# SECTION 2 BOTTOM SLAMMING LOADS

## 1 General

### 1.1 Slamming loads

**1.1.1** As a rule, bottom slamming loads given in the present Section, in kN/m$^2$, are applied to the following types of ships:

- high speed motor yacht of monohull and multihull type
- sailing yachts of monohull type.

**1.1.2** Slamming loads sustained by plating and ordinary stiffeners may be considered as uniform pressures.

### 1.2 Slamming areas

**1.2.1** As a rule, bottom slamming loads are to be calculated at following areas:

- high speed motor yacht of monohull type: bottom area, from centreline to upper limit of bilge or hard chine, and from transom to fore end
- sailing yacht of monohull type: bottom area, from centreline to waterline at side, and from centre of gravity of the keel or the bulb keel to fore end
- motor yacht of multihull type: bottom area, from centreline of each hull to upper limit of bilge or hard chine, and from transom to fore end.

## 2 High speed motor yacht of monohull or multihull type

### 2.1 Plating and stiffeners

**2.1.1** If slamming is expected to occur, the slamming pressure, in kN/m$^2$, considered as acting on the bottom of hull is to be not less than:

$$p_{sl} = 70 \cdot \frac{\Delta}{S_r} \cdot K_1 \cdot K_2 \cdot K_3 \cdot a_{CG}$$

where:

$\Delta$ : Displacement, in tonnes. For catamaran, $\Delta$ in the above formula is to be taken as half of the craft displacement

$S_r$ : Reference area, in m$^2$, equal to:

$$S_r = 0,7 \cdot \frac{\Delta}{T}$$

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$K_1$ : Longitudinal bottom slamming pressure distribution factor (see Fig 1):

- for $x/L < 0,5$: $K_1 = 0,5 + x/L$
- for $0,5 \leq x/L \leq 0,8$: $K_1 = 1,0$
- for $x/L > 0,8$: $K_1 = 3,0 - 2,5\ x/L$

where x is the distance, in m, from the aft perpendicular to the load point

$K_2$ : Factor accounting for slamming area, equal to:

$$K_2 = 0,455 - 0,35 \cdot \frac{u^{0,75} - 1,7}{u^{0,75} + 1,7}$$

with:

- $K_2 \geq 0,50$ for plating
- $K_2 \geq 0,45$ for ordinary stiffeners
- $K_2 \geq 0,35$ for primary stiffeners

$$u = 100 \cdot \frac{s}{S_r}$$

where s is the area, in m$^2$, supported by the element (plating or stiffener). For plating, the supported area is the spacing between the stiffeners multiplied by their span, without taking for the latter more than three times the spacing between the stiffeners

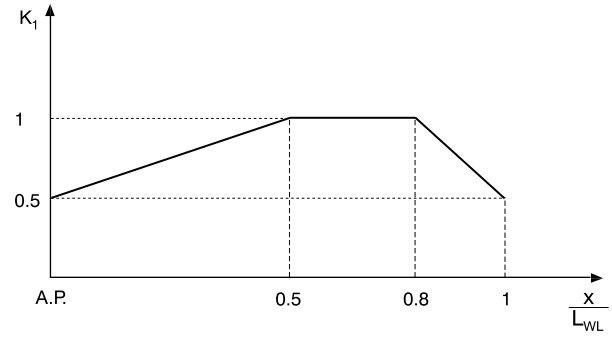
$K_3$ : Factor accounting for shape and deadrise of the hull, equal to:

$$K_3 = (50 - \alpha_d)/(50 - \alpha_{dCG}) \leq 1$$

where $\alpha_{dCG}$ is the deadrise angle, in degrees, measured at LCG and $\alpha_d$ is the deadrise angle, in degrees, between horizontal line and straight line joining the edges of respective area measured at the longitudinal position of the load point; values taken for $\alpha_d$ and $\alpha_{dCG}$ are to be between 10° and 30°

$a_{CG}$ : Design vertical acceleration at LCG, defined in Ch 5, Sec 1, [2.1.7].

**Figure 1 : $K_1$ distribution factor**



# 3 Sailing yachts of monohull type

## 3.1 Plating and stiffeners

**3.1.1** The slamming pressure, in kN/m$^2$, considered as acting on the bottom of hull is to be not less than:

$$p_{sl} = 70 \cdot \frac{\Delta}{S_r} \cdot K_2 \cdot K_3 \cdot a_v$$

where:

$\Delta$ : Displacement, in tonnes

$S_r$ : Reference area, m$^2$, equal to:

$$S_r = 0,7 \cdot \frac{\Delta}{T}$$

$K_2$ : Factor accounting for slamming area, equal to:

$$K_2 = 0,455 - 0,35 \cdot \frac{u^{0,75} - 1,7}{u^{0,75} + 1,7}$$

with:

- $K_2 \geq 0,50$ for plating
- $K_2 \geq 0,45$ for ordinary stiffeners
- $K_2 \geq 0,35$ for primary stiffeners

$$u = 100 \cdot \frac{s}{S_r}$$

where s is the area, in m$^2$, supported by the element (plating, stiffener, floor or girder). For plating, the supported area is the spacing between the stiffeners multiplied by their span, without taking for the latter more than three times the spacing between the stiffeners

$K_3$ : Factor accounting for shape and deadrise of the hull, equal to:

$$K_3 = (50 - \alpha_d)/(50 - \alpha_{dCG}) \leq 1$$

where $\alpha_{dCG}$ is the deadrise angle, in degrees, measured at LCG and $\alpha_d$ is the deadrise angle, in degrees, between horizontal line and a reference line defined in Fig 2 at the transversal section considered; $\alpha_d$ is not to be taken greater than 50 degrees

$a_v$ : Total vertical acceleration resulting from the sum of heave and pitch acceleration (refer to Ch 5, Sec 1, [2.2.4]).

**3.1.2** As a rule, the slamming pressure is to be calculated along the ship, from center of gravity of the keel or the bulb keel to fore part of ship.

Longitudinal location of calculation points can be taken as indicated in Fig 3. The value of the total vertical acceleration $a_v$ is to be calculated at each calculation point $P_i$.

**Figure 2 : Deadrise angle**

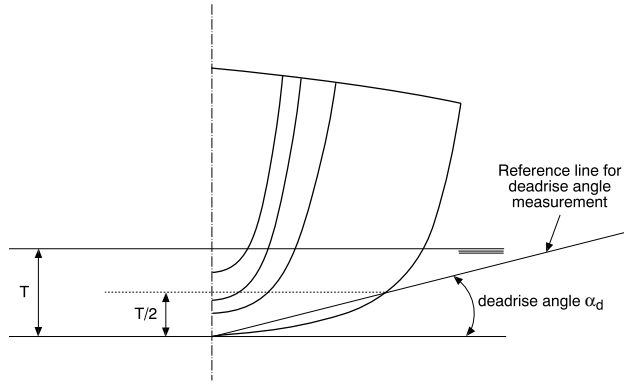



**Figure 3 : Calculation points for slamming pressure**