1.3 Definitions

"Sailing vessel" means a vessel designed to carry sail, whether as a sole means of propulsion or as a supplementary means.

CHAPTER 14

REQUIREMENTS FOR SAILING VESSELS

14.1 General:

(1) Sailing vessels as defined in section 1.3 of the Code shall additionally comply with the provisions of this Chapter of the Code in full.

14.2 Application:

As per Section 1.3 of the Code, a sailing vessel is a vessel designed to carry sail, whether as a sole means of propulsion or as a supplementary means.

14.3 Operating Restrictions

(1) The vessel's "Statement of Operational Limitations" shall give the maximum wind speed or 'Derived Heel Angle' and reference the vessel's 'Sailing Operations Manual'

(2) Any applicable rig limitations shall also be listed on the statement.

14.4 Water Freeing Arrangements

(1) where the solid bulwark height does not exceed 150mm, specific freeing ports, as defined section 2.15, are not required.

14.5 Intact Stability

"the 'down-flooding angle' is the angle of heel causing immersion of the lower edge of openings having an aggregate area, in square metres, greater than:-

$$\frac{\Delta}{1500} = \text{where } \Delta = \text{vessels displacement in tonnes''}$$

(1) *Vessels should comply with the appropriate parts of chapter 4 in full.*

(2) *Current Chapter 4 requirements are to be assessed without accounting for the added windage of the sails. Vessels with lifting keels, should meet the requirements of Chapter 4 in the most onerous condition.*

(3) *Asymmetric ballasting is not permitted whilst sailing*

(4) *Vessels shall additionally comply with the following:*

14.6 Intact Stability Monohulls

(1) *Curves of statical stability (GZ curves) for at least the Loaded Departure with 100% consumables and the Loaded Arrival with 10% consumables should be produced.*

(2) *The GZ curves required by (1) should have a positive range of not less than 90º, where the 'Sail Area Displacement Ratio' is greater than [5] calculated as follows:*

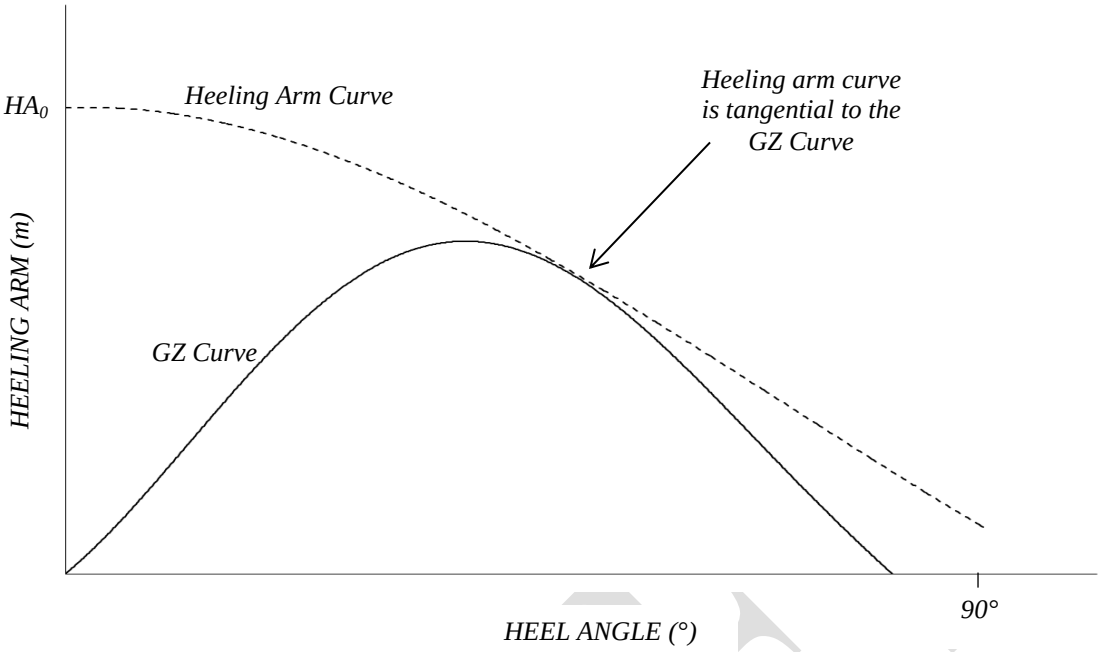
$$\frac{A_{sails}}{\Delta^{\left(\frac{2}{3}\right)}} = \text{Sail Area Displacement Ratio}$$

Δ = *Vessel displacement in meters cubed* (m^3)

A_{sails} = *is the area of the full upwind sail plan, including sail overlaps in square meters* (m^2)

(3) *For vessels where the 'Sail Area Displacement Ratio' is less than [5] calculated as per (2), Where a range of less than 90º exists, the wind speed required to capsize should be calculated to be more than [40] knots as follows:*

The heel angle resulting from a steady wind heeling moment corresponds to the intersection of the righting and heeling arm curves, so the heeling arm at the point of capsize is defined where the heeling arm curve is tangential to the GZ curve.



The heeling arm curve is defined by the formula:

$$HA_\Theta = HA_0(\cos\Theta)^{1.3}$$

Where

HA_Θ = *Heeling arm at any given angle* Θ

HA_0 = *Heeling arm at 0° where heeling arm curve is tangential to the GZ curve*

V is calculated by the formula:

$$V \times 0.514 = v = \sqrt{\left(\frac{\Delta \times 9.81 \times HA_0}{0.5\rho\left(A_{SAILS}h_{SAILS}C_{SAILS} + A_{HULL}h_{HULL}C_{HULL}\right)}\right)}$$

Where

V = *Apparent wind speed in knots*

v = *Apparent wind speed in meters per second (m/s)*

ρ = *Density of Air (assumed to be 1.22)*

Δ = *Vessel displacement in kilograms (kg)*

A_{sails} = *is the area of the full upwind sail plan, including sail overlaps in*

square meters (m^2)

h_{sails} = *is the height of the centroid of the sail plan above half the draft in metres (m)*

C_{sails} = *is the maximum sail heeling force coefficient, assumed to be 1.75 (unless proven otherwise)*

A_{hull} = *is the profile area of the hull and superstructure in square meters (m^2)*

h_{hull} = *is the height of the centroid of the hull and superstructure area above half the draft in metres (m)*

C_{hull} = *is the hull heeling force coefficient, assumed to be 1.0 (unless proven otherwise)*

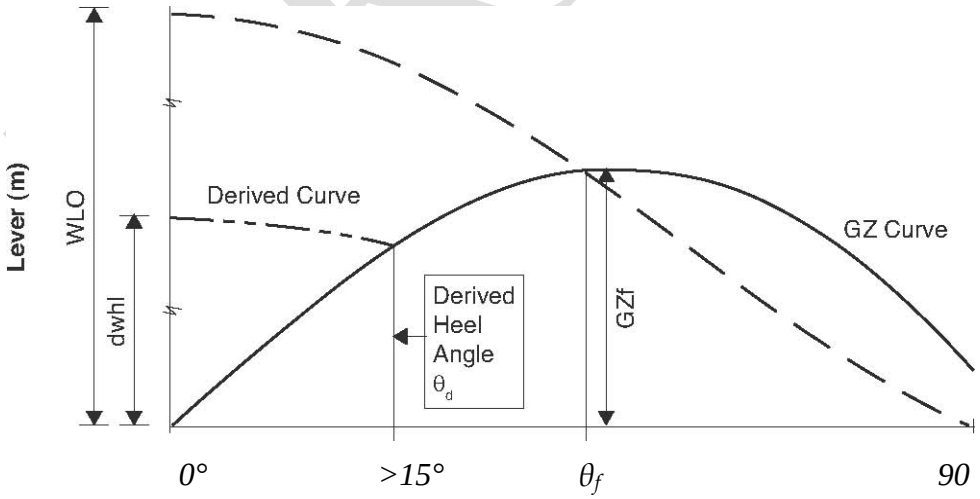
(4) *In addition to the requirements of (2) or (3), the angle of steady heel should be greater than 15 degrees (see figure). The angle of steady heel is obtained from the intersection of a "derived wind heeling lever" curve with the GZ curve required by (1)*

In the figure:-

'dwhl' = the "derived wind heeling lever" at any angle θ°

$= 0.5 \times WLO \times Cos^{1.3}\theta$

where $WLO = \dfrac{GZ_f}{Cos^{1.3}\theta_f}$



Noting That:

WLO= is the magnitude of the actual wind heeling lever at 0º which would cause the vessel to heel to the 'down flooding angle' θ_f or 60º whichever is least.

GZ_f = is the lever of the vessel's GZ at the down flooding angle (θ_f) or 60º whichever is least.

θ_d = is the angle at which the 'derived wind heeling' curve intersects the GZ curve. (If θ_d is less than 15º the vessel will be considered as having insufficient stability for the purpose of the Code).

θ_f = the 'down-flooding angle' is the angle of heel causing immersion of the lower edge of openings having an aggregate area, in square metres, greater than:-

$\frac{\Delta}{1500}$ *= where Δ = vessels displacement in tonnes*

All regularly used openings for access and for ventilation should be considered when determining the downflooding angle. No opening regardless of size which may lead to progressive flooding should be immersed at an angle of heel of less than 40°. Air pipes to tanks can, however, be disregarded.

If, as a result of immersion of openings in a superstructure, a vessel cannot meet the required standard, those superstructure openings may be ignored and the openings in the weather deck used instead to determine θf. In such cases the GZ curve should be derived without the benefit of the buoyancy of the superstructure.

It might be noted that provided the vessel complies with the requirements of (1) to (4) and is sailed with an angle of heel which is no greater than the' derived angle of heel', it should be capable of withstanding a wind gust equal to 1.4 times the actual wind velocity (i.e. twice the actual wind pressure) without immersing the' down-flooding openings', or heeling to an angle greater than 60°.

14.7 Intact Stability Multihulls

(1) Curves of statical stability in both roll and pitch should be prepared for at least the Loaded Arrival with 10% consumables. The VCG should be obtained by one of the three methods listed below:

(a) inclining of complete craft in air on load cells, the VCG being calculated from the moments generated by the measured forces; or

(b) separate determination of weights of hull and rig (comprising masts and all running and standing rigging), and subsequent calculation assuming that the hull VCG is 75% of the hull depth above the bottom of the canoe body,

and that the VCG of the rig is at half the length of the mast (or a weighted mean of the lengths of more than one mast); or

(c) a detailed calculation of the weight and CG position of all components of the vessel, plus a 15% margin of the resulting VCG height above the underside of canoe body.

(2) If naval architecture software is used to obtain a curve of pitch restoring moments, then the trim angle must be found for a series of longitudinal centre of gravity (LCG) positions forward of that necessary for the Design Waterline. The curve can then be derived as follows:

GZ in pitch = CG' x cos (trim angle)

$$trim\ angle = \tan^{-1}\left(\frac{T_{FP} - T_{AP}}{L_{BP}}\right)$$

where: CG'= shift of LCG forward of that required for design trim, measured parallel to baseline

T_{FP}= *draught at forward perpendicular*

T_{AP}= *draught at aft perpendicular*

L_{BP}= *length between perpendiculars*

Approximations to maximum roll or pitch moments are not acceptable.

(3) Data should be provided to the user showing the maximum advised mean apparent wind speed appropriate to each combination of sails, such wind speeds being calculated as the lesser of the following:

$$v_W = 1.5\sqrt{\frac{LM_R}{A'_S\, h \cos\phi_R + A_D b}}$$

or

$$v_W = 1.5\sqrt{\frac{LM_P}{A'_S\, h \cos\phi_P + A_D b}}$$

where

v_W = *maximum advised apparent wind speed (knots)*

LM_R = *maximum restoring moment in roll (N.m)*

LM_P = *limiting restoring moment in pitch (N.m), defined as the pitch restoring moment at the least angle of the following:*

a) angle of maximum pitch restoring moment, or

b) angle at which foredeck is immersed

c) 10º from design trim

A'_S = *area of sails set including mast and boom (square metres)*

h = height of combined centre of effort of sails and spars above the waterline

φ_R = *heel angle at maximum roll righting moment (in conjunction with* LM_R*)*

φ_P = *limiting pitch angle used when calculating* LM_P *(in conjunction with* LM_P*)*

A_D = *plan area of the hulls and deck (square metres)*

b = *distance from centroid of* A_D *to the centreline of the leeward hull*

This data should be accompanied by the note:

"In following winds, the tabulated safe wind speed for each sail combination should be reduced by the boat speed"

(4) *If the maximum safe wind speed under full fore-and-aft sail is less than 27 knots, it should be demonstrated by calculation using annex D of ISO 12217-2 (2002) that, when inverted and/or fully flooded, the volume of buoyancy, expressed in cubic metres (m^3), in the hull, fittings and equipment is greater than:*

1.2 x (fully loaded mass in tonnes)

thus ensuring that it is sufficient to support the mass of the fully loaded vessel by a margin. Allowance for trapped bubbles of air (apart from dedicated air tanks and watertight compartments) should not be included.

(5) *The maximum safe wind speed with no sails set calculated in accordance with (3) above should exceed 36 knots. For PY1 & PY2 Vessels this wind speed should exceed 32 knots.*

(6) *Trimarans used for unrestricted operations should have sidehulls each having a total buoyant volume of at least 150% of the displacement volume in the fully loaded condition.*

(7) The stability information booklet should include information and guidance on: (plus in operations manual)

(a) the stability hazards to which these craft are vulnerable, including the risk of capsize in roll and/or pitch;

(b) the importance of complying with the maximum advised apparent wind speed information supplied;

(c) the need to reduce the tabulated safe wind speeds by the vessel speed in following winds;

(d) the choice of sails to be set with respect to the prevailing wind strength, relative wind direction, and sea state;

(e) the precautions to be taken when altering course from a following to a beam wind.

(8) In vessels required to demonstrate the ability to float after inversion, an emergency escape hatch should be fitted to each main inhabited watertight compartment such that it is above both upright and inverted waterlines.

(9) The overall sail area and spar weights and dimensions should be as documented in the vessel's stability information booklet. Any rigging modifications that increase the overall sail area, or the weight/dimensions of the rig aloft, must be accompanied by an approved updating of the stability information booklet.

14.8 Damage Stability

(1) The maximum assumed wind force (M_{wind}) acting in a damage situation as per Section 4.8(6), shall be calculated so that the 'projected lateral area above the waterline' (A), includes all running/standing rigging sail controls and spars.

(2) The projected lateral area in Section 4.29(10)(c) is to include all running/standing rigging sail controls and spars.

(3) Where applicable, Chapter 4 Part VII requirements should be met whilst under a moment due to wind pressure as calculated by Section 4.29(10)(c).

14.9 Equipment Numeral

(1) When calculating the equipment numeral, sailing vessels should take into account the additional windage effect of the masts and rigging.

(2) Typically, for square rigged sailing vessels, experience based guidance on approximate increase in anchor mass and cable strength required is:

a. *for vessels up to 50 metres in length, typically 50% above the requirements for a typical motor vessel having the same total longitudinal profile area of hull and superstructure as the square rigged sailing vessel under consideration; and*

b. *for vessels 100 metres in length and over, typically 30% above the requirements for a typical motor vessel having the same total longitudinal profile area of hull and superstructure as the square rigged sailing vessel under consideration.*

c. *For a square rigged sailing vessel of between 50 and 100 metres in length the increase should be obtained by linear interpolation.*

14.10 Machinery and Electrical Installations

(1) Lighting supplied by the emergency source of electrical power shall be provided for illuminating the rigging, sails and sail controls including and dropping/furling in an emergency. The lighting shall be such that the night vision of the watchkeepers is not impaired, and is to be arranged so that it cannot be mistaken for navigation light by another ship. Care should also be given to preventing glare and stray reflections.

(2) Main engines shall have a minimum power to ensure that the vessel has a minimum speed of 6 knots while heading into Beaufort Force 8 weather and corresponding sea conditions.

(3) The sail handling facilities should be equipped to allow a controlled emergency release of the sheets from both locally and from the bridge which shall be supplied by stored power. Sail controls shall have a local secondary means of control in the event of failure.

(4) Lowering or furling of any combination of the sails should be operational not in the main source of power. These controls shall be operational at the down flooding angle or 60º whichever is least.

(5) The Emergency Generator, fire pump and bilge pumps should operate at 22.5degrees.

(6) Vessels should have lightning strike protection.

14.11 Fire Protection, Detection and Extinction

(1) Within the interior of the vessel, the mast should be either insulated directly to A-60 class requirements or contained within a space dedicated to the protection of

the mast only, and insulated to A-60 Class. The space Shall be fitted with a fully addressable fire detection system and a fixed fire fighting system complying with the relevant provision of the FSS Code.

(2) *Standing and running rigging shall not be located or terminated in Category 11, 6 or 7 spaces. Where this is not possible, the rigging shall be locally protected to A-60 Class.*

14.12 Life-Saving Appliances and Arrangements

(1) LSA should not be stowed in any position during normal operating conditions where, if required to be used or float free, rigging, the running rigging, spars or any other structure or equipment would cause an obstruction to its use.

(2) 7.4(a) shall be achievable under any combinations of sails within the Sailing Operations Manual.

(3) Equipment shall be provided for the cutting and clearing of the rigging if dismasted.

14.13 Emergency Procedures, Training and Drills:

(1) Sail Reduction drills should be conducted in accordance with the vessel's 'Sailing Operations Manual'. These drills should be conducted weekly or within the first 24 hours of the ship leaving a port where one has not been conducted within the last 7 days.

14.14 Safety of Navigation

(1) Subject to any special provisions given in the national legislation every ship to which this Code applies shall comply with the applicable requirements of Chapter V of SOLAS, 1974, as amended.

(2) Special consideration shall be given to 'Bridge Visibility' on sailing vessels in compliance with the Code specifically with regard to the placement of dedicated lookouts which shall:

a. have the sole duty, while the ship is underway, of maintaining a lookout,

b. be positioned outside the passenger spaces, and

c. be instructed by the master to keep a continuous lookout, and in particular over any or all (as the case may be) of the areas which are obstructed from the navigating position which the helmsman cannot see.

d. the dedicated lookout may be in the wheelhouse, but if positioned outside the wheelhouse and remote they shall be provided with a means voice communication to the helmsman.

(3) Every sailing vessel should carry a masthead anemometer, and an inclinometer, both of which shall be readable from the helms position.

(4) Where the GMDSS radio aerial is located in the mast or rigging, an emergency aerial shall be carried so that in the event of a dismasting, the equipment can be rendered serviceable.

14.15 Sailing Operations Manual

(1) 'SAILING OPERATIONS MANUAL' shall be Approved by the Administration and used to indicate the various applicable sail combinations in relation to maximum wind speed & direction. This data should be supported by results from appropriate testing and/or sea trials.

(2) The sailing operations manual should include the following:

(a) General design parameters, environment data and limited operating conditions.

(b) Sail combination and reefing schedules with their corresponding, or in the case of a multihull, the values of maximum advised mean apparent wind speed, for the reference of the watchkeeper.

(c) Curves of maximum steady heel angle to prevent down flooding in squalls

(d) Operational plans should outline the sailing manoeuvres and numbers of trained crew required to conduct them (this will be considered in the requirements for minimum safe manning) including full particulars and plans of automatic operating systems

(e) The Stability book and Sailing Operations Manual should contain the following statement for the Master:

> *The vessel has not been reviewed against damage stability criteria whilst under sail. Additional wind heeling moments from the sails could lead to capsize after minor damage.*
>
> *IN THE EVENT OF DAMAGE, ALL SAILS SHOULD BE IMMEDIATELY FURLED OR DROPPED AS APPROPRIATE*

14.16 Health and Safety

(1) Consideration will need to be given to the function of doors at adverse angles of heel while not making them dangerous to passengers at adverse heel angles.

(2) Crew and passengers should be able to move about the vessel safely at angles up to the 'Derived Healing Angle'.

(3) Consideration should be given to the protection of persons on board from running rigging, sheets and spars, and in particular the possible flogging of sails and sheets.

(4) Escape routes, muster stations and embarkation stations should be protected from running rigging, sheets and spars.

14.17 Manning Certification

(1) In addition to the requirements of 12.3(2) & (4), In assessing the appropriate level of manning for a passenger yacht the following factors are among those which are to be taken into account:

(f) Sail control/handling systems onboard (captive winch systems etc)

(g) Sail areas & numbers of sails & masts

(h) Type of rig (traditional square rigger, modern sloop etc)

(i) Skilled crew requirements for maneuvering as per the 'Sailing Operations Manual'

(j) Obstructed views from the bridge caused by masts and sails (see 14.14(2)

(2) All deck officers should have RYA/MCA Yachtmaster Ocean Certificate of Competence for sailing vessel.

(3) *[In addition to those described in section 12.3, a sufficient number of [Sail Coordinators] may be required to be carried dependent on the rig and sail configuration. Although the ultimate responsibility for the vessel is always with the Master, the on watch [Sail Coordinators] is the designated person who's only responsibility is for the number and combination of sails to be set for the prevailing and forecast conditions, staying within the statement of operational limitation related to the sailing and the rig, adhering to the curves of maximum steady heel angle to prevent down flooding in squalls and providing constant reference to the 'Sailing Operations Manual' and Stability Book. [Sail Coordinators] should hold as a minimum an RYA/MCA Yachtmaster Ocean Certificate of Competence for sailing vessel.*

14.18 Masts and Spars and Standing Rigging

(1) Dimensions and construction materials of masts and spars and dimensions of standing rigging including connection to chain plates should be in accordance with the requirements or recommendations of one of the Classification Societies or a recognised national or international standard.

(2) The associated structure for masts and spars (including chainplates, fittings, decks and floors) should be constructed to effectively carry and transmit the forces involved.

(3) Running rigging, blocks, shackles, rigging screws, cleats and associated fittings should be Type approved and sized as per the Classification Societies' satisfaction.

(4) [Sails controls (sheets, Halyards), blocks & attachments should be Type approved and sized as per the Classification Societies' satisfaction]

(5) Compliance with (1) to (3) [& 4] should be confirmed by a design review and approval by one of the Classification Societies (e.g. Rig Design Certificate) which is assigned with the review of the rig.

(6) The Maintenance Manual provided by the mast manufacturer should be reviewed and approved by the Classification Society which is assigned to review the rig design.

(7) A physical survey on the rig stepping procedure and the rig behaviour during sea trials is to be carried out by or on behalf of the Classification Society that is involved with the classification of the vessel's hull.

(8) Annual surveys on the vessel should include reviewing records and history of rig Maintenance

(9) Rig manuals (Rig Behavior Report and Rig Maintenance Manual) to monitor the condition of the rig in accordance with a Maintenance Manual and a planned maintenance schedule. The schedule should include, in particular, regular monitoring of all the gear associated with safe work aloft and on the bowsprit.

14.19 Sails

(1) In order to eliminate the wind heeling moment in case of damage, all the sails for any given sail combination (as per the vessel's Sailing Operations Manual) should be able to be dropped/stowed or furled within [10] minutes under the conditions described in Sub-section 14.10(4).

(2) *Adequate means of reefing or shortening sail should be provided.*

(3) *[Vessels operating as PY-1 need not carry storm canvas. All other vessels should either be provided with separate storm sails or have specific sails designated and constructed to act as storm canvas.]*