ClassIBS

ISTHMUS BUREAU OF SHIPPING

PART 4
INTACT STABILITY

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PRINCIPLES FOR THE CLASSIFICATION AND CONSTRUCTION OF STEEL SHIPS

PART 4 INTACT STABILITY

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PRINCIPLES FOR THE CLASSIFICATION AND CONSTRUCTION OF STEEL SHIPS

PART 4 INTACT STABILITY

Chapter 1 GENERAL

1.1 General

1.1.1 Application

1. The requirements on intact stability (hereinafter referred to as stability in this Part) in this Part apply to ships which are 24 *meters* in length for freeboard and over. However, fishing vessels, mobile offshore drilling units and dynamically supported craft may be excepted.

2. The stability of ships intended for the carriage of cargoes having moisture contents which exceed transportable moisture limit are to be in accordance with the requirements provided in this Part. In addition, the special considerations deemed necessary by the Society are to be taken into account.

3. Special consideration may be given to the ships registered for a restricted service.

1.1.2 Special Cases in Application

In case of the ships considered inadequate to be fully and/or directly applied the requirements in this Part because of some special reasons (e.g. novel design features, unusual form of ships), stability will be individually determined by the Society.

1.1.3 National Requirements

The Society may make special requirements as instructed by the flag-government of ships or the government of sovereign nation in which ships navigate.

1.1.4 Definitions

For the purpose of the application of this part, the following definitions apply

(1) The definition of “downflooding angle” refers to the angle of heel al which opening in the hull, superstructures or deckhouses which cannot be closed weathertight, immerse.

(2) Timber deck cargo means a cargo of timber carried on an uncovered part of a freeboard or superstructure deck. The term does not include wood pulp or similar cargo.

1.2 Stability Information

1.2.1 Stability Information Booklet

Ships are to be provided with a stability information booklet approved by the Society, to ensure the enough stability of the ship under varying conditions of service. Such booklet is to include principal particulars regarding the ships stability, the results of stability experiments and information as necessary by the master to verify the ships stability.

1.2.2 Stability Computer

1. Where a computer for stability calculation is on board the ship as a supplement to the stability information booklet, such computer is to be approved by the Society.

2. The computer specified in -1 above, is to be provided with an operation manual.

1.2.3 Special Requirements for Bulk Carriers

1. Bulk carriers as defined in CSR-B of less than 150 m in length Lf but not less than 500 gross tonnage are to be fitted with a loading computers approved by the Society, as a supplement to the stability information booklet.

2. Notwithstanding the provisions of preceding -1, bulk carriers not engaged on international voyages with Class Notation “Coasting Service”, “Smooth Water Service” or equivalent need not to be fitted with the loading computers.

3. Notwithstanding the provisions of preceding -1, for bulk carriers not engaged on international voyages, where deemed appropriate by the Society taking account of various conditions of such ships related to the navigation, the requirements of the loading computers need not to be applied to.

1.3 Marking of draughts

1.3.1 Marking of bow and stern draughts

Every ship is to 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 ship is to also be fitted with a reliable draught indicating system by which the bow and stern draughts can be determined.

Chapter 2 STABILITY REQUIREMENTS

2.1 General

2.1.1 General

1. Stability curves and heeling moment curves are to be prepared by the method deemed appropriate by the Society for all designed loading conditions and they are to be verified to comply with the requirements in 2.2 and 2.3.

2. Free surface effects are to be accounted for in all conditions of loading.

3. In cases where anti- rolling devices are installed in a ship, the requirements given in 2.2 and 2.3 are to be satisfied when such devices are in operation and when there is either a failure of power supply to the device(s) or a failure of device(s).

4. Influences such as the 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.

5. Provisions are to be made for the safe margin of stability all stages of the voyage, regard being given to additions of weight, such as those due to the absorption of water andicing as well as to losses of weight such as those due to the consumption of fuel and stores.

6. Curves or tables of minimum operational metacentric height (GM) or maximum centre of gravity (VCG) are to extend over the full range of operational trims.

2.1.2 Calculation on Stability

Stability is to be calculated under the following conditions.

(1) In preparing stability curves, the position center of gravity is to be determined on the basis of the data obtained at inclining test required in 2.3.2, Part 1 B.

(2) Free surface effects of liquid in tanks are to be of what the stability during navigation under the relevant design loading condition is most severely affected.

(3) Where anti-rolling devices are installed in a ship, the requirements in 2.2 are to be satisfied whether the devices are in operation or not.

2.2 General Stability Requirements

2.2.1 Stability Curves

1. For ships without timber deck cargoes, the stability curves are to comply with the following requirements in Fig. 2.1.

(1) A_1 is not to be less than 0.055 *m•rad.*

(2) A_2 is not to be less than 0.03 *m•rad.*

(3) $(A_1 + A_2)$ is not to be less than 0.09 *m•rad*.

(4) *GZ* is to be at least 0.20 *m* at an angle of heel equal to or greater than 30°.

(5) θ_{max} q is not to be less than 25°.

(6) G_0M is not to be less than 0.15 m.

Where:

A_1: Area under stability curve between 0º and 30º (*m•rad*).

A_2: Area under stability curve between 30º and θ_u (*m•rad*).

θ_u : Heeling angle (*degree*) to be taken of whichever is less, downloading angle in relevant loading condition or 40º.

GZ_{max} : Maximum righting lever (*m*).

θ_{max}: Heeling angle at which righting arm reaches maximum (*degree*).

G_0M: Initial metacentric height corrected by free surface effect (*m*).

2. For ships loaded with timber deck cargoes, the stability curves are to comply with the following requirements in **Fig. 2.1** in case where deemed acceptable by the Society

(1) $(A_1 + A_2)$ is not to be less than 0.08 *m· rad*.

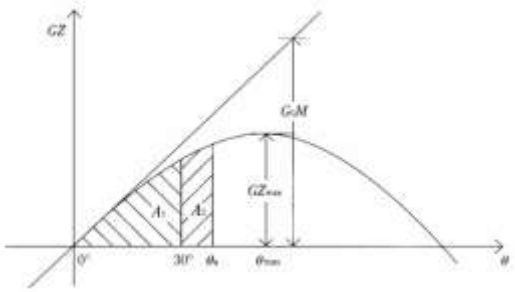
(2) GZ_{max} is not to be less than 0.25 *m*.

(3) G_0M is not to be less than 0.10 *m* during navigation.

(4) The value of all symbols in this Part is to be one in relevant loading condition except the case that it is particularly specified.

A_1, A_2, θ_u, GZ_{max}, θ_{max} and G_0M: As given in **(1)** above.

Fig. 2.1 Stability Curve (General Stability Requirements)



2.3 Stability Requirements in Wind and Waves

2.3.1 Stability Curves and Wind-heeling Moment Lever Curves

1. Stability curves and wind-heeling moment lever curves of ships are to comply with the following requirements in Fig. 2.2.

(1) Heeling angle caused by steady wind is to be less than 16º or an angle corresponding to 80% of immersing angle of deck edge, whichever is less.

(2) Area "*b*" is not to be less than area "*a*".

Where:

l_{w1} Heeling moment lever caused by steady wind (m) given by the following formula:

$$\frac{0.0514AZ}{W'}$$

A: Projected lateral area of hull and cargoes on deck above waterline (m^2).

Z: Vertical distance between the center of "*A*" and the center of underwater projected lateral area of hull (*m*). In general, the center of underwater projected lateral area may be approximated to locate at half the draught.

W´: Displacement (*t*).

l_{w2}: Heeling moment lever caused by gust (*m*) given by the following formula:

$1.5l_{w1}$

a: Area encircled by stability curve, l_{w2} and θ_r (*m· rad*).

b: Area encircled by stability curve, l_{w2} and θ_2 (*m· rad*).

θ_r: Angle of rolling stop motion (*degree*). In general, it may be given by the formula (θ_0-θ_1)

θ_c: Heeling angle at the second intersection between heeling moment lever and stability curve (*degree*).

θ_2: Heeling angle (*degree*) to be taken of whichever is the least, downflooding angle, θ_c or 50º.

θ_0: Angle of heel under action of steady wind (*degree*).

θ_1: Angle of roll to windward due to wave action (degree) given by the following formula:

$109x_1x_2k\sqrt{rs}$

x_1: Values obtained from **Table 2.1** according to the value of *B/d´* In case the value of *B/d´* becomes intermediate, values are to be determined by interpolation.

B: Moulded breadth of the ship (*m*).

d´: Mean draught of the ship (*m*).

x_2 Values obtained from **Table 2.2** according to C_b . In case C_b becomes intermediate, values are to be determined by interpolation.

C_b: Block coefficient given by the following formula:

$$\frac{w'}{1.025L'Bd'}$$

L': Length of the ship at waterline (m).

k : Values determined as follows:

For round-bilged ships having neither bilge keels nor bar keels: 1.0

For ships with sharp bilges: 0.7

For ships with bilge keel and/or bar keels: Values obtained from **Table 2.3** according to the value of $100A_k/L'B$. In case $100A_k/L'B$ becomes intermediate, values are to be determined by interpolation.

A_k: Total area of bilge keels, projected lateral area of bar keels or sum of those areas (m^2).

r: Values obtained from the following formula. However, the value of r need not be taken over 1.0.

$$0.73+0.6\frac{OG}{d'}$$

OG: Distance between the center of gravity and the waterline (m), and is taken as positive when the center of gravity is above waterline.

s: Values obtained from **Table 2.4** according to the value of T. In case T becomes intermediate, values are to be determined by interpolation.

T: Rolling period (seconds) obtained from the following formula. However, value of T based on information considered sufficient may be used instead.

$$\frac{2B}{\sqrt{G_0M}}\left(0.373+0.023\frac{B}{d'}\ 0.043\frac{L'}{100}\right)$$

G_0M: As specified in **2.2.1**

2. For ships loaded with timber deck cargo, notwithstanding the provisions of the preceding -1, stability curves may comply with the following requirements in **Fig.2.2** in cases where deemed acceptable by the Society.

(1) θ_0 is to be less than 16^o.

(2) Stability curves and wind-heeling moment lever curves of ships are to be comply with -1(2) above.

3. Where the requirements specified in above **-1** and **-2** apply to the ships registered as restricted service, the value of l_{W1} may be reduced when deemed acceptable by the Society.

Fig. 2.2 Stability and Wind-heeling Moment Lever Curve (Stability Requirements in Wind and Waves)

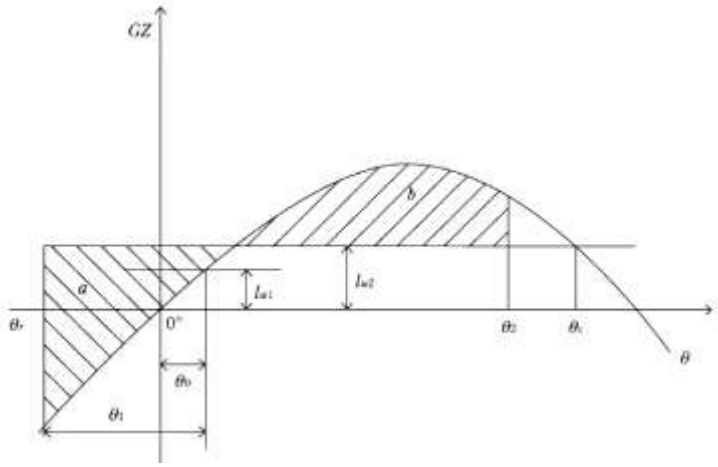


Table 2.1 Value of x_1

B/d'	≤2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	≥3.5
x_1	1.0	0.98	0.96	0.95	0.93	0.91	0.90	0.88	0.86	0.84	0.82	0.80

Table 2.2 Value of x_2

C_b	≤0.45	0.50	0.55	0.60	0.65	≥0.70
x_2	0.75	0.82	0.89	0.95	0.97	1.0

Table 2.3 Value of k

$100A_k/L'B$	0	1.0	1.5	2.0	2.5	3.0	3.5	≥4.0
k	1.0	0.98	0.95	0.88	0.79	0.74	0.72	0.70

Table 2.4 Value of s

T	≤ 6	7	8	12	14	16	18	≥20
s	0.100	0.098	0.093	0.065	0.053	0.044	0.038	0.035