SUB-COMMITTEE ON SHIP DESIGN AND CONSTRUCTION
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Agenda item 16

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# ANY OTHER BUSINESS

## Maintenance of the Revised guidance on shipboard towing and mooring equipment (MSC.1/Circ.1175/Rev.1)

## Submitted by IACS

**SUMMARY**

| | |
|---|---|
| *Executive summary:* | This document informs on the recent revisions to IACS Unified Requirement (UR) A1 and UR A2 and Recommendation No. 10, their background and, as a consequence, proposes further revision of the guidance on shipboard towing and mooring equipment (MSC.1/Circ.1175/Rev.1) |
| *Strategic direction, if applicable:* | Not applicable |
| *Output:* | Not applicable |
| *Action to be taken:* | Paragraph 11 |
| *Related documents:* | None |


## Introduction

1 The Committee, at its 102nd session, adopted amendments to SOLAS regulation II-1/3-8, including new requirements on the design of mooring arrangements, the selection of mooring equipment including lines and the regime for maintenance and inspection of mooring equipment including lines.

2 Further, MSC 102, having considered a proposal by the Sub-Committee on Ship Design and Construction, at its sixth session, with a view to ensuring a uniform approach towards the application of the provisions of SOLAS regulation II-1/3-8, as amended by resolution MSC.474(102), which is expected to become effective on 1 January 2024, approved the *Revised guidance on shipboard towing and mooring equipment*, as set out in the annex to MSC.1/Circ.1175/Rev.1.

3 MSC.1/Circ.1175/Rev.1, inter alia, aligned the provisions of its annex and appendices with IACS requirements and recommendations set out in UR A2/Rev. 4 and Recommendation No.10.

**Revisions to IACS URs A1 and A2 and to IACS Recommendation No.10**

4 Since the approval of MSC.1/Circ.1175/Rev.1, IACS has revised its URs A1 and A2, and Recommendation No. 10 based on IACS members' experience gained through the application thereof.

5 Revision 5 of UR A2 comes into force 1 January 2022. The requirement makes reference to IACS Recommendation No.10, Rev.4, inter alia, containing guidance on mooring restraint. Further, Recommendation No.10 makes reference to UR A1 containing the definition of the Equipment Number. Revision 7 of UR A1 also comes into force 1 January 2022.

6 With revision 5 of UR A2, the determination of deck cargoes' side-projected area was clarified. Deck cargoes at the ship nominal capacity condition should be included for the determination of side-projected area. In the proposed revision of MSC.1/Circ.1175/Rev.1, this clarification was included in paragraph 1.3 of appendix A "Mooring and Tow Lines".

7 With revision 4 of Recommendation No.10, the definition of mooring loads for ships with EN > 2,000 was clarified, noting that the loads could be underestimated for some vessels in ballast condition. It was clarified that side projected area, $A_1$, in general shall be calculated on lightest ballast draft unless cargo is considered in the calculation of the area. In addition, for ships with small variation in draft, e.g. passenger or ro-ro vessels, the side projected area can be calculated at full load draft as considered for the Equipment Number. In the proposed revision of MSC.1/Circ.1175/Rev.1 this clarification was included in paragraph 3.1.2 of appendix A "Mooring and Tow Lines". In addition, Recommendation No.10 was provided with guidance on direct mooring analysis, which may be performed alternatively to the prescriptive formulations given for the determination of recommended mooring restraint. The further growth in size of some ship types, in particular container ships and cruise vessels, inflicted excessive mooring restraint requirements on large new vessels, which suggested to provide for means allowing to design more efficient mooring systems than those determined with the existing prescriptive formulations. In the proposed revision of MSC.1/Circ.1175/Rev.1 this alternative option for the determination of mooring restraint has been included in paragraph 1.4 of appendix A "Mooring and Tow Lines", referring to IACS Recommendation No.10 for guidance.

8 With revision 7 of UR A1, the definition of the Equipment Number was updated to consider increased funnel sizes due to the installation of equipment such as $SO_X$ scrubbers. In the proposed revision of MSC.1/Circ.1175/Rev.1 this update was included in appendix B "Equipment Number".

9 In addition to the above-described changes, some minor corrections and editorial changes are included in the proposed revision of MSC.1/Circ.1175/Rev.1. These are mainly the correction of the caption of table 1 in appendix A "Mooring and Tow Lines" and the replacement of "minimum breaking load" or "minimum breaking strength" by "ship design minimum breaking load" of the mooring lines in several places.

**Proposal**

10 To align the *Revised guidance on shipboard towing and mooring equipment* with IACS URs A1/Rev.7 and A2/Rev. 5, and Recommendation No.10/Rev. 4, as far as possible, IACS proposes a further revision of appendices A and B of the annex to MSC.1/Circ.1175/Rev.1, as contained in the annex to this document, for the consideration of the Sub-Committee.

**Action requested of the Sub-Committee**

11 The Sub-Committee is invited to consider the foregoing, the proposal in paragraph 10 and take action, as appropriate.

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**ANNEX**

**DRAFT REVISED APPENDICES A AND B OF THE ANNEX TO MSC.1/Circ.1175/Rev.1**

**APPENDIX A**

**MOORING AND TOW LINES**

## 1 General

1.1 The mooring lines for ships with Equipment Number (EN) of less than or equal to 2,000 are given in section 2. For other ships the mooring lines are given in section 3.

1.2 The applicable provisions for tow lines are given in section 2.

1.3 The EN should be calculated in compliance with appendix B. Deck cargoes ~~as given by the loading manual~~at the ship nominal capacity condition should be included for the determination of side-projected area A. The nominal capacity condition is defined as the theoretical condition where the maximum possible deck cargoes are included in the ship arrangement in their respective positions. For container ships, the nominal capacity condition represents the theoretical condition where the maximum possible number of containers is included in the ship arrangement in their respective positions.

1.4 Sections 2 and 3 specify the minimum recommended number and minimum strength of mooring lines ($MBL_{SD}$). As an alternative to sections 2 and 3, the minimum recommendation for mooring lines may be determined by direct mooring analysis in line with the guidance given in appendix A of IACS Recommendation No.10. The designer should consider verifying the adequacy of mooring lines based on assessments carried out for the individual mooring arrangement, expected shore-side mooring facilities and expected prevalent environmental conditions.

## 2 Mooring lines for ships with EN ≤ 2000 and tow lines

2.1 The minimum recommended mooring lines for ships having an EN of less than or equal to 2,000 are given in table 1.

2.2 For ships having the ratio A/EN > 0.9 the following number of lines should be added to the number of mooring lines as given in table 1:

one line where $0.9 < \frac{A}{EN} \leq 1.1$,

two lines where $1.1 < \frac{A}{EN} \leq 1.2$,

three lines where $1.2 < \frac{A}{EN}$

2.3 The tow lines are given in table 1 and are intended as own tow line of a ship to be towed by a tug or another ship.

**Table 1: Mooring lines for ships with EN ≤ 2000 and tow lines ~~for ships with EN ≤ 2000~~**

| EQUIPMENT NUMBER | | MOORING LINES | | TOW LINE* |
|---|---|---|---|---|
| **Exceeding** | **Not exceeding** | **No. of mooring lines** | **Ship design minimum breaking load (kN)** | **Ship design minimum breaking load (kN)** |
| ***1*** | ***2*** | ***3*** | ***4*** | ***5*** |
| 50 | 70 | 3 | 37 | 98 |
| 70 | 90 | 3 | 40 | 98 |
| 90 | 110 | 3 | 42 | 98 |
| 110 | 130 | 3 | 48 | 98 |
| 130 | 150 | 3 | 53 | 98 |
| 150 | 175 | 3 | 59 | 98 |
| 175 | 205 | 3 | 64 | 112 |
| 205 | 240 | 4 | 69 | 129 |
| 240 | 280 | 4 | 75 | 150 |
| 280 | 320 | 4 | 80 | 174 |
| 320 | 360 | 4 | 85 | 207 |
| 360 | 400 | 4 | 96 | 224 |
| 400 | 450 | 4 | 107 | 250 |
| 450 | 500 | 4 | 117 | 277 |
| 500 | 550 | 4 | 134 | 306 |
| 550 | 600 | 4 | 143 | 338 |
| 600 | 660 | 4 | 160 | 370 |
| 660 | 720 | 4 | 171 | 406 |
| 720 | 780 | 4 | 187 | 441 |
| 780 | 840 | 4 | 202 | 479 |
| 840 | 910 | 4 | 218 | 518 |
| 910 | 980 | 4 | 235 | 559 |
| 980 | 1,060 | 4 | 250 | 603 |
| 1,060 | 1,140 | 4 | 272 | 647 |
| 1,140 | 1,220 | 4 | 293 | 691 |
| 1,220 | 1,300 | 4 | 309 | 738 |
| 1,300 | 1,390 | 4 | 336 | 786 |
| 1,390 | 1,480 | 4 | 352 | 836 |
| 1,480 | 1,570 | 5 | 352 | 888 |
| 1,570 | 1,670 | 5 | 362 | 941 |
| 1,670 | 1,790 | 5 | 384 | 1,024 |
| 1,790 | 1,930 | 5 | 411 | 1,109 |
| 1,930 | 2,080 | 5** | 437** | 1,168 |
| 2,080 | 2,230 | ** | ** | 1,259 |
| 2,230 | 2,380 | ** | ** | 1,356 |
| 2,380 | 2,530 | ** | ** | 1,453 |
| 2,530 | - | ** | ** | 1,471 |

* Information is provided in relation to 3.3.1.2 and 3.4.1.2 of the annex to Revised guidance and provision on board of such a line is not necessary under this guidance.

** For ships with EN > 2,000 see section 3 of appendix A.

## 3 Mooring lines for ships with EN > 2,000

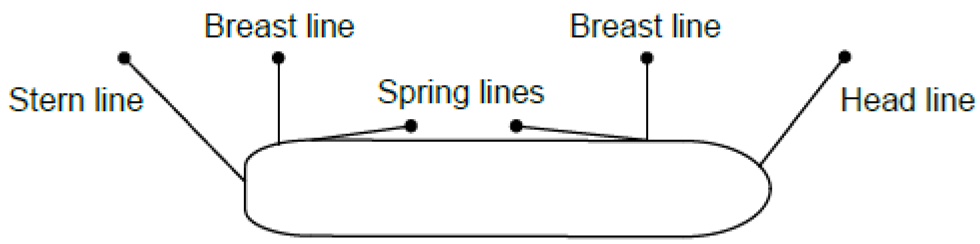
### 3.1 General

3.1.1 The following is defined with respect to the purpose of mooring lines (see also figure below):

.1 *Breast line*: A mooring line that is deployed perpendicular to the ship, restraining the ship in the off-berth direction;

.2 *Spring line*: A mooring line that is deployed almost parallel to the ship, restraining the ship in fore or aft direction; and

.3 *Head/Stern line*: A mooring line that is oriented between longitudinal and transverse direction, restraining the ship in the off-berth and in fore or aft direction. The amount of restraint in fore or aft and off-berth direction depends on the line angle relative to these directions.




.4 Breast lines provide the maximum transverse restraint and spring lines the maximum longitudinal restraint against vessel movement in athwart and in fore- aft direction, respectively. Head and stern lines are much less effective for these purposes. The applied mooring layout should follow these principles as far as possible with respect to the port facilities and as far as reasonable with respect to the vertical line angles.

3.1.2 The strength of mooring lines and the number of head, stern and breast lines for ships with an EN > 2,000 are based on the side-projected area $A_1$. Side-projected area $A_1$ should be calculated similar to the side-projected area A according to appendix B but considering the following conditions:

.1 ~~For oil tankers, chemical tankers, bulk carriers and ore carriers t~~The ~~lightest~~ ballast draft should be considered for the calculation of the side-projected area $A_1$. ~~For other ships the lightest draft of usual loading conditions should be considered if the ratio of the freeboard in the lightest draft and the full load condition is equal to or above two. Usual loading conditions mean loading conditions as given by the trim and stability booklet that are to be expected to regularly occur during operations, excluding light weight conditions, propeller inspection conditions, etc.~~ For ship types having small variation in the draft, like e.g. passenger and ro-ro vessels, the side-projected area $A_1$ may be calculated using the summer load waterline.

.2 Wind shielding of the pier can be considered for the calculation of the side-projected area $A_1$ unless the ship is intended to be regularly moored to jetty-type piers. A height of the pier surface of 3 m above the waterline may be assumed, i.e. the lower part of the side-projected area with a height of 3 m above the waterline for the considered loading condition may be disregarded for the calculation of the side-projected area $A_1$.

.3 Deck cargoes at the ship nominal capacity condition ~~as given by the loading manual~~ should be included for the determination of side-projected area $A_1$. For the condition with cargo on deck, the summer load waterline may be considered. Deck cargoes may not need to be considered if ~~a usual light~~ballast draft condition ~~without cargo on deck~~ generates a larger side-projected area $A_1$ than the full load condition with cargoes on deck. The larger of both side-projected areas should be chosen as side-projected area $A_1$. The nominal capacity condition is defined in 1.3.

3.1.3 The mooring lines as given hereunder are based on a maximum current speed of 1.0 m/s and the following maximum wind speed $v_w$, in m/s:

$v_w$ = 25.0 - 0.002 ($A_1$ – 2,000) for passenger ships, ferries and car carriers with 2,000 $m^2 < A_1 \leq 4,000\ m^2$

= 21.0 for passenger ships, ferries and car carriers with $A_1 > 4,000\ m^2$

= 25.0 for other ships

3.1.4 The wind speed is considered representative of a 30 second mean speed from any direction and at a height of 10 m above the ground. The current speed is considered representative of the maximum current speed acting on bow or stern (±10°) and at a depth of one-half of the mean draft. Furthermore, it is considered that ships are moored to solid piers that provide shielding against cross current.

3.1.5 Additional loads caused by, for example, higher wind or current speeds, cross currents, additional wave loads or reduced shielding from non-solid piers may need to be particularly considered. Furthermore, it should be observed that unbeneficial mooring layouts can considerably increase the loads on single mooring lines.

## 3.2 Ship design minimum breaking load

3.2.1 The ship design minimum breaking load, in kN, of the mooring lines should be taken as:

$$MBL_{SD} = 0.1 \cdot A_1 + 350$$

3.2.2 The ship design minimum breaking load may be limited to 1,275 kN (130 t). However, in this case the moorings are to be considered as not sufficient for environmental conditions given by ~~A.~~3.1.3. For these ships, the acceptable wind speed $v_w$,* in m/s, can be estimated as follows:

$$v_w^* = v_w \cdot \sqrt{\frac{MBL_{SD}^*}{MBL_{SD}}}$$

where $v_w$ is the wind speed as per 3.1.3 above, $MBL_{SD}$* the ship design minimum breaking ~~strength~~ load of the mooring lines intended to be supplied and $MBL_{SD}$ the ship design minimum breaking ~~strength~~ load as recommended according to the above formula. However, the ship design minimum breaking load should not be taken less than corresponding to an acceptable wind speed of 21 m/s:

$$MBL_{SD}^{*} \geq \left(\frac{21}{v_w}\right)^2 \cdot MBL_{SD}$$

3.2.3 If lines are intended to be supplied for an acceptable wind speed $v_w$* higher than $v_w$ as per 3.1.3, the ship design minimum breaking load should be taken as:

$$MBL_{SD}^{*} = \left(\frac{v_w^*}{v_w}\right)^2 \cdot MBL_{SD}$$

### 3.3 Number of mooring lines

3.3.1 The total number of head, stern and breast lines should be taken as:

$$n = 8.3 \cdot 10^{-4}_{1} \cdot A + 6$$

3.3.2 For oil tankers, chemical tankers, bulk carriers and ore carriers, the total number of head, stern and breast lines should be taken as:

$$n = 8.3 \cdot 10^{-4}_{1} \cdot A + 4$$

3.3.3 The total number of head, stern and breast lines should be rounded to the nearest whole number.

3.3.4 The number of head, stern and breast lines may be increased or decreased in conjunction with an adjustment to the ship design minimum breaking strength load~~strength~~ of the lines. The adjusted ship design minimum breaking strength load~~strength~~, $MBL_{SD}$~~,~~**, should be taken as:

$MBL_{SD}** = 1.2 \cdot MBL_{SD} \cdot n/n** \leq MBL_{SD}$ for increased number of lines,

$MBL_{SD}** = MBL_{SD} \cdot n/n**$ for reduced number of lines,

where $MBL_{SD}$ is $MBL_{SD}$ or $MBL_{SD}$* specified in 3.2, as appropriate; n** is the increased or decreased total number of head, stern and breast lines and n the number of lines for the considered ship type as calculated according to 3.3.1 or 3.3.2 without rounding.

3.3.5 Vice versa, the ship design minimum breaking strength load~~strength~~ of head, stern and breast lines may be increased or decreased in conjunction with an adjustment to the number of lines.

3.3.6 The total number of spring lines should be taken not less than:

two lines where EN < 5,000; and

four lines where EN ≥ 5,000.

3.3.7 The ship design minimum breaking strength load~~strength~~ of spring lines should be the same as that of the head, stern and breast lines. If the number of head, stern and breast lines is increased in conjunction with an adjustment to the ship design minimum breaking strength load ~~strength~~ of the lines, the number of spring lines should be taken as follows, but rounded up to the nearest even number:

$$n_S^* = MBL_{SD} / MBL_{SD}^{**} \cdot n_S$$

where $MBL_{SD}$ is $MBL_{SD}$ or $MBL_{SD}^*$ specified in 3.2, as appropriate, $MBL_{SD}^{**}$ the adjusted ship design minimum breaking strength load~~strength~~ of lines as specified in 3.3.4, $n_S$ the number of spring lines as given in 3.3.6 and $n_S^*$ the increased number of spring lines.

## APPENDIX B

## EQUIPMENT NUMBER

The equipment number (EN) should be calculated as follows:

$$\cancel{EN = \Delta^{2/3} + 2.0hB + \frac{A}{10}}$$

$$EN = \Delta^{\frac{2}{3}} + 2.0\,(hB + S_{fun}) + \frac{A}{10}$$

where:

$\Delta$= Moulded displacement, in tonnes, to the Summer Load Waterline.

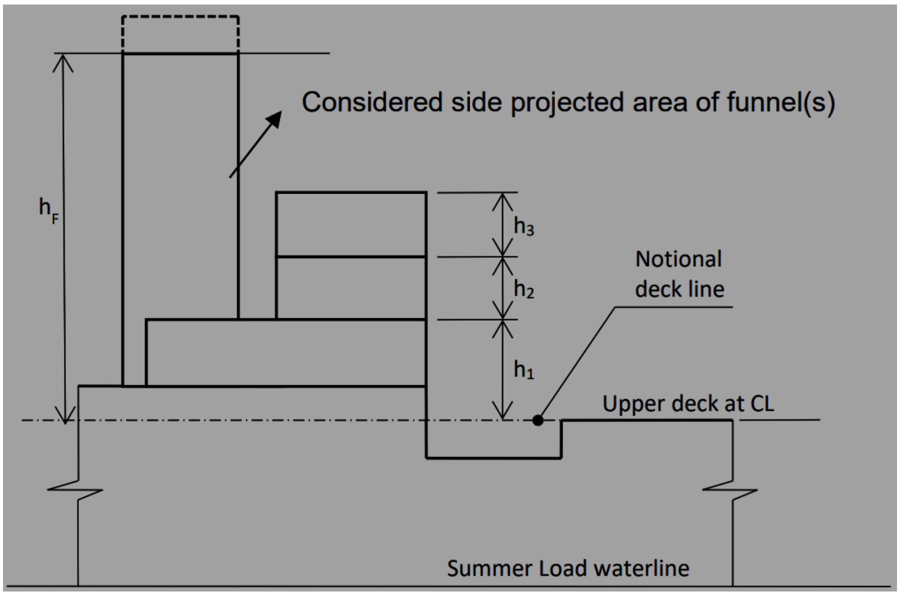
B = Moulded breadth, in metres.

h = Effective height, in metres, from the Summer Load Waterline to the top of the uppermost house~~; for the lowest tier 'h' should be measured at centreline from the upper deck or from a notional deck line where there is local discontinuity in the upper deck (see figure below for an example)~~.

$$h = a + \sum h_i$$

a = Vertical ~~D~~distance at hull side, in metres, from the Summer Load Waterline amidships to the upper deck.

$h_i$ = Height, in metres, on the centreline of each tier of houses having a breadth greater than B/4; for the lowest tier $h_1$ is to be measured at centreline from the upper deck or from a notional deck line where there is local discontinuity in the upper deck, see figure below for an example.



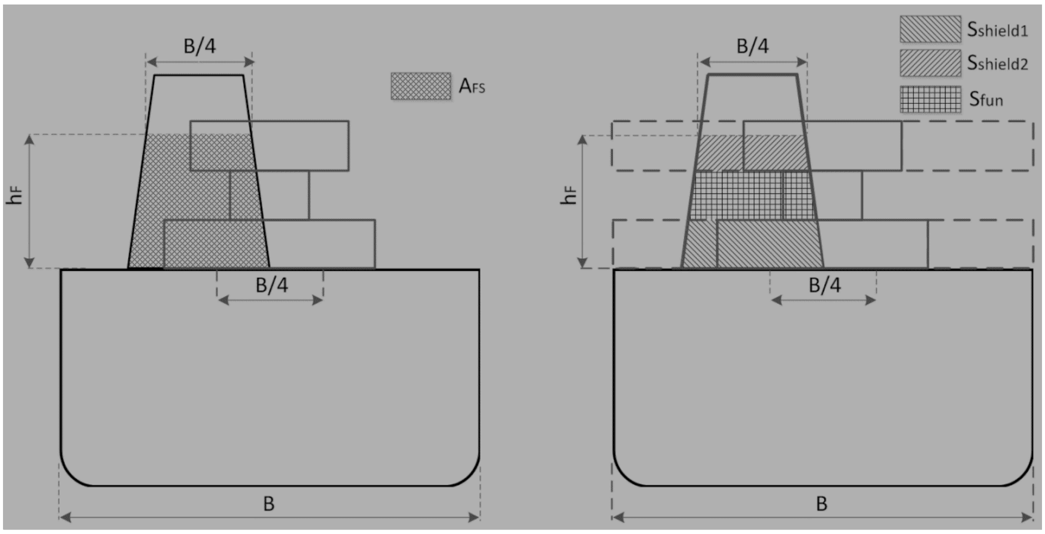
$S_{fun}$ = Effective front-projected area of the funnel, in square metres, defined as:

$$S_{fun} = A_{FS} - S_{shield}$$

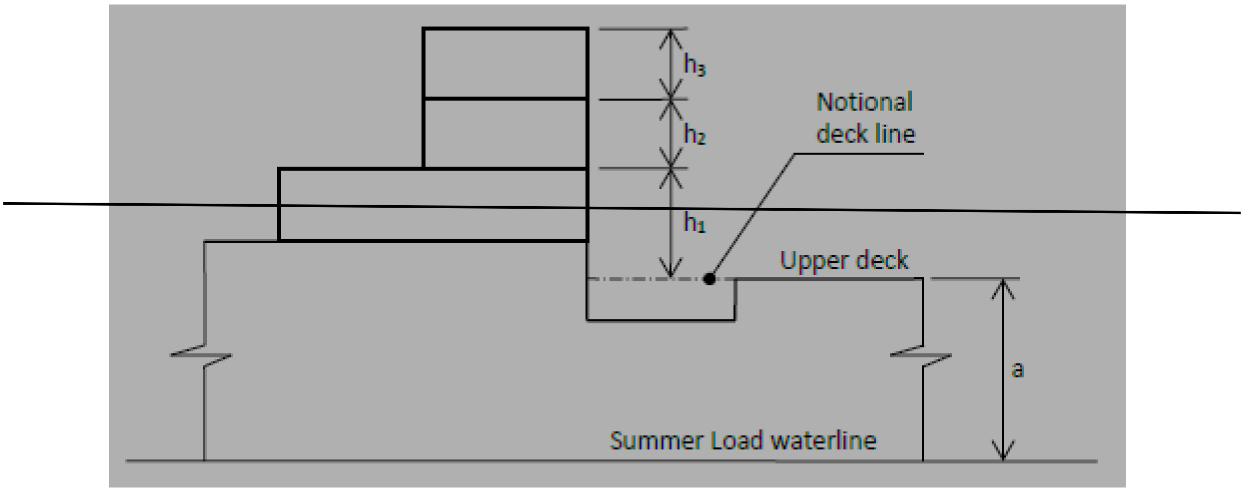
$A_{FS}$ = Front-projected area of the funnel, in square metres, calculated between the upper deck at centreline, or notional deck line where there is local discontinuity in the upper deck, and the effective height $h_F$. $A_{FS}$ is taken equal to zero if the funnel breadth is less than or equal to B/4 at all elevations along the funnel height.

$h_F$ = Effective height of the funnel, in metres, measured from the upper deck at centreline, or notional deck line where there is local discontinuity in the upper deck, and the top of the funnel. The top of the funnel may be taken at the level where the funnel breadth reaches B/4.

$S_{shield}$ = The section of front-projected area $A_{FS}$, in square metres, which is shielded by all deck houses having breadth greater than B/4. If there are more than one shielded section, the individual shielded sections i.e $S_{shield1}$, $S_{shield2}$ etc., as shown in the figure below, to be added together. To determine $S_{shield}$, the deckhouse breadth is assumed B for all deck houses having breadth greater than B/4 as shown for $S_{shield1}$, $S_{shield2}$ in figure below.




A = Side-projected area, in square metres, of the hull, superstructures, ~~and~~ houses and funnels above the Summer Load Waterline which are within the equipment length of the ship and also have a breadth greater than B/4. The side-projected area of the funnel is considered in A when $A_{FS}$ is greater than zero. In this case, the side-projected area of the funnel should be calculated between the upper deck, or notional deck line where there is local discontinuity in the upper deck, and the effective height $h_F$.

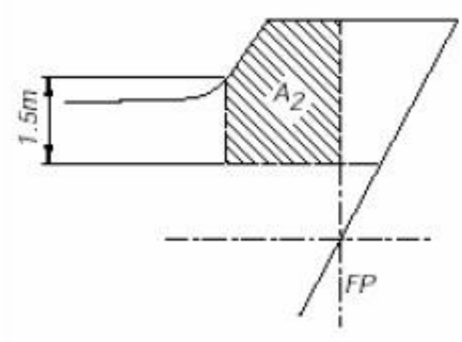



***NOTES:***

1 When calculating h, sheer and trim should be ignored, i.e. h is the sum of freeboard amidships plus the height (at centreline) of each tier of houses having a breadth greater than B/4.

2 If a house having a breadth greater than B/4 is above a house with a breadth of B/4 or less, then the wide house should be included but the narrow house ignored.

3 Screens or bulwarks 1.5 metres or more in height should be regarded as parts of houses when determining h and A. The height of the hatch coamings and that of any deck cargo, such as containers, may be disregarded when determining h and A. With regard to determining A, when a bulwark is more than 1.5 metres high, the area shown below as A2 should be included in A.




4 The equipment length of the ships is the length between perpendiculars but should not be less than 96% nor greater than 97% of the extreme length on the Summer Waterline (measured from the forward end of the waterline).

5 When several funnels are fitted on the ship, the above parameters are taken as follows:

$h_F$ = Effective height of the funnel, in metres, measured from the upper deck, or notional deck line where there is local discontinuity in the upper deck, and the top of the highest funnel. The top of the highest funnel may be taken at the level where the sum of each funnel breadth reaches B/4.

$A_{FS}$ = Sum of the front-projected area of each funnel, in square metres, calculated between the upper deck, or notional deck line where there is local discontinuity in the upper deck, and the effective height $h_F$. $A_{FS}$ is to be taken equal to zero if the sum of each funnel breadth is less than or equal to B/4 at all elevations along the funnel's height.

A = Side-projected area, in square metres, of the hull, superstructures, houses and funnels above the Summer Load Waterline which are within the equipment length of the ship. The total side-projected area of the funnels is to be considered in the side-projected area of the ship, A, when $A_{FS}$ is greater than zero. The shielding effect of funnels in transverse direction may be considered in the total side-projected area, i.e. when the side-projected areas of two or more funnels fully or partially overlap, the overlapped area needs only to be counted once.