

**ANNEX 17**

**RESOLUTION MSC.75(69)  
(adopted on 14 May 1998)**

**ADOPTION OF AMENDMENTS TO THE CODE ON INTACT STABILITY FOR ALL TYPES  
OF SHIPS COVERED BY IMO INSTRUMENTS (RESOLUTION A.749(18))**

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution A.749(18), by which the Assembly, at its eighteenth session, adopted the Code on Intact Stability for All Types of Ships Covered by IMO Instruments (IS Code),

NOTING that the Assembly authorized the Committee to amend the Code as necessary in the light of further studies and experience gained from the implementation of the provisions contained therein,

DESIRING to keep the IS Code up to date,

HAVING CONSIDERED, at its sixty-ninth session, the amendments to the IS Code proposed by the Sub-Committee on Stability and Load Lines and on Fishing Vessels Safety, at its forty-first session,

1. ADOPTS amendments to the Code on Intact Stability for All Types of Ships Covered by IMO Instruments (resolution A.749(18)), the text of which is set out in the Annex to the present resolution;
2. RECOMMENDS Governments to implement the annexed amendments to the IS Code.

## ANNEX

### AMENDMENTS TO THE CODE ON INTACT STABILITY FOR ALL TYPES OF SHIPS COVERED BY IMO INSTRUMENTS (RESOLUTION A.749(18))

#### CONTENTS

- 1 In paragraph 3.3, the word "surface" is replaced by the word "surfaces".
- 2 In paragraph 5.2, the word "cargo" is replaced by the word "cargoes".
- 3 In paragraph 7.3, the word "preparation" is replaced by the word "preparations".

#### PREAMBLE

- 4 In paragraph 1, in the second sentence, the word "with" is replaced by the word "from".
- 5 In paragraph 3, in the third sentence, the word "environment" is replaced by the word "environmental".

#### CHAPTER 1 - GENERAL

##### 1.2 Application

- 6 In paragraph 1.2.1, the word "containerships" is replaced by the words "cargo ships carrying containers on deck and containerships".
- 7 In paragraph 1.2.2, the words "The coastal State" are replaced by the word "Administrations".

##### 1.3 Definitions

- 8 In paragraph 1.3.7.2, the word "ship" is replaced by the word "ship-".
- 9 A new paragraph 1.3.9 is inserted as follows:

"A *high-speed craft (HSC)* is a craft capable of a maximum speed, in metres per second (m/s), equal to or exceeding:

$$3.7 \sqrt[0.1667]{L}$$

where:  $L$  = displacement corresponding to the design waterline (m<sup>3</sup>)."

- 10 Existing paragraphs 1.3.9 to 1.3.13 are renumbered as paragraphs 1.3.10 to 1.3.14.

11 The following new paragraphs 1.3.15, 1.3.16 and 1.3.17 are added after renumbered paragraph 1.3.14:

"1.3.15 *Length of ship.* The length should be taken as 96% of the total length on a waterline at 85% of the least moulded depth measured from the top of the keel, or as the length from the fore side of the stem to the axis of the rudder stock on the waterline, if that be greater. In ships designed with a rake of keel the waterline on which this length is measured should be parallel to the designed waterline.

1.3.16 *A moulded breadth* is the maximum breadth of the ship measured amidships to the moulded line of the frame in a ship with a metal shell and to the outer surface of the hull in a ship with a shell of any other material.

1.3.17 *A moulded depth* is the vertical distance measured from the top of the keel to the top of the freeboard deck beam at side. In wood and composite ships, the distance is measured from the lower edge of the keel rabbet. Where the form at the lower part of the midship section is of a hollow character, or where thick garboards are fitted, the distance is measured from the point where the line of the flat of the bottom continued inwards cuts the side of the keel.

In ships having rounded gunwales, the moulded depth should be measured to the point of intersection of the moulded lines of the deck and side shell plating, the lines extending as though the gunwale were of angular design.

Where the freeboard deck is stepped and the raised part of the deck extends over the point at which the moulded depth is to be determined, the moulded depth should be measured to a line of reference extending from the lower part of the deck along a line parallel with the raised part."

## **CHAPTER 2 - GENERAL PROVISIONS AGAINST CAPSIZING AND INFORMATION FOR THE MASTER**

### **2.1 Stability booklet**

12 The existing text of paragraphs 2.1.1 and 2.1.2 is replaced by the following:

"2.1.1 Stability data and associated plans should be drawn up in the working language of the ship and any other language the Administration may require. Reference is also made to the International Safety Management (ISM) Code, adopted by the Organization by resolution A.741(18). All translations of the stability booklet should be approved.

2.1.2\* Each ship should be provided with a stability booklet, approved by the Administration, which contains sufficient information to enable the master to operate the ship in compliance with the applicable requirements contained in the Code. The Administration may have additional requirements. On a mobile offshore drilling unit, the stability booklet may be referred to as an operating manual. The stability booklet may include information on longitudinal strength. This Code addresses only the stability-related contents of the booklet.\*"

13 In paragraph 2.1.4, the word "as" is inserted between the words "Code" and "may" and the word "authority" is replaced by the word "Administration".

- 14 After paragraph 2.1.4, a new heading and relevant footnote are added as follows:

**"2.2 Stability calculation by computer"**<sup>\*</sup>

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<sup>\*</sup> Refer to the Guidelines for shipboard loading and stability computer programs (MSC/Circ.854)".

- 15 Existing paragraphs 2.1.5 to 2.1.8 are replaced by new paragraphs 2.2.1 to 2.2.4 as follows:

"2.2.1 As a supplement to the approved stability booklet, a computer may be used to facilitate the stability calculations mentioned in 2.1.3.9.

2.2.2 The computer hardware and software should be approved for stability calculation by the Administration. The input/output format should, as far as practicable, be easily comparable in information and format to the stability booklet so that the operators will easily gain familiarity with the stability calculations.

2.2.3 A simple and straightforward instruction manual written in the same language as the stability booklet, complying with the provisions of 2.1.1, should be provided.

2.2.4 In order to validate the proper functioning of the computer hardware and software, pre-defined standard loading conditions should be run in the computer periodically, at intervals recommended by the suppliers but at least at every annual load line inspection, and the printout should be maintained on board as check conditions for future reference."

**2.2 Operating booklets for certain ships**

- 16 Section 2.2 is renumbered as section 2.3.

- 17 The existing paragraph under the heading of this section is numbered as paragraph 2.3.1.

- 18 New paragraphs 2.3.2 and 2.3.3 and the relevant footnote are added after paragraph 2.3.1 as follows:

"2.3.2 For double hull oil tankers of single cargo tank across design, an operation manual for loading and unloading cargo oil should be provided, including operational procedures of loading and unloading cargo oil and detailed data of the initial metacentric height of the oil tanker and that of free surface correction of liquids in cargo oil tanks and ballast tanks during loading and unloading cargo oil (including ballasting and discharging) and cargo oil washing of tanks.<sup>\*</sup>

2.3.3 The stability booklet of ro-ro passenger ships should contain information concerning the importance of securing and maintaining all closures watertight due to the rapid loss of stability which may result when water enters the vehicle deck and the fact that capsizing can rapidly follow.

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<sup>\*</sup> Refer to the Guidance on intact stability of existing tankers during liquid transfer operations (MSC/Circ.706/MEPC/Circ.304)."

19 Existing section 2.4 is inserted after the renumbered section 2.3 with the heading and text amended as follows:

**"2.4 Permanent ballast**

If used, permanent ballast should be located in accordance with a plan approved by the Administration and in a manner that prevents shifting of position. Permanent ballast should not be removed from the ship or relocated within the ship without the approval of the Administration. Permanent ballast particulars should be noted in the ship's stability booklet."

**2.3 General precautions against capsizing**

20 Existing section 2.3 is renumbered as section 2.5.

21 Existing paragraphs 2.3.1 to 2.3.7 are renumbered as paragraphs 2.5.1 to 2.5.7.

22 In the renumbered paragraph 2.5.1, an asterisk at the end of the paragraph and relevant footnote are added as follows:

"  
\* Refer to the Guidance to the master for avoiding dangerous situations in following and quartering seas (MSC/Circ.707)."

23 In the renumbered paragraph 2.5.3, an asterisk at the end of the paragraph and relevant footnote are added as follows:

"  
\* Refer to the Guidelines for the preparation of the Cargo Securing Manual (MSC/Circ.745)."

24 The existing text of the renumbered paragraph 2.5.4 is replaced by the following:

"2.5.4 A ship, when engaged in towing operations, should possess an adequate reserve of stability to withstand the anticipated heeling moment arising from the tow line without endangering the towing ship. Deck cargo on board the towing ship should be so positioned as not to endanger the safe working of the crew on deck or impede the proper functioning of the towing equipment and be properly secured. Tow line arrangements should include towing springs and a method of quick release of the tow."

25 In the renumbered paragraph 2.5.6, the following is added after the last sentence:

"Slack tanks may, in exceptional cases, be used as a means of reducing excessive values of metacentric height. In such cases, due consideration should be given to sloshing effects."

**2.5 Operational procedures related to weather conditions**

26 Existing section 2.5 is renumbered as section 2.6 and the heading is replaced by the following:

**"2.6 Operational procedures before and in heavy weather "**

27 Existing paragraphs 2.5.1 to 2.5.12 are renumbered as paragraphs 2.6.1 to 2.6.12.

28 In the renumbered paragraph 2.6.8, an asterisk at the end of the paragraph and relevant footnote are added as follows:

"  
\* Refer to the Guidance to the master for avoiding dangerous situations in following and quartering seas (MSC/Circ. 707)."

29 In the renumbered paragraph 2.6.9, in the second sentence, the word "the" is inserted between the words "or" and "course".

30 The existing text of the renumbered paragraph 2.6.12 is replaced by the following:

"2.6.12 Dynamically supported craft and high-speed craft should not be intentionally operated outside the worst intended conditions and limitations specified in the relevant certificates, or in documents referred to therein."

## **CHAPTER 3 - DESIGN CRITERIA APPLICABLE TO ALL SHIPS**

### **3.1.2 Recommended general criteria**

31 In paragraph 3.1.2.1, in the first sentence, the words "angle of flooding" are replaced by the words "angle of downflooding".

32 In paragraph 3.1.2.6, the reference in the formula to "0.02" is replaced by the reference "0.196"; the reference in the definition of  $M_R$  to "metre-tonnes" is replaced by the reference "kNm"; and in the definition of KG, the word "keel" is replaced by the word "baseline".

### **3.2.2 Recommended weather criterion**

33 In paragraph 3.2.2.2, in the definition of Z, the word "draught" is replaced by the words "mean draught"; in the definition of P, the reference to "504 N/m<sup>2</sup>" is replaced by the words "wind pressure of 504 Pa"; and in the definition of g, the reference to "9.81 m/s<sup>2</sup>" is replaced by "gravitational acceleration of 9.81 m/s<sup>2</sup>".

34 In paragraph 3.2.2.3, in the definition of L, the words "waterline length of the ship (m)" are replaced by the words "length of the ship at waterline (m)".

### **3.3 Effect of free surfaces of liquids in tanks**

35 The existing text of section 3.3 is replaced by the following:

"3.3.1 For all loading conditions, the initial metacentric height and the righting lever curve should be corrected for the effect of free surfaces of liquids in tanks.

3.3.2 Free surface effects should be considered whenever the filling level in a tank is less than 98% of full condition. Free surface effects need not be considered where a tank is nominally full, i.e. filling level is 98% or above. Free surface effects for small tanks may be ignored under condition specified in 3.3.9.\*

3.3.3 Tanks which are taken into consideration when determining the free surface correction may be in one of two categories:

- .1 Tanks with filling levels fixed (e.g. liquid cargo, water ballast). The free surface correction should be defined for the actual filling level to be used in each tank.
- .2 Tanks with filling levels variable (e.g. consumable liquids such as fuel oil, diesel oil and fresh water, and also liquid cargo and water ballast during liquid transfer operations). Except as permitted in 3.3.5 and 3.3.6, the free surface correction should be the maximum value attainable between the filling limits envisaged for each tank, consistent with any operating instructions.

3.3.4 In calculating the free surface effects in tanks containing consumable liquids, it should be assumed that for each type of liquid at least one transverse pair or a single centreline tank has a free surface and the tank or combination of tanks taken into account should be those where the effect of free surfaces is the greatest.

3.3.5 Where water ballast tanks, including anti-rolling tanks and anti-heeling tanks, are to be filled or discharged during the course of a voyage, the free surface effects should be calculated to take account of the most onerous transitory stage relating to such operations.

3.3.6 For ships engaged in liquid transfer operations, the free surface corrections at any stage of the liquid transfer operations may be determined in accordance with the filling level in each tank at that stage of the transfer operation.

3.3.7 The corrections to the initial metacentric height and to the righting lever curve should be addressed separately as follows.

3.3.7.1 In determining the correction to initial metacentric height, the transverse moments of inertia of the tanks should be calculated at 0° angle of heel according to the categories indicated in 3.3.3.

3.3.7.2 The righting lever curve may be corrected by any of the following methods subject to the agreement of the Administration:

- .1 Correction based on the actual moment of fluid transfer for each angle of heel calculated.
- .2 Correction based on the moment of inertia, calculated at 0° angle of heel, modified at each angle of heel calculated.

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\* Refer to the intact stability design criteria, contained in MARPOL regulation I/25A, together with the associated Unified Interpretations.

- .3 Correction based on the summation of  $M_{fs}$  values for all tanks taken into consideration (see 3.3.8).

With the exception of .3 above, corrections may be calculated according to the categories indicated in 3.3.3.

Whichever method is selected for correcting the righting lever curve, only that method should be presented in the ship's stability booklet. However, where an alternative method is described for use in manually calculated loading conditions, an explanation of the differences which may be found in the results, as well as an example correction for each alternative, should be included.

3.3.8 The values of  $M_{fs}$  for each tank may be derived from the formula:

$$M_{fs} = v b k \sqrt{\delta}$$

where:

$M_{fs}$  is the free surface moment at any inclination, in m.tonnes  
 $v$  is the tank total capacity, in  $m^3$   
 $b$  is the tank maximum breadth, in m  
 $k$  is the mass density of liquid in the tank, in tonnes/ $m^3$   
 $*$  is equal to  $v/blh$  (the tank block coefficient)  
 $h$  is the tank maximum height, in m  
 $l$  is the tank maximum length, in m  
 $k$  is the dimensionless coefficient to be determined from table 3.3.8 according to the ratio  $b/h$ . The intermediate values are determined by interpolation.

3.3.9 Small tanks which satisfy the following condition using the values of "k" corresponding to an angle of inclination of  $30^\circ$ , need not be included in the correction:

$$M_{fs} / \Delta_{min} < 0.01 \text{ m}$$

where:

$\Delta_{min}$  is the minimum ship displacement calculated at  $d_{min}$ , in tonnes  
 $d_{min}$  is the minimum mean service draught of the ship without cargo, with 10% stores and minimum water ballast, if required, in m.

3.3.10 The usual remainder of liquids in empty tanks need not be taken into account in calculating the corrections, provided that the total of such residual liquids does not constitute a significant free surface effect.

**Table 3.3.8 - Values for coefficient "k"  
for calculating free surface corrections**

$k = \frac{\sin \theta}{12} \left(1 + \frac{\tan^2 \theta}{2}\right) \cdot \frac{b}{h}$ where $\cot \theta \geq \frac{b}{h}$								$k = \frac{\cos \theta}{8} \left(1 + \frac{\tan \theta}{b/h}\right) - \frac{\cos \theta}{12(b/h)^2} \left(1 + \frac{\cot^2}{2}\right)$ where $\cot \theta < \frac{b}{h}$							
$\theta$ $b/h$	5°	10°	15°	20°	30°	40°	45°	50°	60°	70°	75°	80°	85°	$\theta$ $b/h$	
20	0.11	0.12	0.12	0.12	0.11	0.10	0.09	0.09	0.09	0.05	0.04	0.03	0.02	20	
10	0.07	0.11	0.12	0.12	0.11	0.10	0.10	0.09	0.07	0.05	0.04	0.03	0.02	10	
5	0.04	0.07	0.10	0.11	0.11	0.11	0.10	0.10	0.08	0.07	0.06	0.05	0.04	5	
3	0.02	0.04	0.07	0.09	0.11	0.11	0.11	0.10	0.09	0.08	0.07	0.06	0.05	3	
2	0.01	0.03	0.04	0.06	0.09	0.11	0.11	0.11	0.10	0.09	0.09	0.08	0.07	2	
1.5	0.01	0.02	0.03	0.05	0.07	0.10	0.11	0.11	0.11	0.11	0.10	0.10	0.09	1.5	
1	0.01	0.01	0.02	0.03	0.05	0.07	0.09	0.10	0.12	0.13	0.13	0.13	0.13	1	
0.75	0.01	0.01	0.01	0.02	0.02	0.04	0.04	0.05	0.09	0.16	0.18	0.21	0.16	0.75	
0.5	0.00	0.01	0.01	0.02	0.02	0.04	0.04	0.05	0.09	0.16	0.18	0.21	0.23	0.5	
0.3	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.11	0.19	0.27	0.34	0.3	
0.2	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.07	0.13	0.27	0.45	0.2	
0.1	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.04	0.06	0.14	0.53	0.1	

### 3.5 Standard conditions of loading to be examined

36 In the heading of section 3.5, the words "conditions of loading" are replaced by the words "loading conditions".

#### 3.5.1 Loading conditions

37 In paragraphs 3.5.1.3.1 and 3.5.1.3.2, the word "weight" is replaced by the word "mass".

#### 3.5.2 Assumptions for calculating loading conditions

38 In paragraphs 3.5.2.5 and 3.5.2.6, the word "weight", wherever appears, is replaced by the word "mass".

## CHAPTER 4 - SPECIAL CRITERIA FOR CERTAIN TYPES OF SHIPS

### 4.1 Cargo ships carrying timber deck cargoes

39 In paragraph 4.1.3, in the introductory phrase, the expression "and 3.2" is added after "3.1.2.4".

40 In paragraph 4.1.3.3, in the first sentence, the words "be positive" are replaced by the words "not be less than 0.10 m"; and the last sentence is deleted.

41 In paragraph 4.1.3, the following new subparagraph .4 is added after existing subparagraph .3:

".4 When determining the ability of the ship to withstand the combined effects of beam wind and rolling according to 3.2, the 16° limiting angle of heel under action of steady wind should be complied with, but the additional criterion of 80% of the angle of deck edge immersion may be ignored".

42 In paragraph 4.1.5.3.1, the words "should have" are replaced by the word "has".

#### **4.2 Fishing vessels**

43 In paragraph 4.2.3.1, in the second sentence, the word "it" is inserted after the word "should".

44 The existing text of paragraphs 4.2.4.1 and 4.2.4.2 is replaced by the following:

"4.2.4.1 The Administration may apply the provisions of 3.2 to fishing vessels of 45 m length and over.

4.2.4.2 For fishing vessels in the length range between 24 m and 45 m, the Administration may apply the provisions of 3.2. Alternatively the values of wind pressure (see 3.2.2.2) may be taken from the following table:

h (m)	1	2	3	4	5	6 and over
P (Pa)	316	386	429	460	485	504

where h is the vertical distance from the centre of the projected vertical area of the vessel above the waterline, to the waterline."

45 In paragraph 4.2.5.1.2, the words "and a percentage of stores, fuel, etc., as agreed by the Administration" are added at the end.

46 In the heading of section 4.2.6, the expression "24 m" is replaced by "30 m".

#### **4.5 Offshore supply vessels**

47 In paragraph 4.5.3.1, in the first sentence, the word "standards" is inserted after the words "design and construction".

#### **4.6 Mobile offshore drilling units (MODUs)**

48 In the heading of section 4.6.3, the word "wind" is inserted between the words "and" and "heeling".

49 In paragraph 4.6.5.2.1, in the second sentence, the words "equal or" are inserted after the words "must be"; and in the definitions of area "A" and area "B", the word "arm" is replaced by the word "moment".

50 In paragraph 4.6.5.2.2, the expression "(GM cannot be taken to be greater than 2.44 m)" is moved to after the definition of parameter " $k$ ".

51 In paragraph 4.6.5.3, in the first definition of GM, the expression "restoring energy ratio" is replaced by the expression "reserve energy ratio".

52 In paragraph 4.6.5.5, in the equation for " $a$ ", the symbol " $A_{MIN}$ " is replaced by the symbol " $a_{min}$ ".

#### **4.7 Pontoons**

53 In paragraph 4.7.2.2.1, the word "unless" is replaced by the word "except".

54 In paragraph 4.7.2.2.3.3, the word "draught" is replaced by the words "mean draught".

55 In paragraph 4.7.3.1, the word "the" is inserted between the words "under" and "righting".

56 In paragraph 4.7.3.2, the expression "0.54 kPa" is replaced by "540 Pa".

#### **4.8 Dynamically supported craft (DSC)**

57 A new paragraph 4.8.1.3 is added after existing paragraph 4.8.1.2 as follows:

"4.8.1.3 The provisions of this chapter do not apply to any DSC the keel of which is laid, or which is subject to repairs, alterations or modifications of a major character, on or after 1 January 1996."

58 In paragraph 4.8.2.1.2, the word "damage" is replaced by the word "damaged".

59 In paragraph 4.8.3, the word "chapter" is replaced by the word "part".

60 In paragraph 4.8.6.2, the word "its" is inserted after the words "prior to".

61 In paragraph 4.8.7.1.1.4, the symbol " $Z$ " is replaced, wherever appears, by the symbol " $Z_v$ ".

62 In paragraph 4.8.7.1.2.3 and figure 4.8.7-3, the symbol " $g$ " is replaced by the symbol " $h$ ".

#### **4.9 Containerships greater than 100 m**

63 In paragraph 4.9.2.6, in the definition of  $B$ , the symbol " $B$ " is replaced by the symbol " $B_D$ "; the words "D'= moulded depth of the ship, corrected for defined parts of volumes within the hatch coamings according to the formula:" are inserted before the formula for " $D'$ "; and the explanation after " $KG$ =" is replaced by the words "height of the centre of mass above base, corrected for free surface effect, not be taken as less than  $d$ , in m".

64 In paragraph 4.9.2.6, the following text is added at the end:

$R_H$	=	length of each hatch coaming within L/4 forward and aft from amidships, in m (see figure 4.9-1);
b	=	mean width of hatch coamings within L/4 forward and aft from amidships, in m (see figure 4.9-1);
h	=	mean height of hatch coamings within L/4 forward and aft from amidships, in m (see figure 4.9-1);
L	=	length of the ship, in m;
B	=	breadth of the ship on the waterline, in m;
$B_m$	=	breadth of the ship on the waterline at half mean draught, in m.

The shaded areas in figure 4.9-1 represent partial volumes within the hatch coamings considered contributing to resistance against capsizing at large heeling angles when the ship is on a wave crest."

65 In figure 4.9-1, the symbol "B/4" is replaced by the symbol  $B_D/4$ .

66 The following new section 4.10 is added after existing section 4.9:

#### **"4.10 High-speed craft**

High-speed craft as defined in 1.3.9, constructed on or after 1 January 1996, to which chapter X of the International Convention for the Safety of Life at Sea, 1974 applies should comply with stability requirements of the HSC Code."

### **CHAPTER 5 - ICING CONSIDERATIONS**

#### **5.5 Dynamically supported craft**

67 In paragraph 5.5.1, in the second sentence, the word "for" is replaced by the word "of".

68 At the end of chapter 5, in the "CHART OF AREAS OF ICING CONDITIONS", the area north of latitude 56°N in the Baltic Sea is shaded according to paragraph 5.3.2.1. (see the same chart in the 1993 Torremolinos Protocol).

### **CHAPTER 6 - CONSIDERATIONS FOR WATERTIGHT INTEGRITY**

#### **6.4 Cargo ports and other similar openings**

69 The following new paragraphs 6.4.3 and 6.4.4 are added after existing paragraph 6.4.2:

"6.4.3\* Cargo port and other similar openings in passenger ships to which the International Convention for the Safety of Life at Sea, 1974 applies should comply with regulations II-1/17, 20 and 20-1 of this Convention. In addition, such openings in ro-ro passenger ships to which this Convention applies, should comply with regulation II-1/23-2 of this Convention.

6.4.4\* Cargo port and other similar openings in cargo ships to which the International Convention for the Safety of Life at Sea, 1974 applies should comply with regulation II-1/25-10 of this Convention."

### **6.5 Sidescuttles, window scuppers, inlets and discharges**

70 The existing text of paragraph 6.5.1 is replaced by the following:

"6.5.1\* In passenger ships to which the International Convention for the Safety of Life at Sea, 1974 applies, openings in shell plating below the bulkhead deck should comply with regulation II-1/17 of this Convention.

Watertight integrity above the bulkhead deck should comply with regulation II-1/20 of this Convention.

In addition, in ro-ro passenger ships, watertight integrity below the bulkhead deck should comply with regulation II-1/20-2 and integrity of the hull and superstructure should comply with regulation II-1/23-2 of this Convention."

71 In paragraph 6.5.4.10, in the first sentence, the word "discharge" is replaced by the word "discharges".

72 The following new paragraph 6.5.5 is added after existing paragraph 6.5.4:

"6.5.5 In cargo ships to which the International Convention for the Safety of Life at Sea, 1974 applies, external openings should comply with regulation II-1/25-10 of this Convention."

### **6.8 Freeing ports**

73 In paragraph 6.8.1, in the first sentence, the word "the" is inserted before the words "freeboard" and "working".

74 In paragraph 6.8.2.1, in the first sentence, the word "paragraphs" is replaced by the word "subparagraphs".

## **CHAPTER 7 - DETERMINATION OF LIGHTSHIP DISPLACEMENT AND CENTRES OF GRAVITY**

### **7.3 Preparations for the inclining test**

75 The existing text of subparagraph .4 of paragraph 7.3.1.1 is replaced by the following:

".4 Measuring devices:

- .1 pendulums – approximate location and length;
- .2 U-tubes – approximate location and distance between legs;
- .3 inclinometers - location and details of approvals and calibrations."

76 In paragraph 7.3.2.3, in the second sentence, the word "incline" is replaced by the word "inclining".

77 In paragraph 7.3.2.6, in the fourth sentence, the words "water specific gravity" are replaced by the words "specific gravity of water".

78 The existing text of paragraph 7.3.2.8 is replaced by the following:

"7.3.2.8 The total weight used should be sufficient to provide a minimum inclination of one degree and a maximum of four degrees of heel to each side. The Administration may, however, accept a smaller inclination angle for large ships provided that the requirements on pendulum deflection or U-tube difference in height in 7.3.2.9 are complied with. Test weights should be compact and of such a configuration that the vertical centre of gravity of the weights can be accurately determined. Each weight should be marked with an identification number and its weight. Re-certification of the test weights should be carried out prior to the inclining. A crane of sufficient capacity and reach, or some other means, should be available during the inclining test to shift weights on the deck in an expeditious and safe manner. Water ballast transfer may be carried out, when it is impractical, to incline using solid weights, if acceptable to the Administration."

79 In paragraph 7.3.2.9, the last two sentences are replaced by the following:

"One or more pendulums may be substituted by other measuring devices (U-tubes or inclinometers) at the discretion of the Administration. Alternative measuring devices should not be used to reduce the minimum inclining angles recommended in 7.3.2.8."

#### **7.4 Plans required**

80 In paragraph 7.4.2, the words "curves of form" and the parentheses are deleted.

81 The existing text of subparagraph .4 of paragraph 7.4 is replaced by the following :

".4 capacity plan showing capacities and vertical and longitudinal centres of gravity of cargo spaces, tanks, etc. When ballast water is used as inclining weights, the transverse and vertical centres of gravity for the applicable tanks, for each angle of inclination, must be available;"

82 Existing section 7.6 is deleted from the chapter and its text is included in a new annex 3 (see paragraph 94 below).

## ANNEX 1 - DETAILED GUIDANCE FOR THE CONDUCT OF AN INCLINING TEST

### 2.1 Free surface and tankage

83 In paragraph 2.1.1, in the first sentence, the word "it" is replaced by the word "they"; in the third sentence, the words "incline" is replaced by the word "inclining"; in the formula for free surface moment, the word "Free surface moment" are replaced by the symbol " $M_{fs}$ "; and in the formula for free surface correction and explanations thereto, the symbol "FSM" is replaced by the symbol  $M_{fs}$ .

84 In paragraph 2.1.1, in the equation of the free surface moment, the word "Sum" is replaced by the summation sign " $\Sigma$ ".

85 At the end of paragraph 2.1.1, the following is added:

"When ballast water is used as inclining weight, the actual transverse and vertical movements of the liquid should be calculated taking into account the change of heel of the ship. Free surface corrections as defined in this paragraph should not apply to the inclining tanks."

86 The existing text of section 2.2 "Mooring arrangements" is replaced by the following:

### "2.2 Mooring arrangements

The importance of good mooring arrangements cannot be over-emphasised. The arrangement selections will be dependent upon many factors. Among the most important are depth of water, wind and current effects. Whenever possible, the ship should be moored in a quiet, sheltered area free from extraneous forces such as propeller wash from passing ships, or sudden discharges from shore side pumps. The depth of water under the hull should be sufficient to ensure that the hull will be entirely free of the bottom. The tide conditions and trim of the ship during the test should be considered. Prior to the test, the depth of water should be measured and recorded in as many locations as necessary to ensure the ship will not contact the bottom. If marginal, the test should be conducted during high tide or the ship moved to deeper water.

2.2.1 The mooring arrangement should ensure that the ship will be free to list without restraint for a sufficient period of time to allow a satisfactory reading of the heeling angle, due to each weight shift, to be recorded.

2.2.2 The ship should be held by lines at the bow and the stem, attached to bollards and/or cleats on the deck. If suitable restraint of the ship cannot be achieved using deck fittings, then temporary padeyes should be attached as close as possible to the centreline of the ship and as near the waterline as practical. Where the ship can be moored to one side only, it is good practice to supplement the bow and stern lines with two spring lines in order to maintain positive control of the ship, as shown in figure 2.2.1. The leads of the spring lines should be as long as practicable. Cylindrical camels should be provided between the ship and the dock. All lines should be slack, with the ship free of the pier and camels, when taking readings.

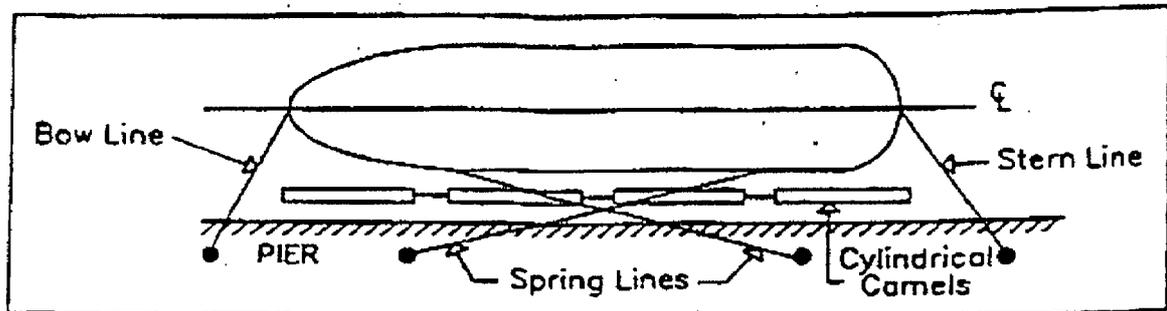


Figure 2.2.1

2.2.2.1 If the ship is held off the pier by the combined effect of the wind and current, a superimposed heeling moment will act on the ship throughout the test. For steady conditions this will not affect the results. Gusty wind or uniformly varying wind and/or current will cause these superimposed heeling moments to change, which may require additional test points to obtain a valid test. The need for additional test points can be determined by plotting test points as they are obtained.

2.2.2.2 If the ship is pressed against the fenders by wind and/or current, all lines should be slack. The cylindrical camels will prevent binding but there will be an additional superimposed heeling moment due to the ship bearing against the camels. This condition should be avoided where possible but, when used, consideration should be given to pulling the ship free of the dock and camels and letting the ship drift as readings are taken.

2.2.2.3 Another acceptable arrangement is where the combined wind and current are such that the ship may be controlled by only one line at either the bow or the stern. In this case, the control line should be led from on or near the centre line of the ship with all lines but the control line slack, the ship is free to veer with the wind and/or current as readings are taken. This can sometimes be troublesome because varying wind and/or current can cause distortion of the plot.

2.2.3 The mooring arrangement should be submitted to the approval authority for review prior to the test.

2.2.4 If a floating crane is used for handling inclining weights, it should not be moored to the ship."

### 2.3 Test weights

87 Paragraph 2.3.2 is deleted.

88 Existing paragraphs 2.3.3 to 2.3.5 are renumbered as paragraphs 2.3.2 to 2.3.4.

89 The existing text of the renumbered paragraph 2.3.4 is replaced by the following:

"2.3.4 Where the use of solid weights to produce the inclining moment is demonstrated to be impracticable, the movement of ballast water may be permitted as an alternative method. This acceptance would be granted for a specific test only, and approval of the test procedure by the Administration is required. As a minimal prerequisite for acceptability, the following conditions should be required:

- .1 inclining tanks should be wall-sided and free of large stringers or other internal members that create air pockets. Other tank geometries may be accepted at the discretion of the Administration;
- .2 tanks should be directly opposite to maintain ship's trim;
- .3 specific gravity of ballast water should be measured and recorded;
- .4 pipelines to inclining tanks should be full. If the ship's piping layout is unsuitable for internal transfer, portable pumps and pipes/hoses may be used;
- .5 blanks must be inserted in transfer manifolds to prevent the possibility of liquids being "leaked" during transfer. Continuous valve control must be maintained during the test;
- .6 all inclining tanks must be manually sounded before and after each shift;
- .7 vertical, longitudinal and transverse centres should be calculated for each movement;
- .8 accurate sounding/ullage tables must be provided. The ship's initial heel angle should be established prior to the incline in order to produce accurate values for volumes and transverse and vertical centres of gravity for the inclining tanks at every angle of heel. The draught marks amidships (port and starboard) should be used when establishing the initial heel angle;
- .9 verification of the quantity shifted may be achieved by a flowmeter or similar device; and
- .10 the time to conduct the inclining must be evaluated. If time requirements for transfer of liquids is considered too long, water may be unacceptable because of the possibility of wind shifts over long periods of time."

## **2.4 Pendulums**

90 In paragraph 2.4.1, the following new text is inserted before the last sentence:

"On large ships with high GM, pendulum lengths in excess of the length recommended above may be required to obtain the minimum deflection. In such cases, the trough, as shown in figure A1-2.4.6, should be filled with high viscosity oil."

91 In paragraph 2.4.7, the following sentence is added at the end of the paragraph:

"The Administration may approve an alternative arrangement when this is found impractical."

92 After paragraph 2.4.7, a new heading is inserted as follows:

**"2.5 U-tubes"**

93 Existing paragraph 2.4.8 is replaced by the following:

2.5.1 The legs of the device should be securely positioned as far outboard as possible and should be parallel to the centreline plane of the ship. The distance between the legs should be measured perpendicular to the centreline plane. The legs should be vertical, as far as practical.

2.5.2 Arrangements should be made for recording all readings at both legs. For easy reading and checking for air pockets, clear plastic tube or hose should be used throughout. The U-tube should be pressure tested prior to the inclining test to ensure watertightness.

2.5.3 The horizontal distance between the legs of the U-tube should be sufficient to obtain a level difference of at least 15 cm between the upright and the maximum inclination to each side.

2.5.4 Normally, water would be used as the liquid in the U-tube. Other low-viscosity liquids may also be considered.

2.5.5 The tube should be free of air pockets. Arrangements should be made to ensure that the free flow of the liquid in the tube is not obstructed.

2.5.6 When a U-tube is used as a measuring device, due consideration should be given to the prevailing weather conditions (see 4.1.1.3):

- .1 if the U-tube is exposed to direct sunlight, arrangements should be made to avoid temperature differences along the length of the tube;
- .2 if temperatures below 0°C are expected, the liquid should be a mixture of water and an anti-freeze additive; and
- .3 where heavy rain squalls can be expected, arrangements should be made to avoid additional water entering the U-tube.

**2.6 Inclometers**

The use of inclinometers should be subject to at least the following recommendations:

- .1 the accuracy should be equivalent to that of a pendulum;
- .2 the sensitivity of the inclinometer should be such that the non-steady heeling angle of the ship can be recorded throughout the measurement;
- .3 the recording period should be sufficient to accurately measure the inclination. The recording capacity should be generally sufficient for the whole test;
- .4 the instrument should be able to plot or print the recorded inclination angles on paper;

- .5 the instrument should have linear performance over the expected range of inclination angles;
- .6 the instrument should be supplied with the manufacturer's instructions giving details of calibration, operating instructions, etc.; and
- .7 it should be possible to demonstrate the required performance to the satisfaction of the Administration during the inclining test."

94 A new annex 3 entitled "Determination of ship's stability by means of rolling period test (for ships up to 70 m in length)" including the text of existing section 7.6 is added (see paragraph 82 above).

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