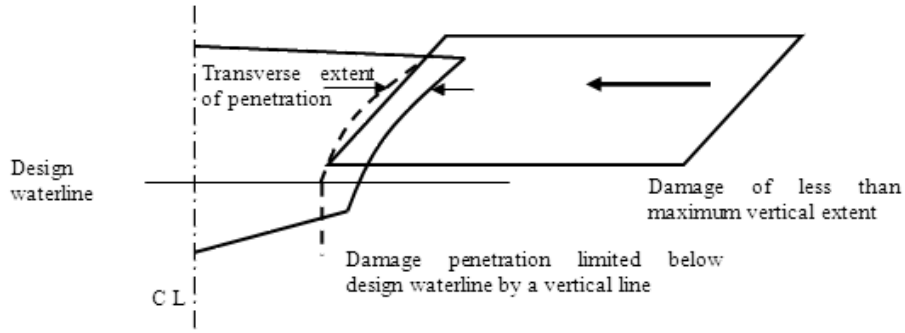


FIGURE F.H6.206.2

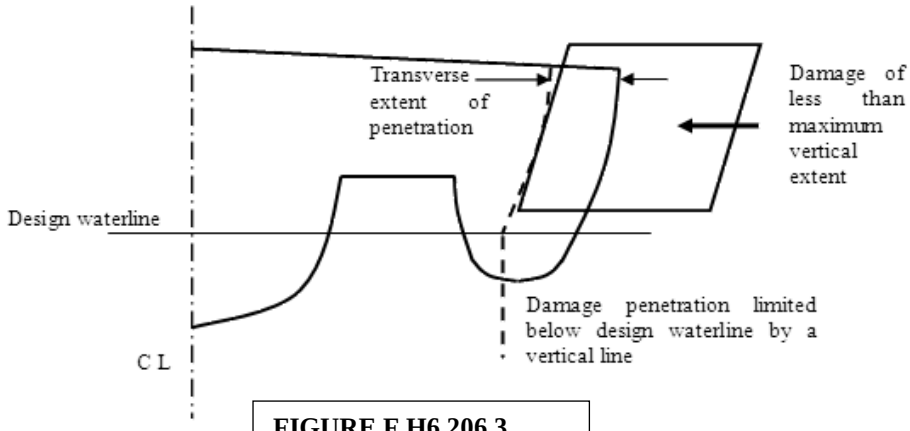


FIGURE F.H6.206.3

Guidance

A parallelepiped is defined as "a solid contained by parallelograms" and a parallelogram is defined as "a four-sided rectilinear figure whose opposite sides are parallel".

End of guidance

203. Side damage shall not transversely penetrate a greater distance than the extent of 0.2 ∇1/3 at the design waterline, except where a lesser extent is provided for in H6.201.b. Refer to figures 2.6.7 b and c.

204. If considering a multihull, the periphery of the craft is considered to only be the surface of the shell encompassed by the outboard surface of the outermost hull at any given section

300. 2.6.8 Extent of bow and stern damage

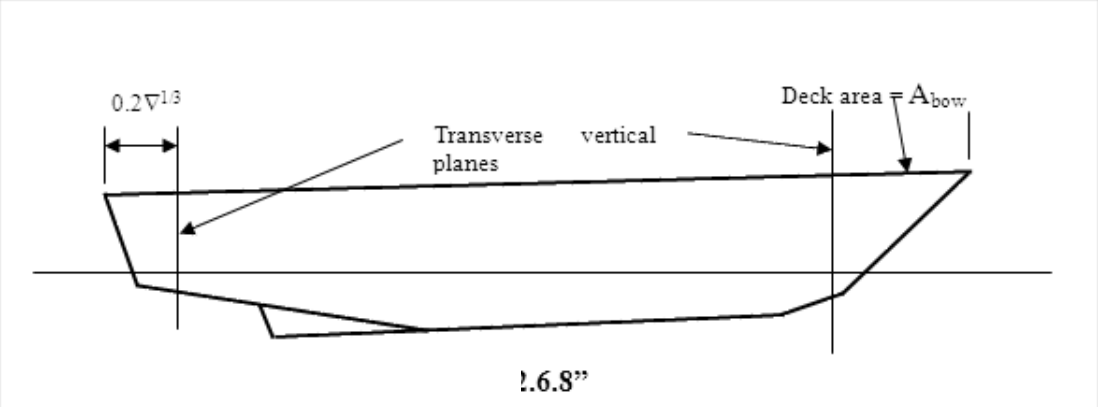
301. 2.6.8.1 The following extents of damage are to be applied to bow and stern, as illustrated in figure F.H6.301.1:

a. .1 at the fore end, damage to the area defined as above, the aft limit of which being a transverse vertical plane, provided that this area need not extend further aft from the forward extremity of the craft' s water-tight envelope than the distance defined in H6.201; and

b. .2 at the aft end, damage to the area aft of a transverse vertical plane at a distance 0.2 triangle(1/3) forward of the aft extremity of the water-tight envelope of the hull.

302. 2.6.8.2 The provisions of 2.6.6 in relation to damage of lesser extent remain applicable to such damage.

FIGURE F.H6.301.1 EXTENTS OF DAMAGE



!.6.8"

400. 2.6.9 Extent of bottom damage in areas vulnerable to raking damage

401. 2.6.9.1 **Application**

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

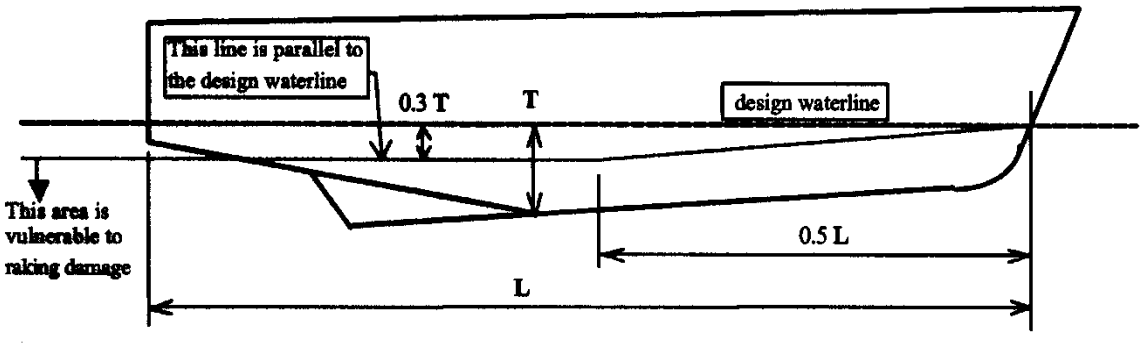
a.1. .1.1 it is in contact with the water at 90% of maximum speed.

a.2. .1.2 it also lies below two planes which are perpendicular to the craft centreline plane and at heights as shown in figure f.h6.4011.

a.3. For multihulls, individual hulls shall be considered separately.

b. .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.F.H6.401.2 below:

FIGURE F.H6.401.2 – RAKING DAMAGE



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, provided that structures such as single plate skegs or solid metal appendages shall be considered to be non-buoyant and thus excluded.

c. 3 Damage shall not be applied at the same time as that defined in H6.200 or H6.400.

402. 2.6.9.2 **Extent**

a. 2.6.9.2.1 Two different longitudinal extents shall be considered separately:

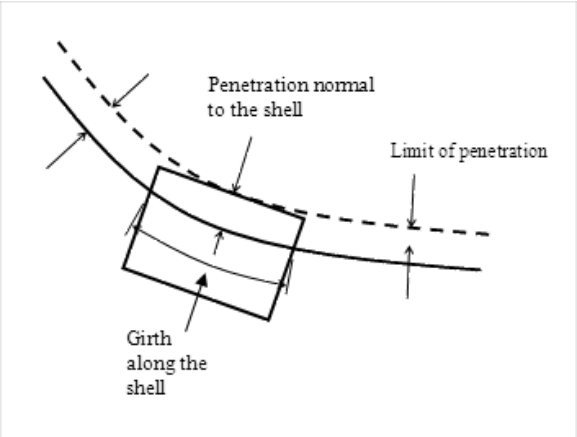
a.1. .1 55% of the length L, measured from the most forward point of the underwater buoyant volume of each hull; and

a.2. .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 50 m.

b. 2.6.9.2.2 Except as provided below, the penetration normal to the shell shall be 0.04 ∇1/3 or 0.5 m, whichever is the lesser, in association with a girth along the shell equal to 0.1 ∇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 h6.301.a.

c. 2.6.9.2.3 The shape of damage shall be assumed to be rectangular in the transverse plane as illustrated in figure F.H6.402.1 below. Damage is to be assumed at a series of sections within the defined longitudinal extent in accordance with figure F.H6.402.1, the mid-point of the damaged girth being maintained at a constant distance from the centreline throughout that longitudinal extent.

FIGURE F.H6.402.1 – SHAPE OF DAMAGE



500. 2.6.10 Extent of bottom damage in areas not vulnerable to raking damage

501. **Application**

This applies to all parts of the hull(s) below the design waterline which are not defined as vulnerable to raking damage in H6.301.a. Damage shall not be applied at the same time as that defined in H6.200 or H6.300.

502. **Extent**

The following extent of damage shall be assumed:

a. .1 the length of damage in the fore-and-aft direction shall be 0.75 ∇1/3, or (3 m + 0.225 ∇1/3), or 11 m whichever is the least;

b. .2 the athwartships girth of damage shall be 0.2 ∇1/3; and

c. .3 the depth of penetration normal to the shell shall be 0.02 ∇1/3,

d. where:

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

f. .4 the shape of damage shall be assumed to be rectangular in the plane of the shell of the craft, and rectangular in the transverse plane as illustrated in figure F.H6.401.2.

503. 2.6.10In applying H6.300 and H6.400 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 H6.100 shall also be applied.

504. 2.6.11Following any of the postulated damages detailed in H6.100 to H6.500, the craft in still water shall have sufficient buoyancy and positive stability to simultaneously ensure that:

a. .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;

b. .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;

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

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

e. .5 the residual stability of craft meets the appropriate criteria as laid out in H8 and H9 according to table T.H5.204.1. Within the range of positive stability governed by the criteria of annexes 7 or 8, no unprotected opening shall be submerged.

505. 2.6.12Downflooding openings referred to in H6.404.a and H6.404.b2 shall include doors and hatches which are used for damage control or evacuation procedures, but may exclude those which are closed by means of weather-tight doors and hatch covers and not used for damage control or evacuation procedures.

H7. STABILITY OF HYDROFOIL CRAFT [ANNEX 6]

100. General

101. The stability of these craft shall be considered in the hull-borne, transitional and foil-borne modes. The stability investigation shall also take into account the effects of external forces. The following procedures are outlined for guidance in dealing with stability.

102. As required by H6.101, the stability of hydrofoil craft shall be assessed under all permitted conditions of loading.

Guidance

The term **hull-borne mode** *has the same meaning as* **displacement mode** *defined in A5.124.*

The term **foil-borne mode** *has the same meaning as* **non-displacement mode** *defined in A5.138 of the Code.*

End of guidance

200. A6.1 Surface-piercing hydrofoils

201**.** A6.1.1.1**Hull-borne mode** the stability shall be sufficient to satisfy the provisions of H5.200, H5.300 and H6.100.

202. A6.1.1.2 **Heeling moment due to turning**

The heeling moment developed during manoeuvring of the craft in the displacement mode may be derived from the following formula:

$M_R = 0.196 (V_o^2/L) \times \Delta \times KG$

where:

M_R = moment of heeling;

Δ = displacement (t);
L = length of the craft on the waterline (m);

K_G = height of the centre of gravity above keel (m).

This formula is applicable when the ratio of the radius of the turning circle to the length of the craft is 2 to 4.

203. A6.113 **Relationship between the capsizing moment and heeling moment to satisfy the weather criterion**

The stability of a hydrofoil boat in the displacement mode can be checked for compliance with the weather criterion K as follows:

$K = M_c/M_v \geq 1$

where:

M_c = minimum capsizing moment as determined when account is taken of rolling;

M_v = dynamically applied heeling moment due to the wind pressure.

204. A6.1.1.4 **Heeling moment due to wind pressure**

The heeling moment $M_v$shall be taken as constant during the whole range of heel angles and calculated by the following expression:

$M_V = 0.001\ P_V \times A_V \times Z$ (kNm)
where:

Z = the wind speed corresponding to the worst intended conditions (m/s).

PV = wind pressure = 750 (VW / 26)2 (N/m2

AV = windage area including the projections of the lateral surfaces of the hull, superstructure and various structure s above the waterline (m2

205. A6.1.1.5 **Evaluation of the minimum capsizing moment Mc in the displacement mode**

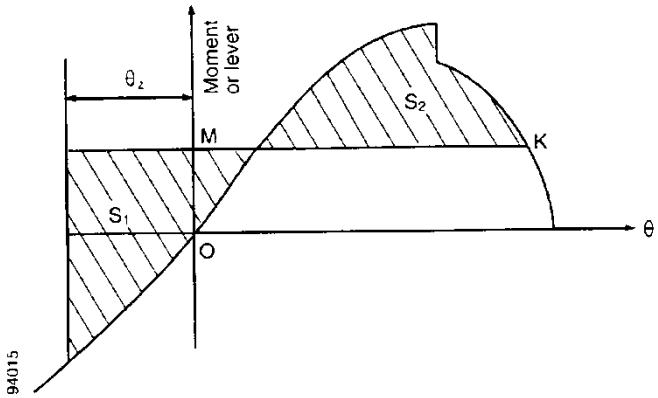
The minimum capsizing moment is determined from the static and dynamic stability curves taking rolling into account.

a. When the static stability curve is used, M_c is determined by equating the areas under the curves of the capsizing and righting moments (or levers) taking rolling into account, as indicated by figure 1, where $\theta;_z$ is the amplitude of roll and MK is a line drawn parallel to the abscissa axis such that the shaded areas S_1 and S_2 are equal.

M_c = OM, if the scale of ordinates represents moments,

M_c= OM × displacement, if the scale of ordinates represents levers.

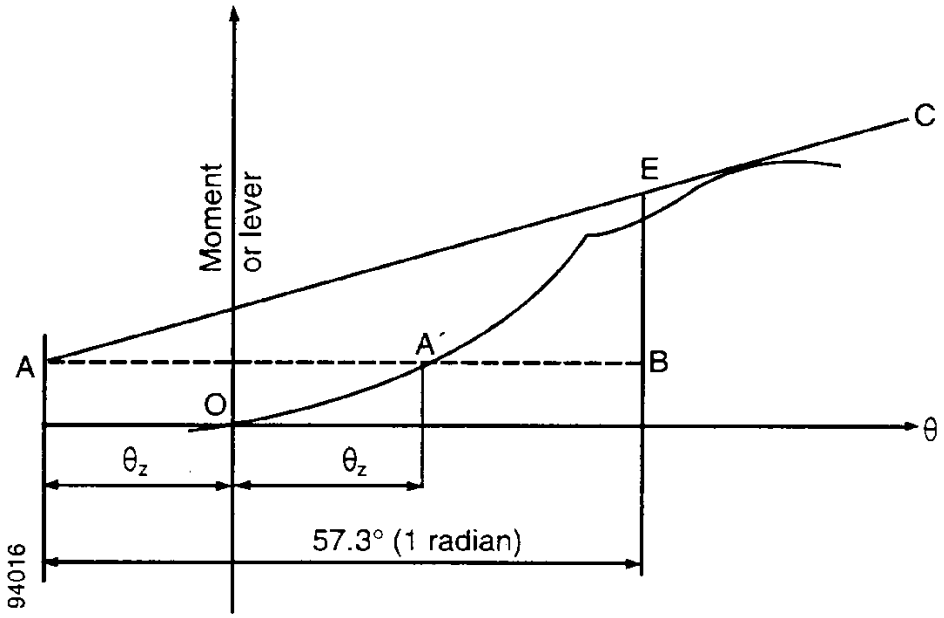
FIGURE F.H7.205.1 – STATIC STABILITY CURVE



b. When the dynamic stability curve is used, first an auxiliary point A shall be determined. For this purpose the amplitude of heeling is plotted to the right along the abscissa axis and a point A' is found (see figure 2). A line AA' is drawn parallel to the abscissa axis equal to the double amplitude of heeling (AA' = $2\times\ \theta;_z$) and the required auxiliary point A is found. A tangent AC to the dynamic stability curve is drawn. From the point A the line AB is drawn parallel to the abscissa axis and equal to 1 radian (57.3°). From the point B a perpendicular is drawn to intersect with the tangent in point E. The distance BE is equal to the capsizing moment if measured along the ordinate axis of the dynamic stability curve. If, however, the dynamic stability levers are plotted along this axis, BE is then the capsizing lever, and in this case the capsizing moment M_c is determined by multiplication of ordinate BE (in metres) by the corresponding displacement in tonnes:

$M_c = 9.81\ \Delta$ BE (kNm)

FIGURE F.H7.205.2 – DYNAMIC STABILITY CURVE



c. The amplitude of rolling θ_z is determined by means of model and full-scale tests in irregular seas as a maximum amplitude of rolling of 50 oscillations of a craft travelling at 90° to the wave direction in sea state for the worst design condition. If such data are lacking the amplitude is assumed to be equal to 15° .

d. The effectiveness of the stability curves shall be limited to the angle of flooding.

300. 1.2 Transitional and foil-borne modes

301. 1.2.1 The stability shall satisfy the provisions of H5.200 and H5.300.

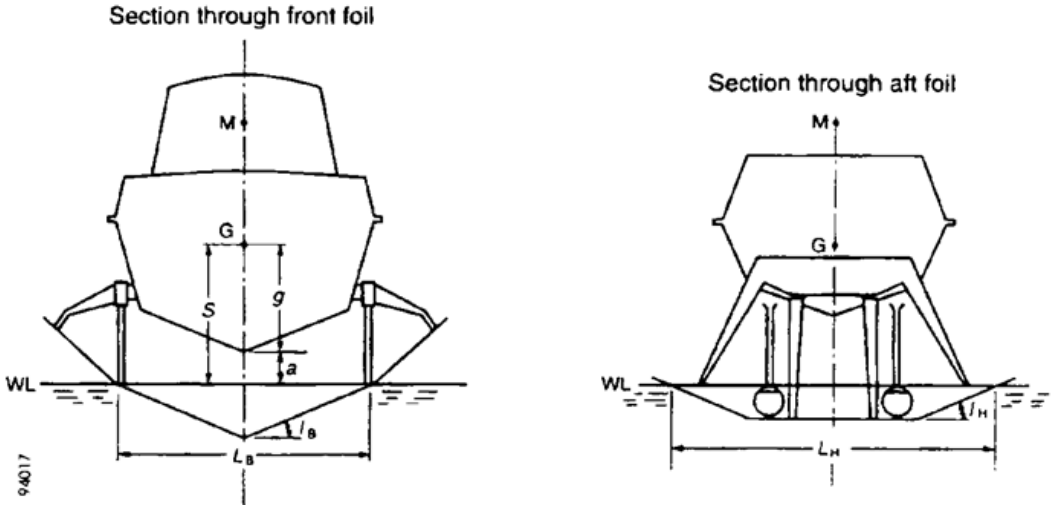
a. 1.2.2.1 The stability in the transitional and foil-borne modes shall be checked for all cases of loading for the intended service of the craft.

b. 1.2.2.2 The stability in the transitional and foil-borne modes may be determined either by calculation or on the basis of data obtained from model experiments and shall be verified by full-scale tests by imposition of a series of known heeling moments by off-centre ballast weights, and recording the heeling angles produced by these moments. When taken in the hull-borne, take-off, steady foil-borne and settling to hull-borne modes, these results will provide an indication of the values of the stability in the various situations of the craft during the transitional condition.

c. 1.2.2.3 The angle of heel in the foil-borne mode caused by the concentration of passengers at one side shall not exceed 8°. During the transitional mode the angle of heel due to the concentration of passengers on one side shall not exceed 12°. The concentration of passengers shall be determined by the RBNA, having regard to the guidance given at H8.

302. 1.2.3 One of the possible methods of assessing foil-borne metacentric height (GM) in the design stage for a particular foil configuration is given in figure F.H6.302.1.

FIGURE F.H7.302.1 – METHOD OF ASSESSING METACENTRIC HEIGHT FOR TRANSFORMATION AND FOIL-BORN MODES



$$GM = \eta_B \left(\frac{LB}{2 \tan IB} - S\right) + \eta_H \left(\frac{LH}{2 \tan IH} - S\right)$$

where:

n_B = percentage of hydrofoil load borne by front foil

n_H = percentage of hydrofoil load borne by aft foil

L_B = clearance width of front foil

L_H = clearance width of aft foil

a = clearance between bottom of keel and water

g = height of centre of gravity above bottom of keel

I_B = angle at which front foil is inclined to horizontal

I_H = angle at which aft foil is inclined to horizontal

S = height of centre of gravity above water

400. A6.2 Fully submerged hydrofoils

401. A6.2.1**Hull-borne mode**

The stability in the hull-borne mode shall be sufficient to satisfy the provisions of H5.200 and H6 of this Code.

Paragraphs H7.202 to H7.205 of this annex are appropriate to this type of craft in the hull-borne mode.

402. A6.2.2 **Transitional mode**

a. The stability shall be examined by the use of verified computer simulations to evaluate the craft's motions, behaviour and responses under the normal conditions and limits of operation and under the influence of any malfunction.

b. The stability conditions resulting from any potential failures in the systems or operational procedures during the transitional stage which could prove hazardous to the craft's water-tight integrity and stability shall be examined.

500. A6.2.3 Foil-borne mode

a. The stability of the craft in the foil-borne mode shall be in compliance with the provisions of H5.300. The provisions of H4 shall also apply.

b. Paragraphs H7.301 shall be applied to this type of craft as appropriate and any computer simulations or design calculations shall be verified by full-scale tests.

H8. STABILITY OF MULTIHULL CRAFT [ANNEX 7]

100. A7.1 Stability criteria in the intact condition

101. A multihull craft, in the intact condition, shall have sufficient stability when rolling in a seaway to successfully withstand the effect of either passenger crowding or high-speed turning as described in H8.200. The craft's stability shall be considered to be sufficient provided compliance with this paragraph is achieved. (See figure F.H7.101.1)

102. A7.1.1 **Area under the GZ curve**

The area (A_1) under the GZ curve up to an angle θ shall be at least:

$A_1 = 0.055 \times (30° - \theta)$; (m·rad)

where θ is the least of the following angles:

a. the downflooding angle;

b. the angle at which the maximum GZ occurs; and

c. 30°.

103. A7.1.2 **Maximum GZ**

The maximum GZ value shall occur at an angle of at least 10° .

104. A7.1.3 **Heeling due to wind**

The wind heeling lever shall be assumed constant at all angles of inclination and shall be calculated as follows:

$H_{L1}=(P_i \times A \times Z) / (9800\ \Delta)$ (m)

where:

$p = 500\ (VW / 26)^2$ (N/m²)

where:

V_W = wind speed corresponding to the worst intended conditions (m/s)

A = projected lateral area of the portion of the craft

Z = vertical distance from the centre of A to a point

Δ; = displacement (t)

200. A7.1.4 Heeling due to passenger crowding or high-speed turning

201. Heeling due to the crowding of passengers on one side of the craft or to high-speed turning, whichever is the greater, shall be applied in combination with the heeling lever due to wind (HL2).

202. A7.1.4.1 **Heeling due to passenger crowding**

When calculating the magnitude of the heel due to passenger crowding, a passenger crowding lever shall be developed using the assumptions stipulated in 2.10 of this Code.

203. A7.1.4.2 **Heeling due to high-speed turning**

When calculating the magnitude of the heel due to the effects of high-speed turning, a high-speed turning lever shall be developed using either the following formula or an equivalent method specifically developed for the type of craft under consideration, or trials or model test data:

$\frac{1}{g}\frac{Vo^2}{R}\left(KG - \frac{d}{2}\right)$ (m)

where:

T_L = turning lever (m)

V_0 = speed of craft in the turn (m/s) R = turning radius (m)

KG = height of vertical centre of gravity above keel (m)

d = mean draught (m)

g = acceleration due to gravity

Alternatively, another method of assessment may be employed, as provided for in H5.104.

300. A7.1.5Rolling in waves (figure F.H7.101.1)

301. The effect of rolling in a seaway upon the craft's stability shall be demonstrated mathematically. In doing so, the residual area under the GZ curve (A2), i.e. beyond the angle of heel (theta h), shall be at least equal to 0.028 m·rad up to the angle of roll theta r. In the absence of model test or other data theta r shall be taken as 15° or an angle of (theta d - theta h), whichever is less. The determination of theta r using model test or other data shall be made using the method for determining theta Z in H7.205.

400. A7.2 Criteria for residual stability after damage

401. A7.2.1 The method of application of criteria to the residual stability curve is similar to that for intact stability except that the craft in the final condition after damage shall be considered to have an adequate standard of residual stability provided (See figure F.H7.401.1):

a. the required area A2 shall be not less than 0.028 m·; and

b. there is no requirement regarding the angle at which the maximum GZ value shall occur.

402. A7.2.2 The wind heeling lever for application on the residual stability curve shall be assumed constant at all angles of inclination and shall be calculated as follows:

$HL_3 = (P_d \cdot A \cdot Z)/(9800\Delta)$

where:

$P_d = 120\ (V_W / 26)^2\ (N/m^2)$

V_W = wind speed corresponding to the worst intended conditions (m/s)

A = projected lateral area of the portion of the ship above the lightest service waterline (m^2)

Z = vertical distance from the centre of A to a point one half of the lightest service draught (m)

Δ = displacement (t)

403. A7.2.3 The same values of roll angle shall be used as for the intact stability, as determined in H8.300.

404. A7.2.4 The downflooding point is important and is regarded as terminating the residual stability curve. The area A2 shall therefore be truncated at the downflooding angle.

405. A7.2.5 The stability of the craft in the final condition after damage shall be examined and shown to satisfy the criteria, when damaged as stipulated in H6.

406. A7.2.6 In the 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 all cases, only one breach in the hull and only one free surface need to be assumed.

500. A7.3 Application of heeling levers

501. A7.3.1 In applying the heeling levers to the intact and damaged curves, the following shall be considered:

502. A7.3.1.1 **For intact condition**:

a. wind heeling lever (including gusting effect) (HL_2); and

b. wind heeling lever (including gusting effect) plus either the passenger crowding or speed turning levers whichever is the greater (HTL).

503. A7.3.1.2 **For damage condition**:

a. wind heeling lever – steady wind (HL_3); and

b. wind heeling lever plus heeling lever due to passenger crowding (HL_4)

504. A7.3.2 **Angles of heel due to steady wind**

a. The angle of heel due to a wind gust when the heeling lever HL_2, obtained as in H8.104, is applied to the intact stability curve shall not exceed 10°.

b. The angle of heel due to a steady wind when the heeling lever HL_3, obtained as in H8.402, is applied to the residual stability curve after damage, shall not exceed 15° for passenger craft and 20° for cargo craft.

FIGURE F.H8.101.1 – MULTI-HULL CRITERIA: INTACT STABILITY2

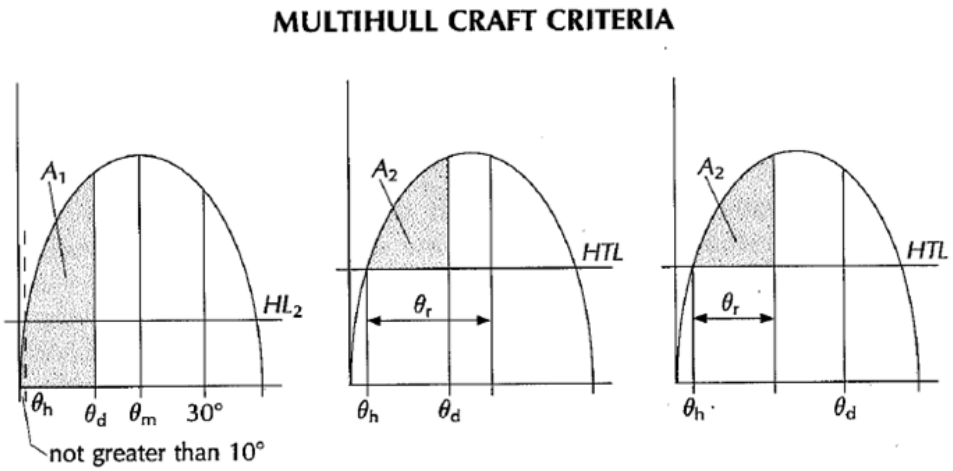
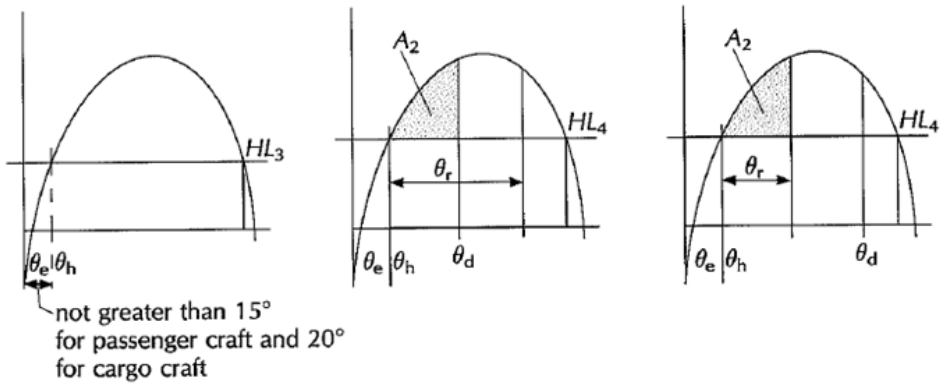


FIGURE F.H8.101.2 – MULTI-HULL CRIETERIA: DAMAGE STABILITY



Abbreviations used in figures F.H8.101.1 and F.H8.401.1:

HL_2 = Heeling lever due to wind + gusting
HTL = Heeling lever due to wind + gusting + (passenger crowding or turning)
HL_3 = Heeling lever due to wind
HL_4 = Heeling lever due to wind + passenger crowding
θ_m = Angle of maximum GZ
θ_d = Angle of downflooding
θ_r = Angle of roll
θ_e = Angle of equilibrium, assuming no wind, passenger crowding or turning effects
θ_h= Angle of heel due to heeling lever HL_2, HTL, HL_3 or HL_4
$A_1 \geq$ Area required by 1.1
A_2 = 0.028 m·rad

H9. STABILITY OF MONOHULL CRAFT 7 [**ANNEX 8**]

100. A8.1 Stability criteria in the intact condition

101. A8.1.1 The weather criterion contained in paragraph 3.2 of the Intact Stability Code* shall apply. In applying the weather criterion, the value of wind pressure P (N/m^2) shall be taken as:

$500\{V_w/26\}^2$

where

V_w = wind speed (m/s) corresponding to the worst intended conditions.

Guidance

Refer to the Code on Intact Stability for All Types of Ships Covered by IMO Instruments, adopted by the Organization by resolution A.749(18), as amended by resolution MSC.75(69).

End of guidance

a. The angle of heel due to wind, in applying paragraph 3.2.2.1.2 of the Intact Stability Code, shall not exceed 16° or 80% of the angle of deck-edge immersion (whichever is less). Where the angle of heel due to wind exceeds 10°, efficient non-slip deck surfaces and suitable holding points shall be provided, in accordance with H10.401.a.

b. In applying the weather criterion, account shall also be taken of the roll damping characteristics of individual craft in assessing the assumed roll angle θ_1, which may alternatively be derived from model or full scale tests using the method for determining θ_z in H7.205.c.

c. Hulls with features which greatly increase damping, such as immersed sidehulls, substantial arrays of foils, or flexible skirts or seals, were likely to experience significantly smaller magnitudes of roll angle. For such craft, therefore, the roll angle shall be derived from model or full scale tests or, in the absence of such data, shall be taken as 15°.

102. A8.1.2 The area under the righting lever curve (GZ curve) shall not be less than 0.07 m·rad up to θ; = 15° when the maximum righting lever (GZ) occurs at θ = 15° , and 0.055 m·rad up to θ = 30° when the maximum righting lever occurs at θ = 30° or above.

Where the maximum righting lever occurs at angles of between θ = 15° and θ = 30°, the corresponding area under the righting lever curve shall be:

$A = 0.055 + 0.001\,(30° - \theta_{max})$ (m·rad)

where:

θ_{max} is the angle of heel, in°, at which the righting lever curve reaches its maximum.

103. A8.1.3 The area under the righting lever curve between θ = 30° and θ = 40° or between θ = 30° and the angle of flooding θ_F* if this angle is less than 40°, shall not be less than 0.03 m·rad.

Guidance

In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

End of guidance

104. A8.1.4 The righting lever GZ shall be at least 0.2 m at an angle of heel equal to or greater than 30°.

105. A8.1.5 The maximum righting lever shall occur at an angle of heel not less than 15°.

106. A8.1.6 The initial metacentric height GMT shall not be less than 0.15 m.

200. A8.2 Criteria for residual stability after damage

201. A8.2.1 The stability required in the final condition after damage, and after equalization where provided, shall be determined as specified in H9.201 to H9.205. The range shall be taken as the difference between the equilibrium heel angle and the heel angle at which the residual righting lever subsequently becomes negative or the angle at which progressive flooding occurs, whichever is less

202. A8.2.1.1 The positive residual righting lever curve shall have a minimum range of 15° beyond the angle of equilibrium. This range may be reduced to a minimum of 10°, in the case where the area under the righting lever curve is that specified in H9.202, increased by the ratio:

a. 15/range

b. where the range is expressed in degrees

203. A8.2.1.3 The area under the righting lever curve shall be at least 0.015 m·rad, measured from the angle of equilibrium to the lesser of:

a. the angle at which progressive flooding occurs; and

b. 27° measured from the upright.

204. A8.2.1.3 A residual righting lever shall be obtained within the range of positive stability, taking into account the greatest of the following heeling moments:

a. the crowding of all passengers towards one side;

b. the launching of all fully loaded davit-launched survival craft on one side; and

c. due to wind pressure,

as calculated by the formula:

GZ = (heeling moment/displacement) + 0,04 (m)

However, in no case, this righting lever shall be less than 0.1 m.

205. A8.2.1.4 For the purpose of calculating the heeling moments referred to in 2.1.3, the following assumptions shall be made:

a. 2.1.4.1 Moments due to crowding of passengers. This should be calculated in accordance with paragraph 2.10 of the Code.

b. 2.1.4.2 Moments due to launching of all fully loaded davit-launched survival craft on one side:

b.1. all lifeboats and rescue boats fitted on the side to which the ship has heeled after having sustained damage shall be assumed to be swung out fully loaded and ready for lowering;

b.2. for lifeboats which are arranged to be launched fully loaded from the stowed position, the maximum heeling moment during launching shall be taken;

b.3. a fully loaded davit-launched liferaft attached to each davit on the side to which the ship has heeled after having sustained damage shall be assumed to be swung out ready for lowering;

b.4. persons not in the life-saving appliances which are swung out shall not provide either additional heeling or righting moment; and

b.5. life-saving appliances on the side of the ship opposite to the side to which the ship has heeled shall be assumed to be in a stowed position.

c. 2.1.4.3 Moments due to wind pressure:

c.1. The wind pressure shall be taken as (120 $\{V_W/ 26\}^2$) (N/m^2), where V_W = wind speed (m/s), corresponding to the worst intended condition;

c.2. The area applicable shall be the projected lateral area of the ship above the waterline corresponding to the intact condition; and

c.3. The moment arm shall be the vertical distance from a point at one half of the mean draught corresponding to the intact condition to the centre of gravity of the lateral area.

206. A8.2.2 In intermediate stages of flooding, the maximum righting lever shall be at least 0.05 m and the range of positive righting levers shall be at least 7°. In all cases, only one breach in the hull and only one free surface need be assumed.

H10. BUOYANCY, STABILITY AND SUBDIVISION FOR PASSENGER CRAFT

For High-Speed Crafts constructed from 2002-07-01

100. 2.10 General

101. 2.10.1 Where compliance with this chapter requires consideration of the effects of passenger weight, the following information shall be used:

a. .1 The distribution of passengers is 4 persons per square metre.

b. .2 Each passenger has a mass of 75 kg.

c. .3 Vertical centre of gravity of seated passengers is 0.3 m above seat.

d. .4 Vertical centre of gravity of standing passengers is 1.0 m above deck.

e. .5 Passengers and luggage shall be considered to be in the space normally at their disposal.

f. .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.

g. .7 Passengers assumed to be occupying seats shall be taken as having a vertical centre of gravity corresponding to being seated, with all others standing.

h. .8 On the decks where assembly stations are located, the number of passengers on each deck shall be that which generates the maximum heeling moment. Any remaining passengers shall be assumed to occupy decks adjacent to those on which the assembly stations are located, and positioned such that the combination of number on each deck and total heeling moment generate the maximum static heel angle.

i. .9 Passengers shall not be assumed to gain access to the weather deck nor be assumed to crowd

abnormally towards either end of the craft unless this is a necessary part of the planned evacuation procedure.

j. .10 Where there are seats in areas occupied by passengers, one passenger per seat shall be assumed, passengers being assigned to the remaining free areas of the deck (including stairways, if appropriate) at the rate of four per square metre.

200. 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).

300. 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 H7.204 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.

2.12.3 Demonstrating the effect of the passenger heeling moment calculated as given by 2.10 above, or a defined beam wind pressure when at speed, shall be established by conducting a trial or model test with an equivalent heeling moment applied by test weights. Passenger movement may only be neglected on craft where the safety announcement (refer to Part II, Ttile 25, Section 3, D4.400 and L2.200) expressly requires passengers to remain seated throughout the voyage.

400. 2.13 Buoyancy and stability in the displacement mode following damage

401. 2.13.1 Following any of the postulated damages detailed in H6 and H6.504.f, the craft in still water shall have sufficient buoyancy and positive stability to simultaneously ensure that:

a. .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

b. .2 any flooding of passenger compartments or escape routes which might occur will not significantly impede the evacuation of passengers.

402. 2.13.2 In addition to the requirements in H10.401, 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 H6.3022, to any part of the surface of the hull(s) defined in H6.301:

a. .1 The angle of inclination of the craft from the horizontal shall not exceed 20° in the equilibrium condition;

b. .2 the range of positive righting lever shall be at least 15° in the equilibrium condition;

c. .3 the positive area under the righting lever curve shall be at least 0.015 m-rad in the equilibrium condition;

d. .4 the requirements of H6.504.c and H2.401.b are satisfied; and

e. .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°.

f. 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.

H11. BUOYANCY, STABILITY AND SUBDIVISION FOR CARGO CRAFT

100. 2.15 Buoyancy and stability in the displacement mode following damage

101. Following any of the postulated damages detailed in H6.100 to H6.500, in addition to satisfying the requirements of H6.504 and H6.505, 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.

102**. 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 T4.200 has been applied, the Administration may waive the requirement of T4.200 for craft to be inclined. In this regard, a craft which lies within the parameters of

T4.1011, when compared with a craft of the series which has been inclined, shall be regarded as being closely similar to that craft.

H12. 16 STABILIZATION SYSTEMS

100. 16.1 Definitions

101. Stabilization control system is a system intended to stabilize the main parameters of the craft' s attitude: heel, trim, course and height and control the craft' s motions: roll, pitch, yaw and heave. This term excludes devices not associated with the safe operation of the craft, e.g. motion-reduction or ride-control systems.

The main elements of a stabilization control system may include the following:

a. devices such as rudders, foils, flaps, skirts, fans, water jets, tilting and steerable propellers, pumps for moving fluids;

b. power drives actuating stabilization devices; and

c. stabilization equipment for accumulating and processing data for making decisions and giving commands such as sensors, logic processors and automatic safety control.

102. For the Stabilization system, the following definitions apply:

a. **Augmented stabilization** is a combination of self-stabilization and forced stabilization.

b. **Automatic safety control** is a logic unit for processing data and making decisions to put the craft into the displacement or other safe mode if a condition impairing safety arises.

c. **Forced stabilization** of the craft is stabilization achieved by:

c.1. an automatic control system; or

c.2. a manually assisted control system; or

c.3. a combined system incorporating elements of both automatic and manually assisted control systems.

d. **Self-stabilization** of the craft is stabilization ensured solely by the craft' s inherent characteristics.

e. **Stabilization device** means a device as enumerated in H12.101 with the aid of which forces for controlling the craft' s position are generated.

200. 16.2 General requirements

201. 16.2.1 Stabilization systems shall be so designed that, in case of failure or malfunctioning of any one of the stabilization devices or equipment, it would be possible either to ensure maintaining the main parameters of the craft' s motion within safe limits with the aid of working stabilization devices or to put the craft into the displacement or other safe mode.

202. 16.2.2 In case of failure of any automatic equipment or stabilization device, or of its power drive, the parameters of craft motion shall remain within safe limits.

203. 16.2.3 Craft fitted with an automatic stabilization system shall be provided with an automatic safety control unless the redundancy in the system provides equivalent safety. Where an automatic safety control is fitted, provision shall be made to override it and to cancel the override from the main operating station.

204. 16.2.4 The parameters and the levels at which any automatic safety control gives the command to decrease speed and put the craft safely in the displacement or other safe mode shall take account of the safe values of heel, trim, yaw and combination of trim and draught appropriate to the particular craft and service; also to the possible consequences of power failure for propulsion, lift or stabilization devices

205. 16.2.5 The parameters and the degree of stabilization of the craft provided by the automatic stabilization system shall be satisfactory, having regard to the purpose and service conditions of the craft.

206. 16.2.6 Failure mode and effect analysis shall include the stabilization system.

300. 16.3 Lateral and height control systems

301. 16.3.1 Craft fitted with an automatic control system shall be provided with an automatic safety control. Probable malfunctions shall have only minor effects on automatic control system operation and shall be capable of being readily counteracted by the operating crew.

302. 16.3.2 The parameters and levels at which any automatic control system gives the command to decrease speed and put the craft safely into the displacement or other safe mode shall take account of the safety levels as given in K.301 and of the safe values of motions appropriate to the particular craft and service.

400. 16.4 Demonstrations

401. 16.4.1 The limits of safe use of any of the stabilization control system devices shall be based on demonstrations and a verification process in accordance with Chapter M.

402. 16.4.2 Demonstration in accordance with Chapter T2 shall determine any adverse effects upon safe operation of the craft in the event of an uncontrollable total deflection of any one control device. Any limitation on the operation of the craft as may be necessary to ensure that the redundancy or safeguards in the systems provide equivalent safety shall be included in the craft operating manual.

H13. ICE ACCRETION APPLICABLE TO ALL TYPES OF CRAFT ANNEX 5

100. A5.1 Icing allowances

101. A5.1.1 For craft operating in areas where ice accretion is likely to occur, the following icing allowance shall be made in the stability calculations.

a. .1 30 kg/m² on exposed weather decks and gangways;

b. .2 7.5 kg/m² for projected lateral area of each side of the craft above the waterplane;

c. .3 the projected lateral area of discontinuous surfaces of rail, sundry booms, spars (except masts) and rigging and the projected lateral area of other small objects shall be computed by increasing the total projected area of continuous surfaces by 5% and the static moments of this area by 10%;

d. .4 reduction of stability due to asymmetric ice accumulations in cross-structure.

102. A5.1.2 For craft operating in areas where ice accretion may be expected:

a. .1 Within the areas defined in H13.200, H13.300 and H13.400 known to have icing conditions significantly different from those in H13.101, ice accretion requirements of one half to twice the required allowance may be applied.

b. .2 Within the area defined in H13.201.b, where ice accretion in excess of twice the allowance required by H13.101 may be expected, more severe requirements than those given in H13.101 may be applied.

103. A5.1.3 Information shall be provided in respect of the assumptions made in calculating the condition of the craft in each of the circumstances set out in this annex for the following:

a. .1 duration of the voyage in terms of the period spent in reaching the destination and returning to port; and

b. .2 consumption rates during the voyage for fuel, water, stores and other consumables.

200. A5.2 Areas of icing conditions

201. In the application of H13.100, the following icing areas shall apply:

a. .1 The area north of latitude 65°30' N, between longitude 28°W and the west coast of Iceland; north of the north coast of Iceland;

b. north of the rhumb line running from latitude 66°N, longitude 15°W to latitude 73°30' N, longitude 15°E, north of latitude 73°30' N between longitude 15°E and 35°E, and east of longitude 35°E, as well as north of latitude 56°N in the Baltic Sea.

c. .2 The area north of latitude 43°N bounded in the west by the North American coast and the east by the rhumb line running from latitude 43°N, longitude 48°W to latitude 63°N, longitude 28°W and thence along longitude 28°W.

d. .3 All sea areas north of the North American continent, west of the areas defined in subparagraphs .1 and .2 of this paragraph.

e. .4 The Bering and Okhotsk Seas and the Tartary Strait during the icing season.

f. .5 South of latitude 60°S.

g. A chart to illustrate the areas is attached.

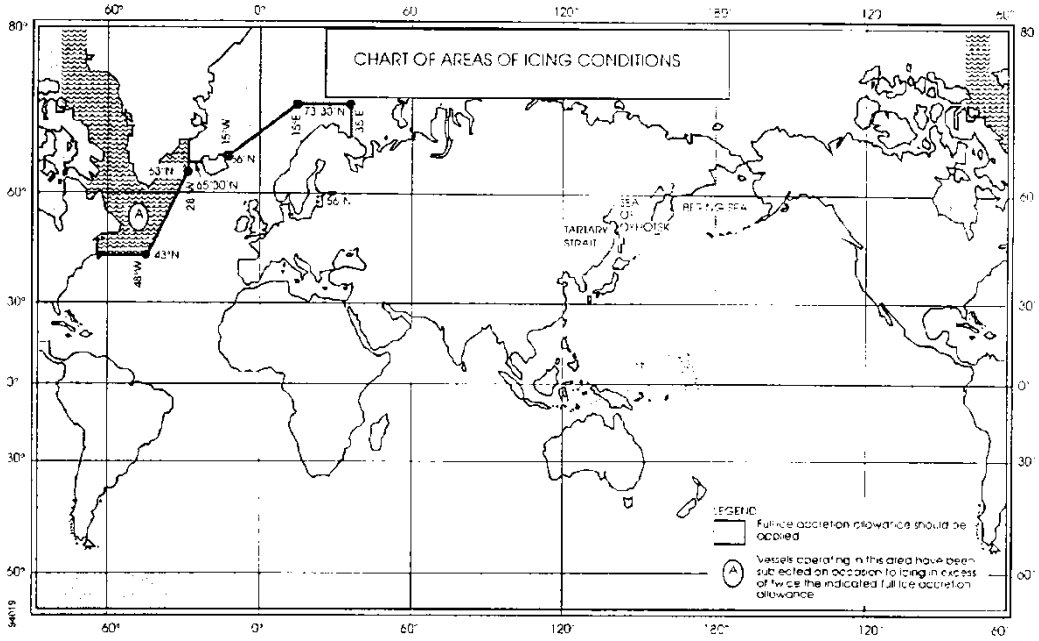
300. A5.3 Special requirements

301. Craft intended for operation in areas where ice accretion is known to occur shall be:

a. .1 designed to minimize the accretion of ice; and

b. .2 equipped with such means for removing ice as the Administration may require.

c. Chart



CHAPTER K
USE OF PROBABILITY CONCEPT

CHAPTER CONTENTS

K1. USE OF PROBABILITY CONCEPT
[ANNEX 3]

100. A3.1 General

101. Absolute safety cannot be achieved in any human activity. Naturally, this fact shall be taken into account in developing safety requirements, which means that requirements shall not imply that safety is absolute. In the case of traditional craft, it has frequently been possible to specify certain aspects of design or construction in some detail, in a way which was consistent with some level of risk which had over the years been intuitively accepted without having to be defined.

102. For high-speed craft, however, it would often be too restrictive to include engineering specifications into the Code. Requirements therefore need to be written (where this question arises) in the sense of "... the Administration shall be satisfied on the basis of tests, investigations and past experience that the probability of --- is (acceptably low)". Since different undesirable events may be regarded as having different general orders of acceptable probability (e.g. temporary impairment of propulsion as compared with an uncontrollable fire), it is convenient to agree on a series of standardized expressions which can be used to convey the relative acceptable probabilities of various incidents, i.e. to perform a qualitative ranking process. A vocabulary is given below which is intended to ensure consistency between various requirements, where it is necessary to describe the level of risk which shall not be exceeded.

200. A4.2 Terms associated with probabilities

201. Different undesirable events may have different orders of acceptable probability. in connection with this, it is convenient to agree on standardized expressions to be used to convey the relatively acceptable probabilities of various occurrences, i.e. to perform a qualitative ranking process.

202. A3.2.1 **Occurrences**

a. "**Occurrence**" is a condition involving a potential lowering of the level of safety.

b. "**Failure**" is an occurrence in which a part, or parts, of the craft fail or malfunction, e.g. runaway. A failure includes:

b.1. a single failure;

b.2. independent failures in combination within a system;

b.3. independent failures in combinations involving more than one system, taking into account:

b.4. any undetected failure that is already present

b.5. such further failures as would be reasonably expected to follow the failure under consideration; and

b.6. In assessing the further failures which follow, account shall be taken of any resulting more severe operating conditions for items that have not up to that time failed.

c. common cause failure (failure of more than one component or system due to the same cause).

d. 2.1.3 "**Event**" is an occurrence which has its origin outside the craft (e.g. waves).

e. "**Error**" is an occurrence arising as a result of incorrect action by the operating crew or maintenance personnel.

203. A3.2.2**Probability of occurrences**

a. 2.2.1 "**Frequen**t" is one which is likely to occur often during the operational life of a particular craft.

b. 2.2.2 "**Reasonably probable**" is one which is unlikely to occur often but which may occur several times during the total operational life of a particular craft.

c. 2.2.3 "**Recurrent**" is a term embracing the total range of frequent and reasonably probable.

d. 2.2.3 "**Remote**" is one which is unlikely to occur to every craft but may occur to a few craft of a type over the total operational life of a number of craft of the same type.

e. 2.2.5 "**Extremely remote**" is one which is unlikely to occur when considering the total operational life of a number of craft of the type, but nevertheless shall be considered as being possible

f. 2.2.6 "**Extremely improbable**" is one which is so extremely remote that it shall not be considered as possible to occur.

203. 2.3 **Effects**

a. 2.3.1 "**Effect**" is a situation arising as a result of an occurrence.

b. 2.3.2 "**Minor effect**" is an effect which may arise from a failure, an event, or an error, as defined in K1.202.b, K1.202.b and K1.202.e which can be readily compensated for by the operating crew. It may involve:

b.1. a small increase in the operational duties of the crew or in their difficulty in performing their duties; or

b.2. a moderate degradation in handling characteristics; or

b.3. slight modification of the permissible operating conditions.

204. 2.3.3 "**Major effect**" is an effect which produces:

a. a significant increase in the operational duties of the crew or in their difficulty in performing their duties which by itself shall not be outside the capability of a competent crew provided that another major effect does not occur at the same time; or

b. significant degradation in handling characteristics; or

c. significant modification of the permissible operating conditions, but will not remove the capability to complete a safe journey without demanding more than normal skill on the part of the operating crew.

205. 2.3.4 "**Hazardous effect**" is an effect which produces:

a. a dangerous increase in the operational duties of the crew or in their difficulty in performing their duties of such magnitude that they cannot reasonably be expected to cope with them and will probably require outside assistance; or

b. dangerous degradation of handling characteristics; or

c. dangerous degradation of the strength of the craft; or

d. marginal conditions for, or injury to, occupants; or

e. an essential need for outside rescue operations.

206. 2.3.5 "**Catastrophic effect**" is an effect which results in the loss of the craft and/or in fatalities.

300. 2,4 Safety level

301. "**Safety level**" is a numerical value characterizing the relationship between craft performance represented as horizontal single-amplitude acceleration (g) and the

severity of acceleration-load effects on standing and sitting humans.

302. The safety levels and the corresponding severity of effects on passengers and safety criteria for craft performance shall be as defined in table T.K1.401.1.

400. 3 Numerical values

401. Where numerical probabilities are used in assessing compliance with requirements using the terms similar to those given above, the following approximate values may be used as guidelines to assist in providing a common point of reference.

The probabilities quoted shall be on an hourly or per-journey basis, depending on which is more appropriate to the assessment in question.

TABLE T.K1,401.1 – APPROXIMATE VAULES OF PROBABILITY

Frequent	More than 10^{-3}
Reasonably probable	10^{-3} to 10^{-5}
Remote	10^{-5} to 10^{-7}
Extremely remote	10^{-7} to 10^{-9}
Extremely improbable	Whilst no approximate numerical probability is given for this, the figures used shall be substantially less than 10^{-9}

Note: Different occurrences may have different acceptable probabilities, according to the severity of their consequences (see table T.K1.402.2).

TABLE T.K1.402.2 – SEVERITY OF CONSEQUENCES

EFFECT	**CRITERIA NOT TO BE EXCEEDED**		**COMMENTS**
	Type of load	**Value**	
LEVEL 1 MINOR EFFECT Moderate degradation of safety	Maximum acceleration measured horizontally*	0.20 g**	0.08 g: Elderly person will keep balance when holding. 0.15 g: Mean person will keep balance when holding. 0.15 g: Sitting person will start holding.
LEVEL 2 MAJOR EFFECT Significant degradation of safety	Maximum acceleration measured horizontally*	0.35 g	0.25 g: Maximum for mean person keeping balance when holding. 0.45 g: Mean falls out of seat when not wearing seat belts.
LEVEL 3 HAZARDOUS EFFECT Major degradation of safety	Collision design condition (calculated) Maximum structural design load,based on vertical acceleration at centre of gravity	Ref. 4.3.3 Ref. 4.3.1	Risk of injury passengers; safe emergency after collision. 1.0 g: Degradation of passenger safety
LEVEL 4 CATASTROPHIC EFFECT	Loss of craft or / and fatalities.		

Notes:
* The accelerometers used shall have an accuracy of at least 5% full scale and shall not have a frequency response of less than 20 Hz. The sampling frequency should not be less than 5 times the maximum frequency response. Anti-aliasing filters, if used, should have a passband equal to the frequency response.
** g = gravity acceleration (9.81 m/s²).

TABLE T.K1.402.3 – SAFETY LEVELS

<table>
<tr><td>SAFETY LEVEL</td><td>1</td><td>1</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>EFFECT ON CRAFT AND OCCUPANTS</td><td>Normal</td><td>Nuisance</td><td>Operating limitations</td><td>Emergency procedures; significant reduction in safety margins; difficult for crew to cope with adverse conditions; passenger injuries.</td><td>Large reduction in safety margins; crew over-burden because of work-load or environ- mental conditions; serious injury to small number of occupants.</td><td>Deaths, usually with loss of craft</td></tr>
<tr><td>F.A.R. [1] PROBABILITY(Reference only)</td><td colspan="3"><---------- PROBABLE ----------></td><td colspan="2"><---- IMPROBABLE ----></td><td>EXTREMELY <--------- > IMPROBABLE</td></tr>
<tr><td rowspan="4">JAR-25 [2]</td><td colspan="3"><---------- PROBABLE ----------></td><td colspan="2"><---- IMPROBABLE ----></td><td rowspan="2">EXTREMELY <---------> IMPROBABLE</td></tr>
<tr><td colspan="2"><----- FREQUENT -----></td><td><----------> REASONABLY PROBABLE</td><td><--------> REMOTE</td><td><----------> EXTREMELY REMOTE</td></tr>
<tr><td>PROBABILITY</td><td>10^{-1}</td><td>10^{-4}</td><td>10^{-6}</td><td>10^{-8}</td><td></td><td></td></tr>
<tr><td>10</td><td>-0</td><td>-2</td><td>-3</td><td>-5</td><td>-7</td><td>-9</td></tr>
<tr><td>CATEGORY OF EFFECT</td><td colspan="3"><---------- MINOR ----------></td><td><-MAJOR-></td><td><---------> HAZARDOUS</td><td>CATA-STROPHIC</td></tr>
</table>

CHAPTER L
OPERATIONAL REQUIREMENTS

CHAPTER CONTENTS

RBNA IMPORTANT NOTE: This Chapter M has been included in the present Title 25 for the sole purpose of not breaking the integrity of the Code. All its contents are not used for classification purposes.

L1. PART A: GENERAL

100. 18.1 Craft operational control

101. 18.1.1 The High-Speed Craft Safety Certificate, the Permit to Operate High-Speed Craft or certified copies thereof, and copies of the route operational manual, craft operating manual, and a copy of such elements of the maintenance manual as the Administration may require shall be carried on board.

102. 18.1.2 The craft shall not be intentionally operated outside the worst intended conditions and limitations specified in the Permit to Operate High-Speed Craft, in the High-Speed Craft Safety Certificate, or in documents referred to therein.

103. 18.1.3 The Administration shall issue a Permit to Operate High-Speed Craft when it is satisfied that the operator has made adequate provisions from the point of view of safety generally, including the following matters specifically, and shall revoke the Permit to Operate if such provisions are not maintained to its satisfaction:

a. .1 the suitability of the craft for the service intended, having regard to the safety limitations and information contained in the route operational manual;

b. .2 the suitability of the operating conditions in the route operational manual;

c. .3 the arrangements for obtaining weather information on the basis of which the commencement of a voyage may be authorized;

d. .4 provision in the area of operation of a base port having functions and facilities in accordance with the requirements of this Code;

e. .5 the designation of the person responsible for decisions to cancel or delay a particular voyage, e.g. in the light of the weather information available;

f. .6 sufficient crew complement required for operating the craft, deploying and manning survival craft, the supervision of passengers, vehicles and cargo in both normal and emergency conditions as defined in the Permit to Operate. The crew complement shall be such that two officers are on duty in the operating compartment when the craft is under way, one of whom may be the master;

g. .7 crew qualifications and training, including competence in relation to the particular type of craft and service intended, and their instructions in regard to safe operational procedures;

h. .8 restrictions with regard to working hours, rostering of crews and any other arrangements to prevent fatigue, including adequate rest periods;

i. .9 the training of crew in craft operation and emergency procedures;

j. .10 the maintenance of crew competence in regard to operation and emergency procedures;

k. .11 safety arrangements at terminals and compliance with any existing safety arrangements, as appropriate;

l. .12 traffic control arrangements and compliance with any existing traffic control, as appropriate;

m. .13 restrictions and/or provisions relating to position fixing and to operation by night or in restricted visibility, including the use of radar and/or other electronic aids to navigation, as appropriate;

n. .14 additional equipment which may be required, due to the specific characteristics of the service intended, for example, night operation;

o. .15 communication arrangements between craft, coast radio stations, base ports radio stations, emergency services and other ships, including radio frequencies to be used and watch to be kept;

p. .16 the keeping of records to enable the Administration to verify:

p.1. .16.1 that the craft is operated within the specified parameters,

p.2. .16.2 the observance of emergency and safety drills/procedures;

p.3. .16.3 the hours worked by the operating crew;

p.4. .16.4 the number of passengers on board;

p.5. .16.5 compliance with any law to which the craft is subject;

p.6. .16.6 craft operations; and

p.7. .16.7 maintenance of the craft and its machinery in accordance with approved schedules;

q. .17 arrangements to ensure that equipment is maintained in compliance with the Administration' s requirements, and to ensure co-ordination of information as to the serviceability of the craft and equipment between the operating and maintenance elements of the operator' s organization;

r. 18 the existence and use of adequate instructions regarding:

r.1. 18.1 loading of the craft so that weight and centre of gravity limitations can be effectively observed and cargo is, when necessary, adequately secured;

r.2. .18.2 the provision of adequate fuel reserves;

r.3. .18.3 action in the event of reasonable foreseeable emergencies; and

s. .19 provision of contingency plans by operators for foreseeable incidents including all land-based activities for each scenario. The plans shall provide operating crews with information regarding search and rescue (SAR) authorities and local administrations and organizations which may complement the tasks undertaken by crews with the equipment available to them

* Refer to the IMO Search and Rescue Manual (IMOSAR), adopted by the Organization by resolution A.439(XI), and Use of Radar Transponders for Search and Rescue Purposes, adopted by resolution A.530(13).

104. 18.1.4 The Administration shall determine the maximum allowable distance from a base port or place of refuge after assessing the provisions made under 18.1.3.

105. 18.1.5 The master shall ensure that an effective system of supervision and reporting of the closing and opening of accesses referred to in H4.402 and H4.403 is implemented.

200. 18.2 Craft documentation

201. The company shall ensure that the craft is provided with adequate information and guidance in the form of technical manual(s) to enable the craft to be operated and maintained safely. The technical manual(s) shall consist of a route operational manual, craft operating manual, training manual, maintenance manual and servicing schedule. Arrangements shall be made for such information to be updated as necessary.

202. 18.2.1 **Craft operating manual**

The craft operating manual shall contain at least the following information:

a. .1 leading particulars of the craft;

b. .2 description of the craft and its equipment;

c. .3 procedures for checking the integrity of buoyancy compartments;

d. .4 details arising from compliance with the requirements of Chapter H likely to be of direct practical use to the crew in an emergency;

e. .5 damage control procedures (e.g. information in a damage control plan required by SOLAS regulation II-1/23 or II-1/25-8.2, as appropriate);

f. .6 description and operation of machinery systems;

g. .7 description and operation of auxiliary systems;

h. .8 description and operation of remote control and warning systems;

i. .9 description and operation of electrical equipment;

j. .10 loading procedures and limitations, including maximum operational weight, centre of gravity position and distribution of load, including any cargo or car securing arrangement and procedures depending on operational restrictions or damaged conditions. Such arrangement and procedures shall not be included as a separate Cargo Securing Manual as required by chapter VI of the Convention;

k. .11 description and operation of fire-detection and fire-extinguishing equipment;

l. .12 drawings indicating the structural fire protection arrangements;

m. .13 description and operation of radio equipment and navigational aids;

n. .14 information regarding the handling of the craft as determined in accordance with chapter T, T.1;

o. .15 maximum permissible towing speeds and towing loads, where applicable;

p. .16 procedure for dry-docking or lifting, including limitations;

q. .17 in particular, the manual shall provide information, in clearly defined chapters , relating to:

q.1. 17.1 indication of emergency situations or malfunctions jeopardizing safety, required actions to be taken and any consequential restrictions on operation of the craft or its machinery;

q.2. .17.2 evacuation procedures;

q.3. .17.3 the worst intended conditions;

q.4. .17.4 limiting values of all machinery parameters requiring compliance for safe operation. In regard to information on machinery or system failures, data shall take into account the results of any FMEA reports developed during the craft design.

203. 18.2.2 **Route operational manual**

The route operational manual shall include at least the following information:

a. .1 evacuation procedures;

b. .2 operating limitations, including the worst intended conditions;

c. .3 procedures for operation of the craft within the limitations of .203.b;

d. .4 the elements of applicable contingency plans for primary and secondary rescue assistance in the case of foreseeable incidents, including land-based arrangements and activities for each incident;

e. .5 arrangements for obtaining weather information;

f. .6 identification of the "base port(s)";

g. .7 identification of the person responsible for decisions to cancel or delay voyages;

h. .8 identification of crew complement, functions and qualifications;

i. .9 restrictions on working hours of crew;

j. .10 safety arrangements at terminals;

k. .11 traffic control arrangements and limitations, as appropriate;

l. .12 specific route conditions or requirements relating to position fixing, operations by night and in restricted visibility, including the use of radar or other electronic aids to navigation; and

m. .13 communication arrangements between craft, coast radio stations, base ports radio stations, emergency services and other ships, including radio frequencies to be used and watch to be kept.

204. 18.2.3 **Training manual**

The training manual, which may comprise several volumes, shall contain instructions and information, in easily understood terms, illustrated wherever possible, on evacuation, fire and damage control appliances and systems and on the best methods of survival. Any part of such information may be provided in the form of audio-visual aids in lieu of the manual. Where appropriate, the contents of the training manual may be included in the craft operating manual. The following shall be explained in detail:

a. .1 donning lifejackets and immersion suits, as appropriate;

b. .2 muster at the assigned stations;

c. .3 boarding, launching and clearing the survival craft and rescue boats;

d. .4 method of launching from within the survival craft;

e. .5 release from launching appliances;

f. .6 methods and use of devices for protection in launching areas, where appropriate;

g. .7 illumination in launching areas;

h. .8 use of all survival equipment;

i. .9 use of all detection equipment;

j. .10 with the assistance of illustrations, the use of radio life-saving appliances;

k. .11 use of drogues;

l. .12 use of engine and accessories;

m. .13 recovery of survival craft and rescue boats, including stowage and securing;

n. .14 hazards of exposure and the need for warm clothing;

o. .15 best use of the survival craft facilities in order to survive;

p. .16 methods of retrieval, including the use of helicopter rescue gear (slings, baskets, stretchers), breeches-buoy and shore life-saving apparatus and craft' s line-throwing apparatus;

q. .17 all other functions contained in the muster list and emergency instructions;

r. .18 instructions for emergency repair of the life-saving appliances;

s. .19 instructions in the use of fire protection and fire-extinguishing appliances and systems;

t. .20 guidelines for use of firefighter' s outfit in a fire, if fitted;

u. .21 use of alarms and communications associated with fire safety;

v. .22 methods for surveying damage;

w. .23 use of damage control appliances and systems, including operation of watertight doors and bilge pumps; and

x. .24 for passenger craft, control of and communication with passengers in an emergency.

205. 18.2.4 **Maintenance and servicing manual/system**

The craft maintenance and servicing manual/system shall contain as a minimum:

a. .1 detailed, illustrated description of all craft structure, machinery installations and all installed equipment and systems required for safe operation of the craft;

b. .2 specifications and quantities of all replenishable fluids and of structural materials which may be required for repairs;

c. .3 operational limitations of machinery in terms of values of parameters, vibration and consumption of replenished fluids;

d. .4 limitations of wear of structure or machinery components, including lives of components requiring calendar or operating time replacement;

e. .5 detailed description of procedures, including any safety precautions to be taken or special equipment required, to remove and install main and auxiliary machinery, transmissions, propulsion and lift devices and flexible structure components;

f. .6 test procedures to be followed subsequent to replacement of machinery or system components or for malfunction diagnosis;

g. .7 procedure for lifting or dry-docking the craft, including any weight or attitude limitations;

h. .8 procedure for weighing the craft and establishing the position of longitudinal centre of gravity (LCG);

i. .9 where craft may be dismantled for transportation, instructions shall be provided for dismantling, transport and re-assembly;

j. .10 a servicing schedule, included in the maintenance manual or published separately, detailing the routine servicing and maintenance operations required to maintain the operational safety of the craft and its machinery and systems.

206. 5 **Information on passengers**

a. 18.2.5.1 All persons on board passenger craft shall be counted prior to departure.

b. 18.2.5.2 Details of persons who have declared a need for special care or assistance in emergency situations shall be recorded and communicated to the master prior to departure.

c. 18.2.5.3 The names and gender of all persons on board, distinguished between adults, children and infants shall be recorded for search and rescue purposes.

d. 18.2.5.4 The information required by L1.206.a, L1.206.b and L1.206.c shall be kept ashore and made readily available to search and rescue services when needed.

e. 18.2.5.5 The Administration may exempt from the requirements of L1.206.c passenger craft operating on voyages having a duration of 2 h or less between each port of call.

300. 18.3 Training and qualifications

301. 18.3.1 The level of competence and the training considered necessary in respect of the master and each crew member shall be laid down and demonstrated in the light of the following guidelines to the satisfaction of the company in respect of the particular type and model of craft concerned and the service intended. More than one crew member shall be trained to perform all essential operational tasks in both normal and emergency situations.

302. 18.3.2 The Administration shall specify an appropriate period of operational training for the master and each member of the crew and, if necessary, the periods at which appropriate retraining shall be carried out.

303. 18.3.3 The Administration shall issue a type rating certificate to the master and all officers having an operational role following an appropriate period of operational/simulator training and on the conclusion of an examination including practical test commensurate with the operational tasks on board the particular type and model of craft concerned and the route followed. The type rating training shall cover at least the following items:

a. .1 knowledge of all on-board propulsion and control systems, including communication and navigational equipment, steering, electrical, hydraulic and pneumatic systems and bilge and fire pumping;

b. .2 the failure mode of the control, steering and propulsion systems and proper response to such failures;

c. .3 handling characteristics of the craft and the limiting operational conditions;

d. .4 bridge communication and navigation procedures;

e. .5 intact and damage stability and survivability of the craft in damage condition;

f. .6 location and use of the craft' s life-saving appliances, including survival craft equipment;

g. .7 location and use of escapes in the craft and the evacuation of passengers;

h. .8 location and use of fire protection and fire-extinguishing appliances and systems in the event of fire on board;

i. .9 location and use of damage control appliances and systems, including operation of watertight doors and bilge pumps;

j. .10 cargo and vehicle stowage and securing systems;

k. .11 methods for control of and communication with passengers in an emergency; and

l. .12 location and use of all other items listed in the training manual.

304. The type rating certificate for a particular type and model of craft should only be valid for service on the route to be followed when it is so endorsed by the Administration following the completion of a practical test over that route.

305. The type rating certificate shall be re-validated every two years and the Administration shall lay down the procedures for re-validation.

306. 18.3.6 All crew members shall receive instructions and training, as specified in 18.3.3.6 to 18.3.3.12.

307. 18.3.7 The Administration shall specify standards of physical fitness and frequency of medical examinations, having regard to the route and craft concerned.

308. 18.3.8 The Administration of the country in which the craft is to operate, if other than the flag State, shall be satisfied with the training, experience and qualifications of the master and each crew member. A valid certificate of competency or a valid license appropriately endorsed, in accordance with the provisions of the International Convention on Standards of Training, Certification and Watchkeeping (STCW), 1978 as amended, held by the master or crew member, shall be acceptable as evidence of satisfactory training and qualification to the Administration of the country in which the craft is to operate.

400. 18.4 Manning of survival craft and supervision

401. The company and the master shall ensure that:

a. .1 a sufficient number of trained persons are on board for mustering and assisting untrained persons;

b. .2 a sufficient number of crew members, who may be deck officers or certificated persons, are on board for operating the survival craft, rescue boats and launching arrangements required for abandonment by the total number of persons on board;

c. .3 a deck officer or certificated person is placed in charge of each survival craft to be used recognizing, however, that the Administration, having due regard to the nature of the voyage, the number of persons on board and the characteristics of the craft, may permit a deck officer, certificated person or persons practised in the handling and operation of liferafts to be placed in charge of each liferaft or group of liferafts;

d. .4 the person in charge of survival craft has a list of the survival craft crew and sees that those crew members are acquainted with their duties;

e. .5 every rescue boat and lifeboat has a person assigned who is capable of operating the engine and carrying out minor adjustments; and

f. .6 the persons referred to in L1.401.a to L1.401.c . are equitably distributed among the craft' s survival craft.

500. 18.5 Emergency instructions and drills

501. 18.5.1 The company shall ensure that the emergency instructions and drills referred to in the present L1.500 are implemented, and the master shall be responsible for the enforcement of these instructions and drills on board. On or before departure, passengers shall be instructed in the use of lifejackets and the action to be taken in an emergency. The attention of the passengers shall be drawn to the emergency instructions required by Part II, Title 25, Section 3, Chapter D, D4.401 to D4.403 (Manning of survival craft and supervision).

502. 18.5.2 Emergency fire and evacuation drills for the crew shall be held on board the craft at intervals not exceeding one week for passenger craft and one month for cargo craft.

503. 18.5.3 Each member of each crew shall participate in at least one evacuation, fire and damage control drill per month.

504. 18.5.4 Crew members with enclosed space entry or rescue responsibilities shall participate in an enclosed space entry and rescue drill, to be held on board the craft, at least once every two months.

505. 18.5.5 On-board drills shall, as far as practicable, be conducted to simulate an actual emergency. Such simulations shall include instruction and operation of the craft' s evacuation, fire and damage control appliances and systems.

506. 18.5.6 On-board instruction and operation of the craft' s evacuation, fire and damage control appliances and systems shall include appropriate cross-training of crew members.

507. 18.5.7 Emergency instructions including a general diagram of the craft showing the location of all exits, routes of evacuation, assigned assembly stations, emergency equipment, life-saving equipment and appliances and illustration of lifejacket donning shall be available to each passenger and crew member in appropriate languages. It shall be placed near each passenger and crew seat and conspicuously displayed at assembly stations and other passenger spaces.

508. 18.5.8 **Records**

a. 18.5.8.1 The date when musters are held, details of abandon craft drills and fire drills, drills of other life-saving appliances, enclosed space entry and rescue drills, and onboard training shall be recorded in such log-book as may be prescribed by the Administration. If a full muster, drill or training session is not held at the appointed time, an entry shall be made in the log-book stating the circumstances and the extent of the muster, drill or training session held. A copy of such information shall be forwarded to the operator' s management.

b. 18.5.8.2 The master shall ensure, before the craft leaves the berth on any voyage, that a record is made of the time of the last closing of the accesses referred to H4.402 and H4.403.

509. 18.5.9 **Evacuation drills:**

a. 18.5.9.1 Evacuation drill scenarios shall vary each week so that different emergency conditions are simulated.

b. 18.5.9.2 Each evacuation craft drill shall include:

b.1. .1 summoning of crew to assembly stations with the alarm required by Part II, Title 25, Section 3, Chapter D, D4.202.b.2 and ensuring that they are made aware of the order to abandon craft specified in the muster list;

b.2. .2 reporting to stations and preparing for the duties described in the muster list;

b.3. .3 checking that crew are suitably dressed;

b.4. .4 checking that lifejackets are correctly donned;

b.5. .5 operation of davits if any used for launching liferafts;

b.6. .6 donning of immersion suits or thermal protective clothing by appropriate crew members;

b.7. .7 testing of emergency lighting for mustering and abandonment; and

b.8. .8 giving instructions in the use of the craft' s life-saving appliances and in survival at sea.

c. 18.5.9.3 **Rescue boat drill**

c.1. 1 As far as is reasonable and practicable, rescue boats shall be launched each month as part of the evacuation drill, with their assigned crew aboard, and manoeuvred in the water. in all cases this requirement shall be complied with at least once every three months.

c.2. .2 If rescue boat launching drills are carried out with the craft making headway, such drills shall, because of the dangers involved, be practised in sheltered waters only and under the supervision of an officer experienced in such drills.*

* Refer to the Guidelines on training for the purpose of launching lifeboats and rescue boats from ships making headway through the water, adopted by the Organization by resolution A.624(15).

d. 18.5.9.4 Individual instructions may cover different parts of the craft' s life-saving system, but all the craft' s life-saving equipment and appliances shall be covered within any period of one month on passenger craft and two months on cargo craft. Each member of the crew shall be given instructions which shall include but not necessarily be limited to:

d.1. .1 operation and use of the craft' s inflatable liferafts;

d.2. .2 problems of hypothermia, first-aid treatment of hypothermia and other appropriate first-aid procedures; and

d.3. .3 special instructions necessary for use of the craft' s life-saving appliances in severe weather and severe sea conditions.

e. 18.5.9.5 On-board training in the use of davit-launched liferafts shall take place at intervals of not more than four months on every craft fitted with such appliances. Whenever practicable, this shall include the inflation and lowering of a

liferaft. This liferaft may be a special liferaft intended for training purposes only, which is not part of the craft' s life-saving equipment. Such a special liferaft shall be conspicuously marked.

510. 18.5.10 **Fire drills**

a. 18.5.10.1 Fire drill scenarios shall vary each week so that emergency conditions are simulated for different craft compartments.

b. 18.5.10.2 Each fire drill shall include:

b.1. .1 summoning of crew to fire stations;

b.2. .2 reporting to stations and preparing for the duties described in the muster list;

b.3. .3 donning of firefighter' s outfits;

b.4. .4 operation of fire doors and fire dampers;

b.5. .5 operation of fire pumps and fire-fighting equipment;

b.6. .6 operation of communication equipment, emergency signals and general alarm;

b.7. .7 operation of fire-detection system; and

b.8. .8 instruction in the use of the craft' s fire-fighting equipment and sprinkler and drencher systems, if fitted.

511. 18.5.11 **Damage control drills**

a. 18.5.11.1 Damage control drill scenarios shall vary each week so that emergency conditions are simulated for different damage conditions.

b. 18.5.11.2 Each damage control drill shall include:

b.1. .1 summoning of crew to damage control stations;

b.2. .2 reporting to stations and preparing for the duties described in the muster list;

b.3. .3 operation of watertight doors and other watertight closures;

b.4. .4 operation of bilge pumps and testing of bilge alarms and automatic bilge pump starting systems; and

b.5. .5 instruction in damage survey, use of the craft damage control systems and passenger control in the event of an emergency.

512. 18.5.12 **Enclosed space entry and rescue drills**

a. 18.5.12.1 Enclosed space entry and rescue drills should be planned and conducted in a safe manner, taking into account, as appropriate, the guidance provided in the recommendations developed by the Organization*.

b. 18.5.12.2 Each enclosed space entry and rescue drill shall include:

b.1. .1 checking and use of personal protective equipment required for entry;

b.2. .2 checking and use of communication equipment and procedures;

b.3. .3 checking and use of instruments for measuring the atmosphere in enclosed spaces;

b.4. .4 checking and use of rescue equipment and procedures; and

b.5. .5instructions in first aid and resuscitation techniques.

c. 18.5.12.3 The risks associated with enclosed spaces and onboard procedures for safe entry into such spaces which should take into account, as appropriate, the guidance provided in recommendations developed by the Organization*.

*Refer to the Revised Recommendations for entering enclosed spaces aboard ships, adopted by the Organization by resolution A.1050(27).

L2. PART B: REQUIREMENTS FOR PASSENGER CRAFT

100. 18.6 Type rating training

101. 18.6.1 The company shall ensure that the type rating training is implemented. For all crew members, the type rating training shall cover the control and evacuation of passengers additionally to L1.305.

102. 18.6.2 When a craft carries cargoes, the craft shall comply with the requirements of part C of this chapter in addition to this part.

200. 18.7 Emergency instructions and drills

201. 18.7.1 The company shall ensure that the emergency instructions are implemented, and the master shall be responsible for communicating the provisions of the emergency instructions to passenger upon boarding.

L3. PART C: REQUIREMENTS FOR CARGO CRAFT

100. 18.8 Type rating training

101. The company shall ensure that type rating training is implemented as provided in L1.300For all crew members, the type rating training shall cover knowledge of cargo and vehicles storage area securement systems

L4. FACTORS TO BE CONSIDERED IN DETERMINING OPERATION LIMITATIONS [ANNEX 12]

100. A12.1 Purpose and scope

101. The purpose of this annex is to identify the parameters to which consideration should be given when determining the worst intended conditions (defined in A4.161) and other operational limitations (defined in A4.141) for insertion into the Permit to Operate, in order to facilitate consistent application of the Code.

200. A12.2Factorstobeconsidered

101. As a minimum, the following factors shall be considered:

The maximum distance from refuge implied by A4.304

a. The availability of rescue resources to comply with A5.113 (category A craft only).

b. Minimum air temperature (susceptibility to icing), visibility and depth of water for safe operation as addressed by A4.161.

c. The significant wave height and maximum mean wind speed used when applying the requirements for stability and buoyancy in Chapter H and associated annexes.

d. The safe seakeeping limitations (especially significant wave height) considering the known stability hazards listed in H5.105, the operating conditions on the intended route (see L1.103.b) and the motions experienced during operation defined in T2.403.

e. The structural safety of the craft in critical design conditions according to Part II, Title 25, Section 2.

f. The safe deployment and operation of evacuation systems and survival craft as required by Part II, Title 25, Section 3, Chapter D, D4.605.

g. The safe handling limitations determined in accordance with the sea trials required by Subchapter T1 and Chapter K and Subchapter T2, identifying any limitations on weight and centre-of-gravity position according to T1.300 and the effects of failures and malfunctions according to T1.400.

CHAPTER T
HANDLING, CONTROLLABILITY AND PERFORMANCE

CHAPTER CONTENTS

T1. HANDLING, CONTROLLABILITY AND PERFORMANCE

100. 17.1 General

101. The operational safety of the craft in normal service conditions and in equipment failure situations of a craft to which this Code applies shall be documented and verified by full-scale tests, supplemented by model tests where appropriate, of the prototype craft. The objective of tests is to determine information to be included in the craft operating manual in relation to:

a. operating limitations;

b. procedures for operation of the craft within the limitations;

c. actions to be taken in the event of prescribed failure; and

d. limitations to be observed for safe operation subsequent to prescribed failures.

102. Operational information shall be available on board for guidance, or the craft shall have an instrument system for on-line check of operational performance which shall be approved by the RBNA taking into account the standards for the processing and presentation of measurements developed by the Organization. As a

minimum, the system shall measure accelerations in three axes close to the craft longitudinal centre of gravity.

200. 17.2 Proof of compliance

201. 17.2.1 The information on controllability and manoeuvrability which shall be contained in the craft operating manual shall include the characteristics under T1.405 as applicable, the list of parameters of the worst intended condition saffecting the controllability and manoeuvrability according to T1.406, information on safe maximum speeds as described in T1.802 and the performance data verified in accordance with Subchapter T29.

202. 17.2.2 The information on operating limitations which shall be contained in the route operational manual shall include the characteristics under T1.201, T1.504.a andT1.504.b.

300. 17.3 Weight and centre of gravity

301. Compliance with each of the handling, controllability and performance requirements shall be established for all combinations of weight and centre of gravity position significant for the operational safety in the range of weights up to the maximum permissible weight.

400. 17.4 Effect of failures

401. The effect of any likely failure in handling and control devices, services or components (e.g. power operation, power assistance, trimming and stability augmentation)shall be assessed in order that a safe level of craft operation can be maintained. Effects of failure identified as being critical according to Part II, Title 25, Section 5, "Procedures for Mode and Effect Analysis" shall be verified in accordance with.

500. 17.5 Controllability and manoeuvrability

501. 17.5.1 Instructions to crew members shall be provided in the craft operating manual regarding required actions and craft limitations subsequent to prescribed failures.

502. 17.5.2 It is necessary to ensure that the effort required to operate the controls in the worst intended conditions is not such that the person at the control will be unduly fatigued or distracted by the effort necessary to maintain the safe operation of the craft.

503. 17.5.3 The craft shall be controllable and be capable of performing those manoeuvres essential to its safe operation up to the critical design conditions.

504. 17.5.4.1 When determining the operating limitations of a craft, particular attention shall be paid to the following aspects during normal operation and during failures and subsequent to failures:

a. .1 yawing;

b. .2 turning;

c. .3 automatic pilot and steering performance;

d. .4 stopping in normal and emergency conditions;

e. .5 stability in the non-displacement mode aboutthree axes and in heave;

f. .6 trim;

g. .7 roll;

h. .8 plough in;

i. .9 lift power limitations;

j. .10 broaching;

k. .11 slamming; and

l. .12 bow diving.

505. 17.5.4.2 The terms in 17.5.4.1.2, .8, .9 and .11 are defined as follows:

a. .1 "Turning" is the rate of change of direction ofa craft at its normal maximum operating speed in specified wind and sea conditions.

b. .2 "Plough in" is an involuntary motion involving sustained increase in drag of an air-cushion vehicle at speed, usually associated with partial collapse of the cushion system.

c. .3 "Lift power limitations" are those limitations imposed upon the machinery and components which provide the lift.

d. .4 "Slamming" is the water impact on the underside of the hull in the bow area of the craft.

600. 17.6 Change of operating surface and mode,Minimum depth of water

601. There shall be no unsafe change in the stability, controllability or attitude of the craft during transition from one type of operating surface or mode to another. Information on change in the behaviour characteristics of the craft during transition shall be available to the master.

700. 17.7 Surface irregularities

701. Factors which limit the ability of the craft to operate over sloping ground and steps or discontinuities shall be determined, as applicable, and made available to the master.

800. [17.8]Acceleration and deceleration, [17.9]Speeds, [17.10]Minimum depth of water

801. 17.8 The Administration shall be satisfied that the worst likely acceleration or deceleration of the craft, due

to any likely failure, emergency stopping procedures or other likely causes, would not hazard the persons on the craft.

802. 17.9 Safe maximum speeds shall be determined, taking account of the limitations from Part II, Title 25, Section 4, D4, modes of operation, wind force and direction and the effects of possible failures of anyone lift or propulsion system over calm water, rough water and over other surfaces, as appropriate to the craft.

803. 17.10 The minimum depth of water and other appropriate information required for operations in all modes shall be determined.

900. [17.11] Hard structure clearance, [17.12] Night operation

901. 17.11 For amphibious craft, when cushion-borne, clearance of the lowest point of the hard structure above a hard flat surface shall be determined.

902. 17.12 The schedule of tests shall include sufficient operation to evaluate the adequacy of internal and external lighting and visibility under conditions of normal and emergency electrical power supply during service, cruising and docking manoeuvres.

T2. DEFINITIONS, REQUIREMENTS AND COMPLIANCE CRITERIA RELATED TO OPERATIONAL AND SAFETY PERFORMANCE [ANNEX 9]

100. General

101. This Subchapter T2 applies to all types of craft. Tests to evaluate operational safety shall be conducted on the first craft of a new design or of a design incorporating new features which may modify the results of a previous testing.

102. The tests shall be carried out to a schedule agreed between the RBNA and the manufacturer. Where conditions of service warrant additional testing (e.g., low temperature), the RBNA may require further demonstrations. Functional descriptions, technical and system specifications relevant to the understanding and evaluation of craft performance shall be available.

103. The objective of these tests is to provide essential information and guidance to enable the craft to be operated safely under normal and emergency conditions within the design speed and environmental envelope.

104. The following procedures are outlined as requirements in dealing with verification of craft performance.

200. A9.1 Performance

201. A9.1.1.1 The craft shall meet the applicable operational requirements in Subchapter T1 and this Subchapter T2 for all extremes of passenger and load configurations for which certification is required. The limiting sea state related to the different modes of operation shall be verified by tests and analyses of a craft of the type for which certification is requested.

202. A9.1.1.2 Operational control of the craft shall be in accordance with procedures established by the applicant for operation in service. Procedures to be established shall be start procedure, cruise procedures, normal and emergency stop and manoeuvre procedures.

203. A9.1.1.3 The procedures established under T2.202 shall:

a. demonstrate that normal manoeuvres and craft responses to failures are consistent in performance;

b. use methods or devices that are safe and reliable; and

c. include allowance for any time lag in the execution of procedures that may reasonably be expected in service.

204. A9.1.1.4 Procedures required by this annex shall be conducted over water of sufficient depth such that craft performance will not be affected.

205. A9.1.1.5 Tests shall be conducted at minimum practicable weight and additional testing shall be conducted at maximum weight sufficient to establish the need for additional restrictions and for testing to examine the effect of weight.

300. A9.2 Stopping

301. A9.2.1 This test is to establish the acceleration experienced when stopping the craft in calm water with no passenger load or cargo load during the following conditions:

a. normal stop for 90% of maximum speed;

b. emergency stop for 90% of maximum speed; and

c. crash stop from 90% of maximum speed and from any transitional mode speed.

302. A9.2.2 The tests referred to in T2.201 and T2.202 shall document that the accelerations do not exceed safety level 1 in Chapter K when control levers are used in accordance to written procedures as given in the craft operating manual or in an automatic mode.

Should safety level 1 be exceeded during normal stop, control systems shall be modified in order to avoid exceed ance or passengers shall be required to be seated during normal stop.

Should safety level 1 be exceeded during emergency stop, then written procedures in the craft operating manual shall include detailed information of how to avoid exceedance or the control system shall be modified to avoid exceedance.

303. A9.2.3 The test referred to in T2.203 shall document that the accelerations do not exceed safety level 2 in Chapter K when control levers of automatic modes are used in a manner which will give the highest accelerations.

If safety level 2 is exceeded then the craft operating manual shall include a warning that it is a risk to passengers being injured, if a crash stop is performed.

304. A9.2.4 Other tests shall be repeated during craft turning to establish the need or otherwise to impose any speed-related restrictions during manoeuvres.

400. A9.3 Cruise performance

401. A9.3.1 This test is to establish the craft performance and accelerations experienced during cruise modes with no passenger load or cargo load during the following conditions:

a. normal operation conditions are those in which the craft will safely cruise at any heading while manually operated, auto-pilot assisted operated or operated with any automatic control system in normal mode; and

b. worst intended conditions, referred to in A5.161, are those in which it shall be possible to maintain safe cruise without exceptional piloting skill.

c. However, operations at all headings relative to the wind and sea may not be possible.

d. For type of craft having a higher performance standard in non-displacement mode, the performance and accelerations shall also be established at displacement mode during operation in the worst intended condition.

402. A9.3.2 Operation levels, as defined in T2.401, shall be established and documented by full-scale tests in at least two relevant sea conditions and in head, beam and following seas.

a. It shall be shown that the period of every test (run) and the number of series are sufficient for achieving reliable measurements. In every sea state tested, the aggregate time in each direction shall not be less than 15 min.

b. Model tests and mathematical simulations could be used to verify the performance in the worst intended conditions.

c. Limits for normal operation condition shall be documented by measurements of craft speed, heading to the wave and interpolation of measurements of maximum horizontal accelerations in accordance with 2.4 of annex 3.

d. Measurement of wave height and period shall be made to the maximum extent practicable.

e. Limits for worst intended condition shall be documented by measurements of craft speed, wave height and period, heading to the wave and by root mean square (RMS) values of horizontal accelerations in accordance with K1.204and of vertical accelerations close to the craft longitudinal centre of gravity. RMS values could be used for extrapolation of peak values.

403. A9.3.3 To obtain the expected peak values related to structural design load and safety levels (one per 5-min exceedance), multiply the RMS values by 3.0 or

$$C = \sqrt{2 * \ln N}$$

where:

N is the number of successive amplitudes within the relevant period.

404. If not otherwise verified by model tests or by mathematical calculations, it might be assumed a linear relation between wave height and accelerations based on measurements in the two sea conditions.

405. The worst intended conditions shall not exceed 150% of the more severe of the two measured sea conditions. Limits for worst intended condition shall be documented both related to passenger safety in accordance with K1,204 and related to the actual structural design load of the craft.

406. A9.3.3 The tests and verification process shall document the limiting seas for safe operation of the craft:

a. in normal operation at 90% of maximum speed the accelerations shall not exceed safety level 1 in annex 3 with an average of one per 5-min period. The craft operating manual shall include detailed description of the effects of speed reduction or change of heading to the waves in order to prevent exceedance;

b. in the worst intended conditions, with reduced speed as necessary, the accelerations shall not exceed safety level 2 in Chapter K with an average of one per 5-min period, nor shall any other craft characteristic motion as pitch, roll and yaw exceed levels that could impede the safety of passengers. In worst intended conditions, with reduced speed as necessary, craft shall be safely manoeuvrable and provide adequate stability in order that the craft can continue safe operation to the nearest place of refuge, provided caution is exercised in handling. Passengers shall be required to be seated when safety level 1 in Chapter K is exceeded; and

c. within the actual structural design load for the craft, with reduced speed and change of heading, as necessary.

400. A9.3.4 Turning and manoeuvrability

401. The craft shall be safely controllable and manoeuvrable during:

a. hull-borne operation;

b. operation in non-displacement mode;

c. take-off, landing;

d. any intermediate or transition modes, as applicable; and

e. berthing operations, as applicable.

T3. A9.4 EFFECTS OF FAILURES OR MALFUNCTION

100. A9.4.1 General

101. The limits of safe operation, special handling procedures and any operational restrictions shall be examined and developed as a result of full-scale trials conducted by simulating possible equipment failures.

102. The failures to be examined shall be those leading to major or more severe effects as determined from evaluation of FMEA or similar analysis.

103. Failures to be examined shall be agreed between the craft manufacturer and the Administration and each single failure shall be examined in a progressive manner.

200. A9.4.2 Objects of tests

201. Examination of each failure shall result in:

a. determining safe limits of craft operation at the time of failure, beyond which the failure will result in degradation beyond safety level 2;

b. determining crew member' s actions, if any, to minimize or counter the effect of the failure; and

c. determining craft or machinery restrictions to be observed to enable the craft to proceed to a place of refuge with the failure present.

300. A9.300 Failures to he examined

301. Equipment failures shall include, but not be limited to, the following:

a. total loss of propulsion power;

b. total loss of lift power (for ACV and SES);

c. total failure of control of one propulsion system;

d. involuntary application of full propulsion thrust (positive or negative) on one system;

e. failure of control of one directional control system;

f. involuntary full deflection of one directional control system;

g. failure of control of trim control system;

h. involuntary full deflection of one trim control system element; and

i. total loss of electrical power.

302. Failures shall be fully representative of service conditions and shall be simulated as accurately as possible in the most critical craft manoeuvre where the failure will have maximum impact.

400. A9.4 "Dead ship" test

401. In order to establish craft motions and direction of laying to wind and waves, for the purposes of determining the conditions of a craft evacuation, the craft shall be stopped and all main machinery shut down for sufficient time that the craft' s heading relative to wind and waves has stabilized. This test shall be carried out on an opportunity basis to establish patterns of the design' s "*dead ship*"

T4. INCLINING AND STABILITY INFORMATION

100. 2.14 Inclining and stability information

101. 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.

102. 2.14.2 A report of each inclining or lightweight survey carried out in accordance with paragraph 2.7.1 and of the calculation there from 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.

103. 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.

200. 2.7 Inclining and stability information

201. 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.

202. 2.7.2 On all craft, where an accurate inclining experiment is impractical owing to the height of the centre of gravity (VCG or KG) being less than one third of the transverse metacentric height (GMT), the Administration may accept estimation of KG by detailed calculation in place of an inclining experiment. In such cases, a displacement check shall be undertaken to confirm the calculated lightship characteristics, including LCG, which may be accepted if the measured lightship displacement and LCG are respectively within 2% and 1% L relative to the estimate.

203. 2.7.3 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.

204. 2.7.4 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.

205. 2.7.5 A report of each inclining or lightweight survey carried out in accordance with this chapter and of the calculation there from 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.

206. 2.7.6 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.

207. 2.7.7 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 water-tight compartments, the openings therein with their means of closure and position of any controls thereof. For amphibious air-cushion vehicles this may be achieved by the use of draught gauges in conjunction with deck datum plates.

208. 2.7.8 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 s

209. 2.7.9 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.

300. 2.8 Loading and stability assessment

301. 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.

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