RULES FOR BUILDING AND CLASSING

STEEL VESSELS 2003

PART 3 HULL CONSTRUCTION AND EQUIPMENT

excerpt: Longitudinal strength

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PART

3

CHAPTER **2 Hull Structures and Arrangements**

SECTION **1 Longitudinal Strength**

1 Application

Vessels to be classed for unrestricted service, are to have longitudinal strength in accordance with the requirements of this section. Vessels, however, having one or more of the following characteristics will be subject to special consideration:

i) Proportions: $L/B < 5$, $B/D > 2.5$

ii) Length: $L > 500$ m (1640 ft)

iii) Block Coefficient: $C_b < 0.6$

iv) Large deck opening

v) Vessels with large flare

vi) Carriage of heated cargoes

vii) Unusual type or design

3 Longitudinal Hull Girder Strength

3.1 Sign Convention of Bending Moment and Shear Force

The sign convention for bending moment and shear force is shown in 3-2-1/Figure 1.

3.3 Still-water Bending Moment and Shear Force *(2003)*

Still-water bending moment and shear force calculations, determining the bending moment and hull girder shear force values along the entire vessel's length, for all of the anticipated loaded, transitional and ballasted conditions, are to be submitted together with the distribution of lightship weights. For a flooded hold condition, required for certain bulk carriers, see 5-3-3/3.1.

In the preparation of the calculations, ballast tanks are to be considered full or empty. Unless stated otherwise, intermediate conditions, i.e., those during ballasting or deballasting are subject to the requirements for the respective conditions, at sea or in port. For that purpose, calculations for full and empty conditions will be acceptable.

3.5 Wave Loads

3.5.1 Wave Bending Moment Amidships

The wave bending moment, expressed in kN-m (tf-m, Ltf-ft), may be obtained from the following equations.

$M_{ws} = -k_1 C_1 L^2 B(C_b + 0.7) \times 10^{-3}$ Sagging Moment

$M_{wh} = +k_2 C_1 L^2 B C_b \times 10^{-3}$ Hogging Moment

where

k_1 = 110 (11.22, 1.026)

k_2 = 190 (19.37, 1.772)

$C_1 = 10.75 - \left(\frac{300-L}{100}\right)^{1.5}$ $90 \le L \le 300$ m

$= 10.75$ $300 < L \le 350$ m

$= 10.75 - \left(\frac{L-350}{150}\right)^{1.5}$ $350 \le L \le 500$ m

$C_1 = 10.75 - \left(\frac{984-L}{328}\right)^{1.5}$ $295 \le L \le 984$ ft

$= 10.75$ $984 < L < 1148$ ft

$= 10.75 - \left(\frac{L-1148}{492}\right)^{1.5}$ $1148 \le L \le 1640$ ft

L = length of vessel, as defined in 3-1-1/3.1, in m (ft)

B = breadth of vessel, as defined in 3-1-1/5, in m (ft)

C_b = block coefficient, as defined in 3-1-1/11.3, but is not to be taken less than 0.6

3.5.2 Envelope Curve of Wave Bending Moment

The wave bending moment along the length, L, of the vessel*,* may be obtained by multiplying the midship value by the distribution factor M, given by 3-2-1/Figure 2.

3.5.3 Wave Shear Force

The envelopes of maximum shearing forces induced by waves, F_w, as shown in 3-2-1/Figure 3 and 3-2-1/Figure 4 may be obtained from the following equations.

$F_{wp} = +kF_1 C_1 L\,B\,(C_b + 0.7) \times 10^{-2}$ For positive shear force

$F_{wn} = -kF_2 C_1 L\,B\,(C_b + 0.7) \times 10^{-2}$ For negative shear force

where

F_{wp}, F_{wn} = maximum shearing force induced by wave, in kN (tf, Ltf)

C_1 = as defined in 3-2-1/3.5.1

L = length of vessel, as defined in 3-1-1/3.1, in m (ft)

B = breadth of vessel, as defined in 3-1-1/5, in m (ft)

C_b = block coefficient, as defined in 3-1-1/11.3, but not to be taken less than 0.6

k = 30 (3.059, 0.2797)

F_1 = distribution factor, as shown in 3-2-1/Figure 3

F_2 = distribution factor, as shown in 3-2-1/Figure 4

FIGURE 1
Sign Convention

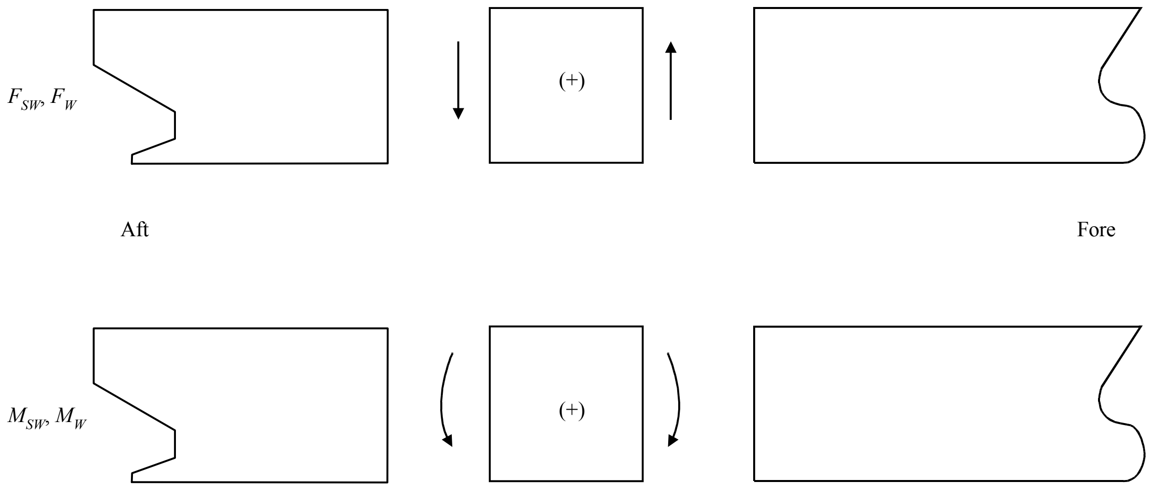

FIGURE 2
Distribution Factor M

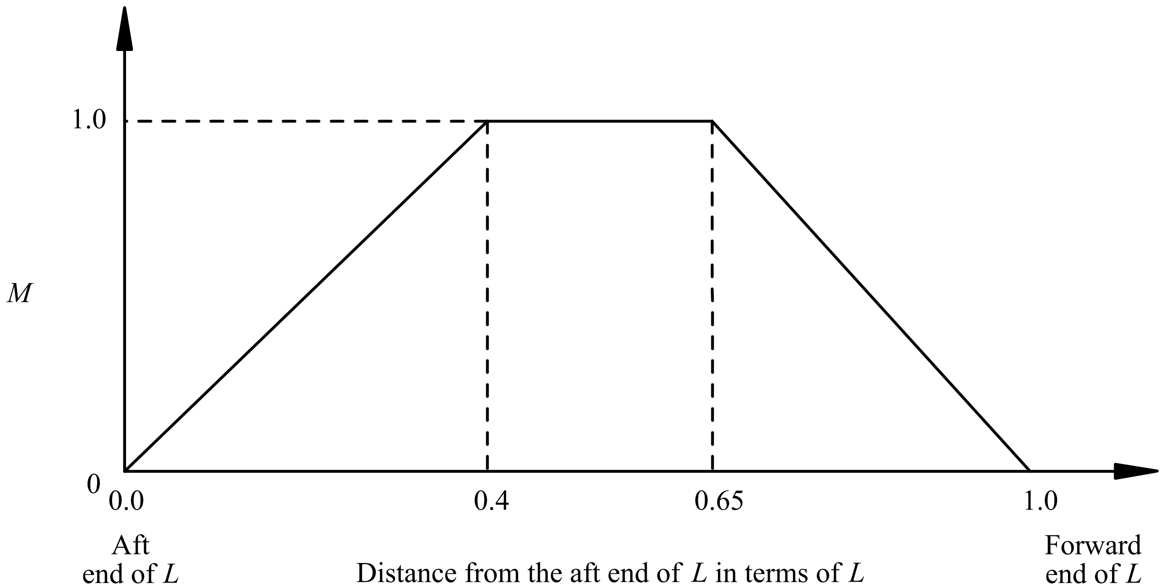

FIGURE 3
Distribution Factor F_1

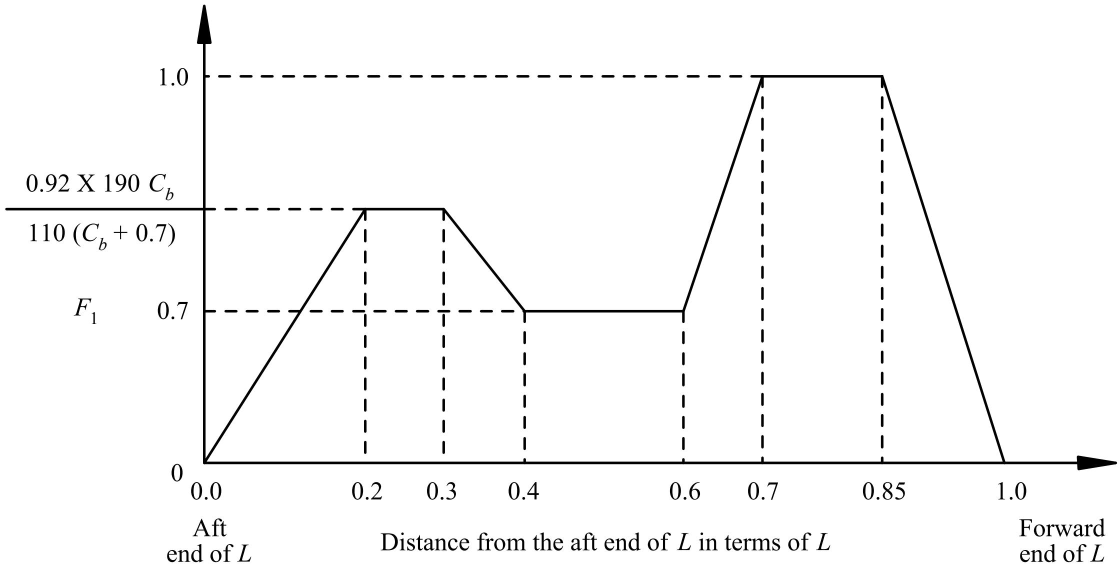

FIGURE 4
Distribution Factor F_2