Part A

Mandatory criteria

CHAPTER 1 – GENERAL

1.1 Application

1.1.1 The criteria stated under chapter 2 of this part present a set of minimum requirements that shall apply to cargo* and passenger ships of 24 m in length and over.

1.1.2 The criteria stated under chapter 3 of this part are special criteria for certain types of ships. For the purpose of part A the definitions given in the introduction apply.

1.2 Dynamic stability phenomena in waves

Administrations shall be aware that some ships are more at risk of encountering critical stability situations in waves. Necessary precautionary provisions may need to be taken in the design to address the severity of such phenomena. The phenomena in seaways which may cause large roll angles and/or accelerations have been identified hereunder.

Having regard to the phenomena described in this section, the Administration may for a particular ship or group of ships apply criteria demonstrating that the safety of the ship is sufficient. Any Administration which applies such criteria should communicate to the Organization particulars thereof. It is recognized by the Organization that performance-oriented criteria for the identified phenomena listed in this section need to be developed and implemented to ensure a uniform international level of safety.

1.2.1 *Righting lever variation*

Any ship exhibiting large righting lever variations between wave trough and wave crest condition may experience parametric roll or pure loss of stability or combinations thereof.

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* For containerships of 100 m in length and over, provisions of chapter 2.3 of part B may be applied as an alternative to the application of chapter 2.2 of this part. Offshore supply vessels and special purpose ships are not required to comply with provisions of chapter 2.3 of part A. For offshore supply vessels, provisions of chapter 2.4 of part B may be applied as an alternative to the application of chapter 2.2 of this part. For special purpose ships, provisions of chapter 2.5 of part B may be applied as an alternative to the application of chapter 2.2 of this part.

1.2.2 *Resonant roll in dead ship condition*

Ships without propulsion or steering ability may be endangered by resonant roll while drifting freely.

1.2.3 *Broaching and other manoeuvring-related phenomena*

Ships in following and quartering seas may not be able to keep constant course despite maximum steering efforts, which may lead to extreme angles of heel.

CHAPTER 2 – GENERAL CRITERIA

2.1 General

2.1.1 All criteria shall be applied for all conditions of loading as set out in part B, 3.3 and 3.4.

2.1.2 Free surface effects (part B, 3.1) shall be accounted for in all conditions of loading as set out in part B, 3.3 and 3.4.

2.1.3 Where anti-rolling devices are installed in a ship, the Administration shall be satisfied that the criteria can be maintained when the devices are in operation and that failure of power supply or the failure of the device(s) will not result in the vessel being unable to meet the relevant provisions of this Code.

2.1.4 A number of influences such as icing of topsides, water trapped on deck, etc., adversely affect stability, and the Administration is advised to take these into account, so far as is deemed necessary.

2.1.5 Provisions shall be made for a safe margin of stability at all stages of the voyage, regard being given to additions of weight, such as those due to absorption of water and icing (details regarding ice accretion are given in part B, chapter 6 – Icing considerations), and to losses of weight, such as those due to consumption of fuel and stores.

2.1.6 Each ship shall be provided with a stability booklet, approved by the Administration, which contains sufficient information (see part B, 3.6) to enable the master to operate the ship in compliance with the applicable requirements contained in the Code. If a stability instrument is used as a supplement to the stability booklet for the purpose of determining compliance with the relevant stability criteria, such instrument shall be subject to approval by the Administration (see part B, chapter 4 – Stability calculations performed by stability instruments).

2.1.7 If curves or tables of minimum operational GM (metacentric height) or maximum VCG (vertical centre of gravity) are used to ensure compliance with the relevant intact stability criteria, those limiting curves shall extend over the full range of operational trims, unless the Administration agrees that trim effects are not significant. When curves or tables of minimum operational metacentric height (GM) or maximum centre of gravity (VCG) versus draught covering the operational trims are not available, the master must verify that the operating condition does not deviate from a studied loading condition, or verify by calculation that the stability criteria are satisfied for this loading condition taking into account trim effects.

2.2 Criteria regarding righting lever curve properties

2.2.1 The area under the righting lever curve (GZ curve) shall not be less than 0.055 metre-radians up to $\varphi = 30^\circ$ angle of heel and not less than 0.09 metre-radians up to $\varphi = 40^\circ$ or the angle of down-flooding φ_f* if this angle is less than 40°. Additionally, the area under the righting lever curve (GZ curve) between the angles of heel of 30° and 40° or between 30° and φ_f, if this angle is less than 40°, shall not be less than 0.03 metre-radians.

2.2.2 The righting lever (GZ) shall be at least 0.2 m at an angle of heel equal to or greater than 30°.

2.2.3 The maximum righting lever shall occur at an angle of heel not less than 25°. If this is not practicable, alternative criteria, based on an equivalent level of safety,† may be applied subject to the approval of the Administration.

2.2.4 The initial metacentric height GM_0 shall not be less than 0.15 m.

2.3 Severe wind and rolling criterion (weather criterion)

2.3.1 The ability of a ship to withstand the combined effects of beam wind and rolling shall be demonstrated, with reference to figure 2.3.1, as follows:

.1 the ship is subjected to a steady wind pressure acting perpendicular to the ship's centreline which results in a steady wind heeling lever (l_{w1});

.2 from the resultant angle of equilibrium (φ_0), the ship is assumed to roll owing to wave action to an angle of roll (φ_1) to windward. The angle of heel under action of steady wind (φ_0) should not exceed 16° or 80% of the angle of deck edge immersion, whichever is less;

.3 the ship is then subjected to a gust wind pressure which results in a gust wind heeling lever (l_{w2}); and

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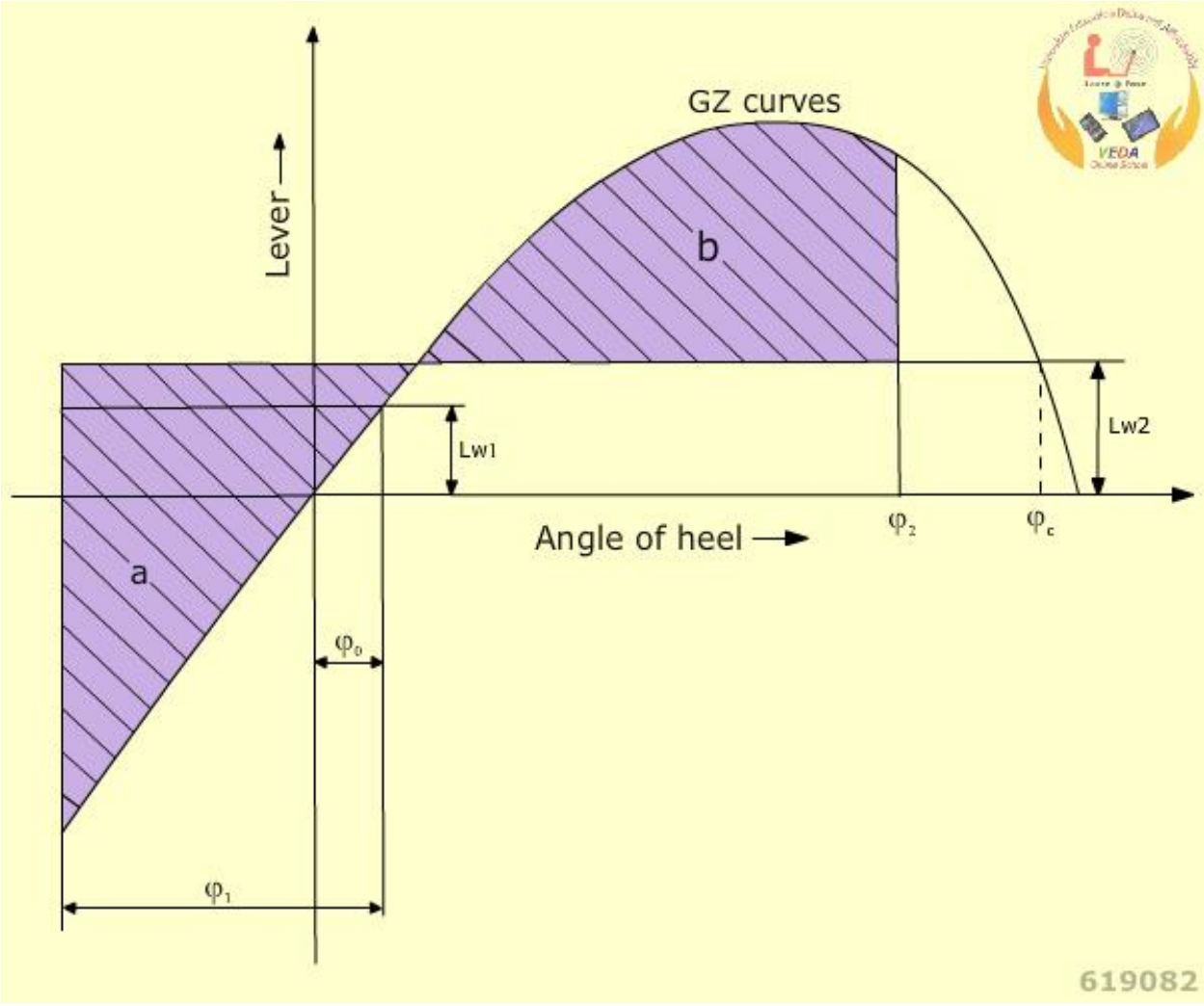
* φ_f is an angle of heel at which openings in the hull, superstructures or deck-houses which cannot be closed weathertight immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

† Refer to the Explanatory Notes to the International Code on Intact Stability, 2008 (MSC.1/Circ.1281) (see page 119 of this publication).

.4 under these circumstances, area *b* shall be equal to or greater than area *a*, as indicated in figure 2.3.1 below:



where the angles in figure 2.3.1 are defined as follows:

φ_0 = angle of heel under action of steady wind

φ_1 = angle of roll to windward due to wave action (see 2.3.1.2, 2.3.4 and second footnote on page 20)

φ_2 = angle of down-flooding (φ_f) or 50° or φ_c, whichever is least,

where:

φ_f = angle of heel at which openings in the hull, super-structures or deck-houses which cannot be closed weathertight immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

φ_c = angle of second intercept between wind heeling lever l_{w2} and GZ curves.

2.3.2 The wind heeling levers l_{w1} and l_{w2} referred to in 2.3.1.1 and 2.3.1.3 are constant values at all angles of inclination and shall be calculated as follows:

$$l_{w1} = \frac{P \times A \times Z}{1000 \times g \times \Delta} \text{ (m) and}$$

$$l_{w2} = 1.5 \times l_{w1} \text{ (m)}$$

where:

P = wind pressure of 504 Pa. The value of P used for ships in restricted service may be reduced, subject to the approval of the Administration

A = projected lateral area of the portion of the ship and deck cargo above the waterline (m^2)

Z = vertical distance from the centre of A to the centre of the underwater lateral area or approximately to a point at one-half the mean draught (m)

Δ = displacement (t)

g = gravitational acceleration of 9.81 m/s^2.

2.3.3 Alternative means for determining the wind heeling lever (l_{w1}) may be accepted, to the satisfaction of the Administration, as an equivalent to calculation in 2.3.2. When such alternative tests are carried out, reference shall be made based on the Guidelines developed by the Organization.* The wind velocity used in the tests shall be 26 m/s in full scale with uniform velocity profile. The value of wind velocity used for ships in restricted services may be reduced to the satisfaction of the Administration.

2.3.4 The angle of roll (φ_1)† referred to in 2.3.1.2 shall be calculated as follows:

$$\varphi_1 = 109 \times k \times X_1 \times X_2 \times \sqrt{r \times s} \text{ (degrees)}$$

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* Refer to the Interim Guidelines for alternative assessment of the weather criterion (MSC.1/Circ.1200).

† The angle of roll for ships with anti-rolling devices should be determined without taking into account the operation of these devices unless the Administration is satisfied with the proof that the devices are effective even with sudden shutdown of their supplied power.

where:

X_1 = factor as shown in table 2.3.4-1

X_2 = factor as shown in table 2.3.4-2

k = factor as follows:

k = 1.0 for a round-bilged ship having no bilge or bar keels

k = 0.7 for a ship having sharp bilges

k = as shown in table 2.3.4-3 for a ship having bilge keels, a bar keel or both

r = $0.73 + 0.6\ OG/d$

with:

$OG = KG - d$

d = mean moulded draught of the ship (m)

s = factor as shown in table 2.3.4-4, where T is the ship roll natural period. In absence of sufficient information, the following approximate formula can be used:

Rolling period $T = \dfrac{2 \times C \times B}{\sqrt{GM}}$ (s)

where: $C = 0.373 + 0.023(B/d) - 0.043(L_{wl}/100)$.

The symbols in tables 2.3.4-1, 2.3.4-2, 2.3.4-3 and 2.3.4-4 and the formula for the rolling period are defined as follows:

L_{wl} = length of the ship at waterline (m)

B = moulded breadth of the ship (m)

d = mean moulded draught of the ship (m)

C_B = block coefficient

A_k = total overall area of bilge keels, or area of the lateral projection of the bar keel, or sum of these areas (m^2)

GM= metacentric height corrected for free surface effect (m).

CHAPTER 3 – SPECIAL CRITERIA FOR CERTAIN TYPES OF SHIPS

3.1 Passenger ships

Passenger ships shall comply with the requirements of 2.2 and 2.3.

3.1.1 In addition, the angle of heel on account of crowding of passengers to one side as defined below shall not exceed 10°.

3.1.1.1 A minimum weight of 75 kg shall be assumed for each passenger except that this value may be increased subject to the approval of the Administration. In addition, the mass and distribution of the luggage shall be approved by the Administration.

3.1.1.2 The height of the centre of gravity for passengers shall be assumed equal to:

.1 1 m above deck level for passengers standing upright. Account may be taken, if necessary, of camber and sheer of deck; and

.2 0.3 m above the seat in respect of seated passengers.

3.1.1.3 Passengers and luggage shall be considered to be in the spaces normally at their disposal, when assessing compliance with the criteria given in 2.2.1 to 2.2.4.

3.1.1.4 Passengers without luggage shall be considered as distributed to produce the most unfavourable combination of passenger heeling moment and/or initial metacentric height, which may be obtained in practice, when assessing compliance with the criteria given in 3.1.1 and 3.1.2, respectively. In this connection, a value higher than four persons per square metre is not necessary.

3.1.2 In addition, the angle of heel on account of turning shall not exceed 10° when calculated using the following formula:

$$M_R = 0.200 \times \frac{V_0^2}{L_{wl}} \times \Delta \times \left(\mathrm{KG} - \frac{d}{2}\right)$$

where:

M_R = heeling moment (kNm)

v_0 = service speed (m/s)

L_{wl} = length of ship at waterline (m)

Δ = displacement (t)

d = mean draught (m)

KG = height of centre of gravity above baseline (m).

3.2 Oil tankers of 5,000 tonnes deadweight and above

Oil tankers, as defined in section 2 (Definitions) of the introduction, shall comply with regulation 27 of Annex I to MARPOL 73/78.

3.3 Cargo ships carrying timber deck cargoes

Cargo ships carrying timber deck cargoes shall comply with the requirements of 2.2 and 2.3 unless the Administration is satisfied with the application of alternative provision 3.3.2.

3.3.1 *Scope*

The provisions given hereunder apply to all ships of 24 m in length and over engaged in the carriage of timber deck cargoes. Ships that are provided with, and make use of, their timber load line shall also comply with the requirements of regulations 41 to 45 of the 1966 Load Lines Convention and the Protocol of 1988 relating thereto.

3.3.2 *Alternative stability criteria*

For ships loaded with timber deck cargoes and provided that the cargo extends longitudinally between superstructures (where there is no limiting superstructure at the after end, the timber deck cargo shall extend at least to the after end of the aftermost hatchway)* transversely for the full beam of ship, after due allowance for a rounded gunwale not exceeding 4% of the breadth of the ship and/or securing the supporting uprights and which remains securely fixed at large angles of heel:

3.3.2.1 The area under the righting lever curve (GZ curve) shall not be less than 0.08 metre-radians up to $\varphi = 40^\circ$ or the angle of flooding if this angle is less than 40°.

3.3.2.2 The maximum value of the righting lever (GZ) shall be at least 0.25 m.

3.3.2.3 At all times during a voyage, the metacentric height GM shall not be less than 0.1 m, taking into account the absorption of water by the deck cargo and/or ice accretion on the exposed surfaces (details regarding ice accretion are given in part B, chapter 6 (Icing considerations)).

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* Refer to regulation 44(2) of the International Convention on Load Lines, 1966, or the Protocol of 1988 relating thereto, as amended, as applicable.

3.3.2.4 When determining the ability of the ship to withstand the combined effects of beam wind and rolling according to 2.3, the 16° limiting angle of heel under action of steady wind shall be complied with, but the additional criterion of 80% of the angle of deck edge immersion may be ignored.

3.4 Cargo ships carrying grain in bulk

The intact stability of ships engaged in the carriage of grain shall comply with the requirements of the International Code for the Safe Carriage of Grain in Bulk adopted by resolution MSC.23(59).*

3.5 High-speed craft

High-speed craft, as defined in section 2 (Definitions) of the introduction, constructed on or after 1 January 1996 but before 1 July 2002, to which chapter X of the 1974 SOLAS Convention applies, shall comply with stability requirements of the 1994 HSC Code (resolution MSC.36(63)). Any high-speed craft to which chapter X of the 1974 SOLAS Convention applies, irrespective of its date of construction, which has undergone repairs, alterations or modifications of a major character, and a high-speed craft constructed on or after 1 July 2002, shall comply with stability requirements of the 2000 HSC Code (resolution MSC.97(73)).

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* Refer to part C of chapter VI of the 1974 SOLAS Convention as amended.