Institute of
Ship Design and Ship Safety

Exercise
Ship Design
RoPax and Pax

Prof. Dr.-Ing. Stefan Krüger
Dipl.-Ing. Philip Augener
M.Sc. Lars Johnsen
Exercise 10

1. Which damage stability rules are valid for passenger ships with keel laying after 01.01.2020? Which rule has to be especially focused on?

2. What is the difference concerning the attained subdivision index for passenger ships compared to cargo ships?

3. What is the difference concerning the required subdivision index for passenger ships compared to cargo ships? How did this change on 01.01.2020?

4. What has to be especially considered for ro-ro passenger ships operating in Europe?

5. What is the assumed extent of the penetration depth following from the special requirements for passenger vessels with keel laying after 01.01.2009? What is a reasonable constructional element following from this?

6. Which damage stability rules are valid for passenger vessels with keel laying before 1.1.2009?

7. What is the assumed extent of the penetration depth following from the special requirements for passenger vessels with keel laying before 1.1.2009? What is a reasonable construction element following from this?

8. What is the consequence if a compartment does not contain the above mentioned construction element?

9. What is the maximum length of a Main-Fire-Zone and by what constructional elements are MFZ separated?

10. Which rule do all passenger ships built after 01.07.2010 have to fulfill, that have a length as defined in SOLAS Rule II-1/2.5 of 120 m or more or three or more vertical main fire zones?

11. What is the margin line and for what kind of ships is it relevant?

12. Please explain a typical propulsion concept for a passenger ship.

13. Please mark the following in the general arrangement plan of the cruise vessel: bulkhead deck, all main fire zones as well as the watertight transverse bulkheads.

14. Please explain a typical propulsion concept for a ro-ro passenger ship.

15. Which intact stability criterions do passenger ships have to fulfill?
Where the required factor of subdivision is 0.5 or less, the combined length of any two adjacent compartments shall not exceed the floodable length.

Regulation 8

Stability of passenger ships in damaged condition*

(Subject to the provisions of regulation 8-1, paragraphs 2.3.1 to 2.3.4, 2.4, 5 and 6.2 apply to passenger ships constructed on or after 29 April 1990. Paragraphs 7.2, 7.3 and 7.4 apply to all passenger ships)

1.1 Sufficient intact stability shall be provided in all service conditions so as to enable the ship to withstand the final stage of flooding of any one main compartment which is required to be within the floodable length.

1.2 Where two adjacent main compartments are separated by a bulkhead which is stepped under the conditions of regulation 7.5.1 the intact stability shall be adequate to withstand the flooding of those two adjacent main compartments.

1.3 Where the required factor of subdivision is 0.5 or less but more than 0.33 intact stability shall be adequate to withstand the flooding of any two adjacent main compartments.

1.4 Where the required factor of subdivision is 0.33 or less the intact stability shall be adequate to withstand the flooding of any three adjacent main compartments.

2.1 The requirements of paragraph 1 shall be determined by calculations which are in accordance with paragraphs 3, 4 and 6 and which take into consideration the proportions and design characteristics of the ship and the arrangement and configuration of the damaged compartments. In making these calculations the ship is to be assumed in the worst anticipated service condition as regards stability.

2.2 Where it is proposed to fit decks, inner skins or longitudinal bulkheads of sufficient tightness to seriously restrict the flow of water, the Administration shall be satisfied that proper consideration is given to such restrictions in the calculations.

* Refer to MSC/Circ.541 (as may be revised): Guidance notes on the integrity of flooding boundaries above the bulkhead deck of passenger ships for proper application of regulations II-1/8 and 20, paragraph 1, of SOLAS 1974, as amended.
2.3 The stability required in the final condition after damage, and after equalization where provided, shall be determined as follows:

2.3.1 The positive residual righting lever curve shall have a minimum range of $15^\circ$ beyond the angle of equilibrium. This range may be reduced to a minimum of $10^\circ$, in the case where the area under the righting lever curve is that specified in paragraph 2.3.2, increased by the ratio:

\[ \frac{15}{\text{range}} \]

where the range is expressed in degrees.

2.3.2 The area under the righting lever curve shall be at least 0.015 metre-radians, measured from the angle of equilibrium to the lesser of:

.1 the angle at which progressive flooding occurs;
.2 $22^\circ$ (measured from the upright) in the case of one-compartment flooding, or $27^\circ$ (measured from the upright) in the case of the simultaneous flooding of two or more adjacent compartments.

2.3.3 A residual righting lever is to be obtained within the range of positive stability, taking into account the greatest of the following heeling moments:

.1 the crowding of all passengers towards one side;
.2 the launching of all fully loaded davit-launched survival craft on one side;
.3 due to wind pressure;

as calculated by the formula:

\[ GZ \text{ (in metres)} = \frac{\text{heeling moment}}{\text{displacement}} + 0.04 \]

However, in no case is this righting lever to be less than 0.1 m.

2.3.4 For the purpose of calculating the heeling moments in paragraph 2.3.3, the following assumptions shall be made:

.1 Moments due to crowding of passengers:
.1.1 four persons per square metre;
.1.2 a mass of 75 kg for each passenger;
.1.3 passengers shall be distributed on available deck areas towards one side of the ship on the decks where muster stations are located and in such a way that they produce the most adverse heeling moment.
Moments due to launching of all fully loaded davit-launched survival craft on one side:

2.1 all lifeboats and rescue boats fitted on the side to which the ship has heeled after having sustained damage shall be assumed to be swung out fully loaded and ready for lowering;

2.2 for lifeboats which are arranged to be launched fully loaded from the stowed position, the maximum heeling moment during launching shall be taken;

2.3 a fully loaded davit-launched liferaft attached to each davit on the side to which the ship has heeled after having sustained damage shall be assumed to be swung out ready for lowering;

2.4 persons not in the life-saving appliances which are swung out shall not provide either additional heeling or righting moment;

2.5 life-saving appliances on the side of the ship opposite to the side to which the ship has heeled shall be assumed to be in a stowed position.

Moments due to wind pressure:

3.1 a wind pressure of 120 N/m² to be applied;

3.2 the area applicable shall be the projected lateral area of the ship above the waterline corresponding to the intact condition;

3.3 the moment arm shall be the vertical distance from a point at one half of the mean draught corresponding to the intact condition to the centre of gravity of the lateral area.

In intermediate stages of flooding, the maximum righting lever shall be at least 0.05 m and the range of positive righting levers shall be at least 7°. In all cases, only one breach in the hull and only one free surface need be assumed.

For the purpose of making damage stability calculations the volume and surface permeabilities shall be in general as follows:

<table>
<thead>
<tr>
<th>Spaces</th>
<th>Permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriated to cargo, coal or stores</td>
<td>60</td>
</tr>
<tr>
<td>Occupied by accommodation</td>
<td>95</td>
</tr>
<tr>
<td>Occupied by machinery</td>
<td>85</td>
</tr>
<tr>
<td>Intended for liquids</td>
<td>0 or 95*</td>
</tr>
</tbody>
</table>

Higher surface permeabilities are to be assumed in respect of spaces which, in the vicinity of the damage waterplane, contain no substantial quantity of

* Whichever results in the more severe requirements.
accommodation or machinery and spaces which are not generally occupied by any substantial quantity of cargo or stores.

4 Assumed extent of damage shall be as follows:

1. longitudinal extent: 3 m plus 3% of the length of the ship, or 11 m, whichever is the less. Where the required factor of subdivision is 0.33 or less the assumed longitudinal extent of damage shall be increased as necessary so as to include any two consecutive main transverse watertight bulkheads;

2. transverse extent (measured inboard from the ship’s side, at right angles to the centreline at the level of the deepest subdivision load line): a distance of one fifth of the breadth of the ship, as defined in regulation 2; and

3. vertical extent: from the base line upwards without limit;

4. if any damage of lesser extent than that indicated in paragraphs 4.1, 4.2 and 4.3 would result in a more severe condition regarding heel or loss of metacentric height, such damage shall be assumed in the calculations.

5 Unsymmetrical flooding is to be kept to a minimum consistent with efficient arrangements. Where it is necessary to correct large angles of heel, the means adopted shall, where practicable, be self-acting, but in any case where controls to cross-flooding fittings are provided they shall be operable from above the bulkhead deck. These fittings together with their controls shall be acceptable to the Administration. The maximum angle of heel after flooding but before equalization shall not exceed 15°. Where cross-flooding fittings are required the time for equalization shall not exceed 15 min. Suitable information concerning the use of cross-flooding fittings shall be supplied to the master of the ship.*

6 The final conditions of the ship after damage and, in the case of unsymmetrical flooding, after equalization measures have been taken shall be as follows:

1. in the case of symmetrical flooding there shall be a positive residual metacentric height of at least 50 mm as calculated by the constant displacement method;

2. in the case of unsymmetrical flooding, the angle of heel for one-compartment flooding shall not exceed 7°. For the simultaneous flooding of two or more adjacent compartments, a heel of 12° may be permitted by the Administration;

* Refer to the Recommendation on a standard method for establishing compliance with the requirements for cross-flooding arrangements in passenger ships adopted by the Organization by resolution A.266(VIII).
in no case shall the margin line be submerged in the final stage of flooding. If it is considered that the margin line may become submerged during an intermediate stage of flooding, the Administration may require such investigations and arrangements as it considers necessary for the safety of the ship.

7.1 The master of the ship shall be supplied with the data necessary to maintain sufficient intact stability under service conditions to enable the ship to withstand the critical damage. In the case of ships requiring cross-flooding the master of the ship shall be informed of the conditions of stability on which the calculations of heel are based and be warned that excessive heeling might result should the ship sustain damage when in a less favourable condition.

7.2 The data referred to in paragraph 7.1 to enable the master to maintain sufficient intact stability shall include information which indicates the maximum permissible height of the ship’s centre of gravity above keel (KG), or alternatively the minimum permissible metacentric height (GM), for a range of draughts or displacements sufficient to include all service conditions. The information shall show the influence of various trims taking into account the operational limits.

7.3 Each ship shall 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 shall also be fitted with a reliable draught indicating system by which the bow and stern draughts can be determined.

7.4 On completion of loading of the ship and prior to its departure, the master shall determine the ship’s trim and stability and also ascertain and record that the ship is in compliance with stability criteria in the relevant regulations. The determination of the ship’s stability shall always be made by calculation. The Administration may accept the use of an electronic loading and stability computer or equivalent means for this purpose.

8.1 No relaxation from the requirements for damage stability may be considered by the Administration unless it is shown that the intact metacentric height in any service condition necessary to meet these requirements is excessive for the service intended.

8.2 Relaxations from the requirements for damage stability shall be permitted only in exceptional cases and subject to the condition that the Administration is to be satisfied that the proportions, arrangements and other characteristics of the ship are the most favourable to stability after damage which can practically and reasonably be adopted in the particular circumstances.
Regulation 8-1
Stability of ro–ro passenger ships in damaged condition*

Ro–ro passenger ships constructed before 1 July 1997 shall comply with regulation 8, as amended by resolution MSC.12(56), not later than the date of the first periodical survey after the date of compliance prescribed below, according to the value of \( A/A_{\text{max}} \) as defined in the annex of the Calculation Procedure to assess the survivability characteristics of existing ro–ro passenger ships when using a simplified method based upon resolution A.265(VIII), developed by the Maritime Safety Committee at its fifty-ninth session in June 1991 (MSC/Circ.574).‡

<table>
<thead>
<tr>
<th>Value of ( A/A_{\text{max}} )</th>
<th>Date of compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 85%</td>
<td>1 October 1998</td>
</tr>
<tr>
<td>85% or more but less than 90%</td>
<td>1 October 2000</td>
</tr>
<tr>
<td>90% or more but less than 95%</td>
<td>1 October 2002</td>
</tr>
<tr>
<td>95% or more but less than 97.5%</td>
<td>1 October 2004</td>
</tr>
<tr>
<td>97.5% or more</td>
<td>1 October 2005</td>
</tr>
</tbody>
</table>

Regulation 8-2
Special requirements for ro–ro passenger ships carrying 400 persons or more

Notwithstanding the provisions of regulations 8 and 8-1:

.1 Ro–ro passenger ships certified to carry 400 persons or more constructed on or after 1 July 1997 shall comply with the provisions of paragraph 2.3 of regulation 8, assuming the damage applied anywhere within the ship’s length \( L \); and

.2 Ro–ro passenger ships certified to carry 400 persons or more constructed before 1 July 1997 shall comply with the requirements of subparagraph .1 not later than the date of the first periodical survey after the date of compliance prescribed in subparagraph .2.1, .2.2 or .2.3 which occurs the latest:

<table>
<thead>
<tr>
<th>Value of ( A/A_{\text{max}} )</th>
<th>Date of compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 85%</td>
<td>1 October 1998</td>
</tr>
<tr>
<td>85% or more but less than 90%</td>
<td>1 October 2000</td>
</tr>
<tr>
<td>90% or more but less than 95%</td>
<td>1 October 2002</td>
</tr>
<tr>
<td>95% or more but less than 97.5%</td>
<td>1 October 2004</td>
</tr>
<tr>
<td>97.5% or more</td>
<td>1 October 2010</td>
</tr>
</tbody>
</table>

* For the application of specific stability requirements to ro–ro passenger ships, refer to resolution 14 of the 1995 SOLAS Conference and resolution MSC.141(76), Revised model test method under resolution 14 of the 1995 SOLAS Conference.

‡ Refer to MSC/Circ.649, Interpretations of provisions of resolution MSC.26(60) and MSC/Circ.574.
Chapter II-1: Construction – structure, stability, installations

Regulation 8-3

Special requirements for passenger ships, other than ro–ro passenger ships, carrying 400 persons or more

Notwithstanding the provisions of regulation 8, passenger ships, other than ro–ro passenger ships, certified to carry 400 persons or more constructed on or after 1 July 2002 shall comply with the provisions of paragraphs 2.3 and 2.4 of regulation 8, assuming the damage applied anywhere within the ship’s length $L$.

Regulation 9

Ballasting of passenger ships

1 Water ballast should not in general be carried in tanks intended for oil fuel. In ships in which it is not practicable to avoid putting water in oil fuel tanks, oily-water separating equipment to the satisfaction of the Administration shall be fitted, or other alternative means, such as discharge to shore facilities, acceptable to the Administration shall be provided for disposing of the oily-water ballast.

2 The provisions of this regulation are without prejudice to the provisions of the International Convention for the Prevention of Pollution from Ships in force.

Regulation 10

Peak and machinery space bulkheads, shaft tunnels, etc., in passenger ships*

1 A forepeak or collision bulkhead shall be fitted which shall be watertight up to the bulkhead deck. This bulkhead shall be located at a

* Refer to MSC/Circ.855, Interpretation of the position of the forward perpendicular for the purpose of SOLAS regulation II-1/10.
3 Breadth of the ship is the extreme width from outside of frame to outside of frame at or below the deepest subdivision load line.

4 Draught is the vertical distance from the moulded base line amidships to the subdivision load line in question.

5 Bulkhead deck is the uppermost deck up to which the transverse watertight bulkheads are carried.

6 Margin line is a line drawn at least 76 mm below the upper surface of the bulkhead deck at side.

7 Permeability of a space is the percentage of that space which can be occupied by water. The volume of a space which extends above the margin line shall be measured only to the height of that line.

8 Machinery space is to be taken as extending from the moulded base line to the margin line and between the extreme main transverse watertight bulkheads, bounding the spaces containing the main and auxiliary propulsion machinery, boilers serving the needs of propulsion, and all permanent coal bunkers. In the case of unusual arrangements, the Administration may define the limits of the machinery spaces.

9 Passenger spaces are those spaces which are provided for the accommodation and use of passengers, excluding baggage, store, provision and mail rooms. For the purposes of regulations 5 and 6, spaces provided below the margin line for the accommodation and use of the crew shall be regarded as passenger spaces.

10 In all cases volumes and areas shall be calculated to moulded lines.

11 Weathertight means that in any sea conditions water will not penetrate into the ship.


13 Ro–ro passenger ship means a passenger ship with ro–ro cargo spaces* or special category spaces as defined in regulation II–2/3.

Regulation 3
Definitions relating to parts C, D and E

For the purpose of parts C, D and E, unless expressly provided otherwise:

1 Steering gear control system is the equipment by which orders are transmitted from the navigation bridge to the steering gear power units.

* This relates to the chapter II–2 in force before 1 July 2002. The equivalent term in the amended chapter II–2 is “ro–ro spaces”.

43
Part B
Subdivision and stability*

(Part B applies to passenger ships and to cargo ships, as indicated in the regulations)

Regulation 4
Floodable length in passenger ships

1 The floodable length at any point of the length of a ship shall be determined by a method of calculation which takes into consideration the form, draught and other characteristics of the ship in question.

2 In a ship with a continuous bulkhead deck, the floodable length at a given point is the maximum portion of the length of the ship, having its centre at the point in question, which can be flooded under the definite assumptions set forth in regulation 5 without the ship being submerged beyond the margin line.

3.1 In the case of a ship not having a continuous bulkhead deck, the floodable length at any point may be determined to an assumed continuous margin line which at no point is less than 76 mm below the top of the deck (at side) to which the bulkheads concerned and the shell are carried watertight.

3.2 Where a portion of an assumed margin line is appreciably below the deck to which bulkheads are carried, the Administration may permit a limited relaxation in the watertightness of those portions of the bulkheads which are above the margin line and immediately under the higher deck.

Regulation 5
Permeability in passenger ships

1.1 The definite assumptions referred to in regulation 4 relate to the permeability of the spaces below the margin line.

1.2 In determining the floodable length, a uniform average permeability

* Instead of the requirements in this part, the Regulations on subdivision and stability of passenger ships as an equivalent to part B of chapter II of the International Convention for the Safety of Life at Sea, 1960, adopted by the Organization by resolution A.265(VIII), may be used, if applied in their entirety.
CHAPTER 3 - SPECIAL CRITERIA FOR CERTAIN TYPES OF SHIPS

3.1 Passenger ships

Passenger ships shall comply with the requirements of 2.2 and 2.3.

3.1.1 In addition, the angle of heel on account of crowding of passengers to one side as defined below shall not exceed $10^\circ$.

3.1.1.1 A minimum weight of 75 kg shall be assumed for each passenger except that this value may be increased subject to the approval of the Administration. In addition, the mass and distribution of the luggage shall be approved by the Administration.

3.1.1.2 The height of the centre of gravity for passengers shall be assumed equal to:

- .1 1 m above deck level for passengers standing upright. Account may be taken, if necessary, of camber and sheer of deck; and
- .2 0.3 m above the seat in respect of seated passengers.

3.1.1.3 Passengers and luggage shall be considered to be in the spaces normally at their disposal, when assessing compliance with the criteria given in 2.2.1 to 2.2.4.

3.1.1.4 Passengers without luggage shall be considered as distributed to produce the most unfavourable combination of passenger heeling moment and/or initial metacentric height, which may be obtained in practice, when assessing compliance with the criteria given in 3.1.1 and 3.1.2, respectively. In this connection, a value higher than four persons per square metre is not necessary.

3.1.2 In addition, the angle of heel on account of turning shall not exceed $10^\circ$ when calculated using the following formula:

$$ M_R = 0.200 \times \frac{\nu_0^2}{L_{w}} \times \Delta \times (KG - \frac{d}{2}) $$

where:

- $M_R$ = heeling moment (kNm)
- $\nu_0$ = service speed (m/s)
- $L_{w}$ = length of ship at waterline (m)
- $\Delta$ = displacement (t)
- $d$ = mean draught (m)
- $KG$ = height of centre of gravity above baseline (m).
Solution 10

1. Which damage stability rules are valid for passenger ships with keel laying after 01.01.2009? Which rule has to be especially focused on?

New probabilistic damage stability calculation acc. to SOLAS 2009 B-1 (before 2009 passenger ships with solely deterministic and cargo ships solely with outdated probabilistic approach acc. to SOLAS 90). Additionally new regulation 8 for passenger ships

2. What is the difference concerning the attained subdivision index for passenger ships compared to cargo ships?

Each of $A_s$, $A_p$ and $A_l$ minimum $0,9\cdot R$ for passenger ships, minimum of $0,5\cdot R$ for cargo ships.

Different assessment of the survivability $s_i$ in calculation of $A$. For Pax: $s_i = 0$ if $\varphi_{eq} \geq 15^\circ$, for cargo: $s_i = 0$ if $\varphi_{eq} \geq 30^\circ$

3. What is the difference concerning the required subdivision index for passenger ships compared to cargo ships?

For passenger ships:

$$R = 1 - \frac{5.000}{L_s + 2.5N + 15.225} \quad (1)$$

with:

$N = N_1 + 2N_2$

$N_1 =$ number of persons (incl. crew) for whom lifeboats are provided

$N_2 =$ number of persons the ship is permitted to carry in excess of $N_1$

For cargo ships:

$R = R(L_s)$

4. What has to be especially considered for ro-ro passenger ships operating in Europe?

Stockholm-Agreement => damage stability acc. to SOLAS 90 Reg. 8 with additional water on the main-garage-deck and neglect of the margin line.

5. What is the assumed extent of the penetration depth following from the special requirements for passenger vessels with keel laying after 01.01.2009? What is a reasonable constructional element following from this?

$0,1^\circ B \Rightarrow B/10$ longitudinal bulkhead
Regulation 8 - Special requirements concerning passenger ship stability

1 A passenger ship intended to carry 400 or more persons shall have watertight subdivision abaft the collision bulkhead so that $s_i = 1$ for the three loading conditions on which is based the calculation of the subdivision index and for a damage involving all the compartments within $0.08L$ measured from the forward perpendicular.

2 A passenger ship intended to carry 36 or more persons is to be capable of withstanding damage along the side shell to an extent specified in paragraph 3. Compliance with this regulation is to be achieved by demonstrating that $s_i$, as defined in regulation 7-2, is not less than 0.9 for the three loading conditions on which is based the calculation of the subdivision index.

3 The damage extent to be assumed when demonstrating compliance with paragraph 2, is to be dependent on both $N$ as defined in regulation 6, and $L_s$ as defined in regulation 2, such that:

- the vertical extent of damage is to extend from the ship’s moulded baseline to a position up to 12.5 m above the position of the deepest subdivision draught as defined in regulation 2, unless a lesser vertical extent of damage were to give a lower value of $s_i$, in which case this reduced extent is to be used;
- where 400 or more persons are to be carried, a damage length of $0.03L_s$ but not less than 3 m is to be assumed at any position along the side shell, in conjunction with a penetration inboard of $0.1B$ but not less than 0.75 m measured inboard from the ship side, at right angle to the centreline at the level of the deepest subdivision draught;
- where less than 400 persons are carried, damage length is to be assumed at any position along the shell side between transverse watertight bulkheads provided that the distance between two adjacent transverse watertight bulkheads is not less than the assumed damage length. If the distance between adjacent transverse watertight bulkheads is less than the assumed damage length, only one of these bulkheads shall be
considered effective for the purpose of demonstrating compliance with paragraph 2;
where 36 persons are carried, a damage length of 0.015Lₜ but not less than 3 m is to be assumed, in conjunction with a penetration inboard of 0.05B but not less than 0.75 m; and where more than 36, but fewer than 400 persons are carried the values of damage length and penetration inboard, used in the determination of the assumed extent of damage, are to be obtained by linear interpolation between the values of damage length and penetration which apply for ships carrying 36 persons and 400 persons as specified in subparagraphs .4 and .2.
6. Which damage stability rules are valid for passenger vessels with keel laying before 1.1.2009?

old SOLAS (2004 and older) Part B Reg. 8: subdivision and stability of passenger ships...
Regel 8-1: Ro-Pax vessels Regel 8-2: Ro-Pax vessels with 400 or more persons Regel 8-3: Passenger vessels with 400 or more persons

7. What is the assumed extent of the penetration depth following from the special requirements for passenger vessels with keel laying before 1.1.2009? What is a reasonable construction element following from this?

0.2*B => B/5 longitudinal bulkhead (from obsolete SOLAS ’90)
Where the required factor of subdivision is 0.5 or less, the combined length of any two adjacent compartments shall not exceed the floodable length.

Regulation 8

Stability of passenger ships in damaged condition

(Subject to the provisions of regulation 8-1, paragraphs 2.3.1 to 2.3.4, 2.4, 5 and 6.2 apply to passenger ships constructed on or after 29 April 1990. Paragraphs 7.2, 7.3 and 7.4 apply to all passenger ships)

1.1 Sufficient intact stability shall be provided in all service conditions so as to enable the ship to withstand the final stage of flooding of any one main compartment which is required to be within the floodable length.

1.2 Where two adjacent main compartments are separated by a bulkhead which is stepped under the conditions of regulation 7.5.1 the intact stability shall be adequate to withstand the flooding of those two adjacent main compartments.

1.3 Where the required factor of subdivision is 0.5 or less but more than 0.33 intact stability shall be adequate to withstand the flooding of any two adjacent main compartments.

1.4 Where the required factor of subdivision is 0.33 or less the intact stability shall be adequate to withstand the flooding of any three adjacent main compartments.

2.1 The requirements of paragraph 1 shall be determined by calculations which are in accordance with paragraphs 3, 4 and 6 and which take into consideration the proportions and design characteristics of the ship and the arrangement and configuration of the damaged compartments. In making these calculations the ship is to be assumed in the worst anticipated service condition as regards stability.

2.2 Where it is proposed to fit decks, inner skins or longitudinal bulkheads of sufficient tightness to seriously restrict the flow of water, the Administration shall be satisfied that proper consideration is given to such restrictions in the calculations.

* Refer to MSC/Circ.541 (as may be revised): Guidance notes on the integrity of flooding boundaries above the bulkhead deck of passenger ships for proper application of regulations II-1/8 and 20, paragraph 1, of SOLAS 1974, as amended.
2.3 The stability required in the final condition after damage, and after
equalization where provided, shall be determined as follows:

2.3.1 The positive residual righting lever curve shall have a minimum range
of $15^\circ$ beyond the angle of equilibrium. This range may be reduced to a
minimum of $10^\circ$, in the case where the area under the righting lever curve is
that specified in paragraph 2.3.2, increased by the ratio:

$$\frac{15}{\text{range}}$$

where the range is expressed in degrees.

2.3.2 The area under the righting lever curve shall be at least 0.015 metre-
radians, measured from the angle of equilibrium to the lesser of:

.1 the angle at which progressive flooding occurs;
.2 $22^\circ$ (measured from the upright) in the case of one-compartment
flooding, or $27^\circ$ (measured from the upright) in the case of
the simultaneous flooding of two or more adjacent compartments.

2.3.3 A residual righting lever is to be obtained within the range of positive
stability, taking into account the greatest of the following heeling moments:

.1 the crowding of all passengers towards one side;
.2 the launching of all fully loaded davit-launched survival craft on
one side;
.3 due to wind pressure;

as calculated by the formula:

$$GZ \text{ (in metres)} = \frac{\text{heeling moment}}{\text{displacement}} + 0.04$$

However, in no case is this righting lever to be less than 0.1 m.

2.3.4 For the purpose of calculating the heeling moments in paragraph
2.3.3, the following assumptions shall be made:

.1 Moments due to crowding of passengers:
.1.1 four persons per square metre;
.1.2 a mass of 75 kg for each passenger;
.1.3 passengers shall be distributed on available deck areas towards
one side of the ship on the decks where muster stations are
located and in such a way that they produce the most adverse
heeling moment.
Chapter II-1: Construction – structure, stability, installations

Regulation 8

.2 Moments due to launching of all fully loaded davit-launched survival craft on one side:

.2.1 all lifeboats and rescue boats fitted on the side to which the ship has heeled after having sustained damage shall be assumed to be swung out fully loaded and ready for lowering;

.2.2 for lifeboats which are arranged to be launched fully loaded from the stowed position, the maximum heeling moment during launching shall be taken;

.2.3 a fully loaded davit-launched liferaft attached to each davit on the side to which the ship has heeled after having sustained damage shall be assumed to be swung out ready for lowering;

.2.4 persons not in the life-saving appliances which are swung out shall not provide either additional heeling or righting moment;

.2.5 life-saving appliances on the side of the ship opposite to the side to which the ship has heeled shall be assumed to be in a stowed position.

.3 Moments due to wind pressure:

.3.1 a wind pressure of 120 N/m² to be applied;

.3.2 the area applicable shall be the projected lateral area of the ship above the waterline corresponding to the intact condition;

.3.3 the moment arm shall be the vertical distance from a point at one half of the mean draught corresponding to the intact condition to the centre of gravity of the lateral area.

2.4 In intermediate stages of flooding, the maximum righting lever shall be at least 0.05 m and the range of positive righting levers shall be at least $\frac{7}{8}$. In all cases, only one breach in the hull and only one free surface need be assumed.

3 For the purpose of making damage stability calculations the volume and surface permeabilities shall be in general as follows:

<table>
<thead>
<tr>
<th>Spaces</th>
<th>Permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriated to cargo, coal or stores</td>
<td>60</td>
</tr>
<tr>
<td>Occupied by accommodation</td>
<td>95</td>
</tr>
<tr>
<td>Occupied by machinery</td>
<td>85</td>
</tr>
<tr>
<td>Intended for liquids</td>
<td>0 or 95*</td>
</tr>
</tbody>
</table>

Higher surface permeabilities are to be assumed in respect of spaces which, in the vicinity of the damage waterplane, contain no substantial quantity of

\* Whichever results in the more severe requirements.
accommodation or machinery and spaces which are not generally occupied by any substantial quantity of cargo or stores.

4 Assumed extent of damage shall be as follows:
   .1 longitudinal extent: 3 m plus 3% of the length of the ship, or 11 m, whichever is the less. Where the required factor of subdivision is 0.33 or less the assumed longitudinal extent of damage shall be increased as necessary so as to include any two consecutive main transverse watertight bulkheads;
   .2 transverse extent (measured inboard from the ship’s side, at right angles to the centreline at the level of the deepest subdivision load line): a distance of one fifth of the breadth of the ship, as defined in regulation 2; and
   .3 vertical extent: from the base line upwards without limit;
   .4 if any damage of lesser extent than that indicated in paragraphs 4.1, 4.2 and 4.3 would result in a more severe condition regarding heel or loss of metacentric height, such damage shall be assumed in the calculations.

5 Unsymmetrical flooding is to be kept to a minimum consistent with efficient arrangements. Where it is necessary to correct large angles of heel, the means adopted shall, where practicable, be self-acting, but in any case where controls to cross-flooding fittings are provided they shall be operable from above the bulkhead deck. These fittings together with their controls shall be acceptable to the Administration. The maximum angle of heel after flooding but before equalization shall not exceed 15°. Where cross-flooding fittings are required the time for equalization shall not exceed 15 min. Suitable information concerning the use of cross-flooding fittings shall be supplied to the master of the ship.\(^*\)

6 The final conditions of the ship after damage and, in the case of unsymmetrical flooding, after equalization measures have been taken shall be as follows:
   .1 in the case of symmetrical flooding there shall be a positive residual metacentric height of at least 50 mm as calculated by the constant displacement method;
   .2 in the case of unsymmetrical flooding, the angle of heel for one-compartment flooding shall not exceed 7°. For the simultaneous flooding of two or more adjacent compartments, a heel of 12° may be permitted by the Administration.

\(^*\) Refer to the Recommendation on a standard method for establishing compliance with the requirements for cross-flooding arrangements in passenger ships adopted by the Organization by resolution A.266(VIII).
in no case shall the margin line be submerged in the final stage of flooding. If it is considered that the margin line may become submerged during an intermediate stage of flooding, the Administration may require such investigations and arrangements as it considers necessary for the safety of the ship.

7.1 The master of the ship shall be supplied with the data necessary to maintain sufficient intact stability under service conditions to enable the ship to withstand the critical damage. In the case of ships requiring cross-flooding the master of the ship shall be informed of the conditions of stability on which the calculations of heel are based and be warned that excessive heeling might result should the ship sustain damage when in a less favourable condition.

7.2 The data referred to in paragraph 7.1 to enable the master to maintain sufficient intact stability shall include information which indicates the maximum permissible height of the ship’s centre of gravity above keel (KG), or alternatively the minimum permissible metacentric height (GM), for a range of draughts or displacements sufficient to include all service conditions. The information shall show the influence of various trims taking into account the operational limits.

7.3 Each ship shall 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 shall also be fitted with a reliable draught indicating system by which the bow and stern draughts can be determined.

7.4 On completion of loading of the ship and prior to its departure, the master shall determine the ship’s trim and stability and also ascertain and record that the ship is in compliance with stability criteria in the relevant regulations. The determination of the ship’s stability shall always be made by calculation. The Administration may accept the use of an electronic loading and stability computer or equivalent means for this purpose.

8.1 No relaxation from the requirements for damage stability may be considered by the Administration unless it is shown that the intact metacentric height in any service condition necessary to meet these requirements is excessive for the service intended.

8.2 Relaxations from the requirements for damage stability shall be permitted only in exceptional cases and subject to the condition that the Administration is to be satisfied that the proportions, arrangements and other characteristics of the ship are the most favourable to stability after damage which can practically and reasonably be adopted in the particular circumstances.
Regulation 8-1

*Stability of ro–ro passenger ships in damaged condition*

Ro–ro passenger ships constructed before 1 July 1997 shall comply with regulation 8, as amended by resolution MSC.12(56), not later than the date of the first periodical survey after the date of compliance prescribed below, according to the value of $A/A_{\text{max}}$ as defined in the annex of the Calculation Procedure to assess the survivability characteristics of existing ro–ro passenger ships when using a simplified method based upon resolution A.265(VIII), developed by the Maritime Safety Committee at its fifty-ninth session in June 1991 (MSC/Circ.574).†

<table>
<thead>
<tr>
<th>Value of $A/A_{\text{max}}$</th>
<th>Date of compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 85%</td>
<td>1 October 1998</td>
</tr>
<tr>
<td>85% or more but less than 90%</td>
<td>1 October 2000</td>
</tr>
<tr>
<td>90% or more but less than 95%</td>
<td>1 October 2002</td>
</tr>
<tr>
<td>95% or more but less than 97.5%</td>
<td>1 October 2004</td>
</tr>
<tr>
<td>97.5% or more</td>
<td>1 October 2005</td>
</tr>
</tbody>
</table>

Regulation 8-2

*Special requirements for ro–ro passenger ships carrying 400 persons or more*

Notwithstanding the provisions of regulations 8 and 8-1:

.1 Ro–ro passenger ships certified to carry 400 persons or more constructed on or after 1 July 1997 shall comply with the provisions of paragraph 2.3 of regulation 8, assuming the damage applied anywhere within the ship’s length $L$; and

.2 Ro–ro passenger ships certified to carry 400 persons or more constructed before 1 July 1997 shall comply with the requirements of subparagraph .1 not later than the date of the first periodical survey after the date of compliance prescribed in subparagraph .2.1, .2.2 or .2.3 which occurs the latest:

<table>
<thead>
<tr>
<th>Value of $A/A_{\text{max}}$</th>
<th>Date of compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 85%</td>
<td>1 October 1998</td>
</tr>
<tr>
<td>85% or more but less than 90%</td>
<td>1 October 2000</td>
</tr>
<tr>
<td>90% or more but less than 95%</td>
<td>1 October 2002</td>
</tr>
<tr>
<td>95% or more but less than 97.5%</td>
<td>1 October 2004</td>
</tr>
<tr>
<td>97.5% or more</td>
<td>1 October 2010</td>
</tr>
</tbody>
</table>

† For the application of specific stability requirements to ro–ro passenger ships, refer to resolution 14 of the 1995 SOLAS Conference and resolution MSC.141(76), Revised model test method under resolution 14 of the 1995 SOLAS Conference.

‡ Refer to MSC/Circ.649, Interpretations of provisions of resolution MSC.26(60) and MSC/Circ.574.
.2.2 Number of persons permitted to be carried

<table>
<thead>
<tr>
<th>Number of Persons</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,500 or more</td>
<td>1 October 2002</td>
</tr>
<tr>
<td>1,000 or more but less than 1,500</td>
<td>1 October 2006</td>
</tr>
<tr>
<td>600 or more but less than 1,000</td>
<td>1 October 2008</td>
</tr>
<tr>
<td>400 or more but less than 600</td>
<td>1 October 2010</td>
</tr>
</tbody>
</table>

.2.3 Age of the ship equal to or greater than 20 years,
where the age of the ship means the time counted from the date on which the keel was laid or the date on which it was at a similar stage of construction or from the date on which the ship was converted to a ro–ro passenger ship.

**Regulation 8-3**
Special requirements for passenger ships, other than ro–ro passenger ships, carrying 400 persons or more

Notwithstanding the provisions of regulation 8, passenger ships, other than ro–ro passenger ships, certified to carry 400 persons or more constructed on or after 1 July 2002 shall comply with the provisions of paragraphs 2.3 and 2.4 of regulation 8, assuming the damage applied anywhere within the ship’s length L.

**Regulation 9**
Ballasting of passenger ships

1. Water ballast should not in general be carried in tanks intended for oil fuel. In ships in which it is not practicable to avoid putting water in oil fuel tanks, oily-water separating equipment to the satisfaction of the Administration shall be fitted, or other alternative means, such as discharge to shore facilities, acceptable to the Administration shall be provided for disposing of the oily-water ballast.

2. The provisions of this regulation are without prejudice to the provisions of the International Convention for the Prevention of Pollution from Ships in force.

**Regulation 10**
Peak and machinery space bulkheads, shaft tunnels, etc., in passenger ships*

1. A forepeak or collision bulkhead shall be fitted which shall be watertight up to the bulkhead deck. This bulkhead shall be located at a

* Refer to MSC/Circ.855, Interpretation of the position of the forward perpendicular for the purpose of SOLAS regulation II-1/10.
8. What is the consequence if a compartment does not contain the above mentioned construction element?
   no B/5 bulkhead => whole compartment damaged i.e. flooded

9. What is the maximum length of a Main-Fire-Zone and by what constructional elements are MFZ separated?

   normal max. length 40 m but in special cases max. 48 m, in order to place the main fire bulkhead on top of the watertight bulkheads. The main fire bulkheads separate the space above the freeboard deck similarly to the watertight bulkheads below.
27 *Helicopter facility* is a helideck including any refuelling and hangar facilities.

28 *Lightweight* is the displacement of a ship in tonnes without cargo, fuel, lubricating oil, ballast water, fresh water and feedwater in tanks, consumable stores, and passengers and crew and their effects.

29 *Low flame-spread* means that the surface thus described will adequately restrict the spread of flame, this being determined in accordance with the Fire Test Procedures Code.

30 *Machinery spaces* are machinery spaces of category A and other spaces containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces.

31 *Machinery spaces of category A* are those spaces and trunks to such spaces which contain either:

.1 internal combustion machinery used for main propulsion;

.2 internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW; or

.3 any oil-fired boiler or oil fuel unit, or any oil-fired equipment other than boilers, such as inert gas generators, incinerators, etc.

32 *Main vertical zones* are those sections into which the hull, superstructure and deckhouses are divided by "A" class divisions, the mean length and width of which on any deck does not in general exceed 40 m.

33 *Non-combustible material* is a material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750°C, this being determined in accordance with the Fire Test Procedures Code.

34 *Oil fuel unit* is the equipment used for the preparation of oil fuel for delivery to an oil-fired boiler, or equipment used for the preparation for delivery of heated oil to an internal combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0.18 N/mm².
Regulation 9 - Containment of fire

1 Purpose

The purpose of this regulation is to contain a fire in the space of origin. For this purpose, the following functional requirements shall be met:

.1 the ship shall be subdivided by thermal and structural boundaries;

.2 thermal insulation of boundaries shall have due regard to the fire risk of the space and adjacent spaces; and

.3 the fire integrity of the divisions shall be maintained at openings and penetrations.

2 Thermal and structural boundaries

2.1 Thermal and structural subdivision

Ships of all types shall be subdivided into spaces by thermal and structural divisions having regard to the fire risks of the spaces.

2.2 Passenger ships

2.2.1 Main vertical zones and horizontal zones

2.2.1.1 In ships carrying more than 36 passengers, the hull, superstructure and deckhouses shall be subdivided into main vertical zones by "A-60" class divisions. Steps and recesses shall be kept to a minimum, but where they are necessary they shall also be "A-60" class divisions. Where a category (5), (9) or (10) space defined in paragraph 2.2.3.2.2 is on one side or where fuel oil tanks are on both sides of the division the standard may be reduced to "A-0".

2.2.1.2 In ships carrying not more than 36 passengers, the hull, superstructure and deckhouses in way of accommodation and service spaces shall be subdivided into main vertical zones by "A" class divisions. These divisions shall have insulation values in accordance with tables in paragraph 2.2.4.

2.2.1.2 As far as practicable, the bulkheads forming the boundaries of the main vertical zones above the bulkhead...
deck shall be in line with watertight subdivision bulkheads situated immediately below the bulkhead deck. The length and width of main vertical zones may be extended to a maximum of 48 m in order to bring the ends of main vertical zones to coincide with watertight subdivision bulkheads or in order to accommodate a large public space extending for the whole length of the main vertical zone provided that the total area of the main vertical zone is not greater than 1,600 m² on any deck. The length or width of a main vertical zone is the maximum distance between the furthermost points of the bulkheads bounding it.

2.2.1.3 Such bulkheads shall extend from deck to deck and to the shell or other boundaries.

2.2.1.4 Where a main vertical zone is subdivided by horizontal "A" class divisions into horizontal zones for the purpose of providing an appropriate barrier between a zone with sprinklers and a zone without sprinklers, the divisions shall extend between adjacent main vertical zone bulkheads and to the shell or exterior boundaries of the ship and shall be insulated in accordance with the fire insulation and integrity values given in table 9.4.

2.2.1.5.1 On ships designed for special purposes, such as automobile or railroad car ferries, where the provision of main vertical zone bulkheads would defeat the purpose for which the ship is intended, equivalent means for controlling and limiting a fire shall be substituted and specifically approved by the Administration. Service spaces and ship stores shall not be located on ro-ro decks unless protected in accordance with the applicable regulations.

2.2.1.5.2 However, in a ship with special category spaces, such spaces shall comply with the applicable provisions of regulation 20 and, where such compliance would be inconsistent with other requirements for passenger ships specified in this chapter, the requirements of regulation 20 shall prevail.

2.2.2 Bulkheads within a main vertical zone

2.2.2.1 For ships carrying more than 36 passengers, bulkheads which are not required to be "A" class divisions shall be at least "B" class or "C" class divisions as prescribed in the tables in paragraph 2.2.3.

2.2.2.2 For ships carrying not more than 36 passengers, bulkheads within accommodation and service spaces which are not required to be "A" class divisions shall be at least "B" class or "C" class divisions as prescribed in the tables in paragraph 2.2.4. In addition, corridor bulkheads, where not required to be "A" class, shall be "B" class divisions which
10. Which rule do all passenger ships built after 01.07.2010 have to fulfill, that have a length as defined in SOLAS Rule II-1/2.5 of 120 m or more or three or more vertical main fire zones?

Safe Return to Port
Enters into Force

1st July 2010

Amendment Details

The following new regulations 21, 22 and 23 are added after the existing regulation 20:

Amendment Consolidated

Note: Amendments are highlighted.

Regulation 21 - Casualty threshold, safe return to port and safe areas

1 Application

Passenger ships constructed on or after 1 July 2010 having length, as defined in regulation II-1/2.5, of 120 m or more or having three or more main vertical zones shall comply with the provisions of this regulation.

2 Purpose

The purpose of this regulation is to establish design criteria for a ship's safe return to port under its own propulsion after a casualty that does not exceed the casualty threshold stipulated in paragraph 3 and also provides functional requirements and performance standards for safe areas.

3 Casualty threshold

The casualty threshold, in the context of a fire, includes:

.1 loss of space of origin up to the nearest "A" class boundaries, which may be a part of the space of origin, if the space of origin is protected by a fixed fire extinguishing system; or

.2 loss of the space of origin and adjacent spaces up to the nearest "A" class boundaries, which are not part of the space of origin.

4 Safe return to port*
When fire damage does not exceed the casualty threshold indicated in paragraph 3, the ship shall be capable of returning to port while providing a safe area as defined in regulation 3. To be deemed capable of returning to port, the following systems shall remain operational in the remaining part of the ship not affected by fire:

.1 propulsion;
.2 steering systems and steering-control systems;
.3 navigational systems;
.4 systems for fill, transfer and service of fuel oil;
.5 internal communication between the bridge, engineering spaces, safety centre, fire-fighting and damage control teams, and as required for passenger and crew notification and mustering;
.6 external communication;
.7 fire main system;
.8 fixed fire-extinguishing systems;
.9 fire and smoke detection system;
.10 bilge and ballast system;
.11 power-operated watertight and semi-watertight doors;
.12 systems intended to support "safe areas" as indicated in paragraph 5.1.2;
.13 flooding detection systems; and
.14 other systems determined by the Administration to be vital to damage control efforts.

5 Safe area(s)

5.1 Functional requirements:

.1 the safe area(s) shall generally be internal space (s); however, the use of an external space as a safe area may be allowed by the Administration taking into account any restriction due to the area of operation and relevant expected environmental
.2 the safe area(s) shall provide all occupants with the following basic services* to ensure that the health of passengers and crew is maintained:

.1 sanitation;
.2 water;
.3 food;
.4 alternate space for medical care;
.5 shelter from the weather;
.6 means of preventing heat stress and hypothermia;
.7 light; and
.8 ventilation;

.3 ventilation design shall reduce the risk that smoke and hot gases could affect the use of the safe area(s); and

.4 means of access to life-saving appliances shall be provided from each area identified or used as a safe area, taking into account that a main vertical zone may not be available for internal transit.

5.2 Alternate space for medical care

Alternate space for medical care shall conform to a standard acceptable to the Administration.**

* Refer to the Performance standards for the systems and services to remain operational on passenger ships for safe return to port and orderly evacuation and abandonment after a casualty (MSC.1/Circ.1214).

** Refer to the Guidance on the establishment of medical and sanitation related programmes for passenger.

Regulation 22 - Design criteria for systems to remain operational after a fire casualty
1 Application

Passenger ships constructed on or after 1 July 2010 having length, as defined in regulation II-1/2.2, of 120 m or more or having three or more main vertical zones shall comply with the provisions of this regulation.

2 Purpose

The purpose of this regulation is to provide design criteria for systems required to remain operational for supporting the orderly evacuation and abandonment of a ship, if the casualty threshold, as defined in regulation 21.3, is exceeded.

3 Systems*

3.1 In case any one main vertical zone is unserviceable due to fire, the following systems shall be so arranged and segregated as to remain operational:

.1 fire main;

.2 internal communications (in support of fire-fighting as required for passenger and crew notification and evacuation);

.3 means of external communications;

.4 bilge systems for removal of fire-fighting water;

.5 lighting along escape routes, at assembly stations and at embarkation stations of life-saving appliances; and

.6 guidance systems for evacuation shall be available.

3.2 The above systems shall be capable of operation for at least 3 h based on the assumption of no damage outside the unserviceable main vertical zone. These systems are not required to remain operational within the unserviceable main vertical zones.

3.3 Cabling and piping within a trunk constructed to an "A-60" standard shall be deemed to remain intact and serviceable while passing through the unserviceable main vertical zone for the purposes of paragraph 3.1. An equivalent degree of protection for cabling and piping may be approved by the Administration.

* Refer to the Performance standards for the systems and
services to remain operational on passenger ships for safe return to port and orderly evacuation and abandonment after a casualty (MSC.1/Circ.1214).

**Regulation 23 - Safety centre on passenger ships**

1 **Application**

Passenger ships constructed on or after 1 July 2010 shall have on board a safety centre complying with the requirements of this regulation.

2 **Purpose**

The purpose of this regulation is to provide a space to assist with the management of emergency situations.

3 **Location and arrangement**

The safety centre shall either be a part of the navigation bridge or be located in a separate space adjacent to and having direct access to the navigation bridge, so that the management of emergencies can be performed without distracting watch officers from their navigational duties.

4 **Layout and ergonomic design**

The layout and ergonomic design of the safety centre shall take into account the guidelines developed by the Organization*, as appropriate.

5 **Communications**

Means of communication between the safety centre, the central control station, the navigation bridge, the engine control room, the storage room(s) for fire extinguishing system(s) and fire equipment lockers shall be provided.

6 **Control and monitoring of safety systems**

Notwithstanding the requirements set out elsewhere in the Convention, the full functionality (operation, control, monitoring or any combination thereof, as required) of the safety systems listed below shall be available from the safety centre:

1. all powered ventilation systems;
2. fire doors;
.3 general emergency alarm system;
.4 public address system;
.5 electrically powered evacuation guidance systems;
.6 watertight and semi-watertight doors;
.7 indicators for shell doors, loading doors and other closing appliances;
.8 water leakage of inner/outer bow doors, stern doors and any other shell door;
.9 television surveillance system;
.10 fire detection and alarm system;
.11 fixed fire-fighting local application system(s);
.12 sprinkler and equivalent systems;
.13 water-based systems for machinery spaces;
.14 alarm to summon the crew;
.15 atrium smoke extraction system;
.16 flooding detection systems; and
.17 fire pumps and emergency fire pumps.

* Refer to guidelines to be developed by the Organization.
11. What is the margin line and for what kind of ships is it relevant?

The margin line is an imaginary horizontal line 76mm below the freeboard deck. The margin line is only relevant for passenger ships built in accordance with SOLAS 90. These ships' margin line must not be submerged in the damage case. By introduction of the SOLAS 2009 the margin line criterion was abolished.
Part A: General
Regulation 3

3 **Breadth of the ship** is the extreme width from outside of frame to outside of frame at or below the deepest subdivision load line.

4 **Draught** is the vertical distance from the moulded base line amidships to the subdivision load line in question.

5 **Bulkhead deck** is the uppermost deck up to which the transverse watertight bulkheads are carried.

6 **Margin line** is a line drawn at least 76 mm below the upper surface of the bulkhead deck at side.

7 **Permeability of a space** is the percentage of that space which can be occupied by water. The volume of a space which extends above the margin line shall be measured only to the height of that line.

8 **Machinery space** is to be taken as extending from the moulded base line to the margin line and between the extreme main transverse watertight bulkheads, bounding the spaces containing the main and auxiliary propulsion machinery, boilers serving the needs of propulsion, and all permanent coal bunkers. In the case of unusual arrangements, the Administration may define the limits of the machinery spaces.

9 **Passenger spaces** are those spaces which are provided for the accommodation and use of passengers, excluding baggage, store, provision and mail rooms. For the purposes of regulations 5 and 6, spaces provided below the margin line for the accommodation and use of the crew shall be regarded as passenger spaces.

10 In all cases volumes and areas shall be calculated to moulded lines.

11 **Weathertight** means that in any sea conditions water will not penetrate into the ship.


13 **Ro–ro passenger ship** means a passenger ship with ro–ro cargo spaces or special category spaces as defined in regulation II-2/3.

Regulation 3
**Definitions relating to parts C, D and E**

For the purpose of parts C, D and E, unless expressly provided otherwise:

1 **Steering gear control system** is the equipment by which orders are transmitted from the navigation bridge to the steering gear power units.

---

* This relates to the chapter II-2 in force before 1 July 2002. The equivalent term in the amended chapter II-2 is “ro–ro spaces”. 

43
Part B

Subdivision and stability

(Part B applies to passenger ships and to cargo ships, as indicated in the regulations)

Regulation 4

Floodable length in passenger ships

1. The floodable length at any point of the length of a ship shall be determined by a method of calculation which takes into consideration the form, draught and other characteristics of the ship in question.

2. In a ship with a continuous bulkhead deck, the floodable length at a given point is the maximum portion of the length of the ship, having its centre at the point in question, which can be flooded under the definite assumptions set forth in regulation 5 without the ship being submerged beyond the margin line.

3.1 In the case of a ship not having a continuous bulkhead deck, the floodable length at any point may be determined to an assumed continuous margin line which at no point is less than 76 mm below the top of the deck (at side) to which the bulkheads concerned and the shell are carried watertight.

3.2 Where a portion of an assumed margin line is appreciably below the deck to which bulkheads are carried, the Administration may permit a limited relaxation in the watertightness of those portions of the bulkheads which are above the margin line and immediately under the higher deck.

Regulation 5

Permeability in passenger ships

1.1 The definite assumptions referred to in regulation 4 relate to the permeability of the spaces below the margin line.

1.2 In determining the floodable length, a uniform average permeability

* Instead of the requirements in this part, the Regulations on subdivision and stability of passenger ships as an equivalent to part B of chapter II of the International Convention for the Safety of Life at Sea, 1960, adopted by the Organization by resolution A.265(VIII), may be used, if applied in their entirety.
12. Please explain a typical propulsion concept for a passenger ship.

Large passenger vessel: Diesel-electric, n x four stroke medium speed diesel engines. Flexible generator power for demands by the hotel and propulsion – sea-voyage at night, and hotel during the day. 2 x FPP. Twin screw for enhanced manoeuvrability. FPP to avoid pressure side cavitation in off-design operation due to high demands in comfort and vibration.

13. Please mark the following in the general arrangement plan of the cruise vessel: bulkhead deck, all main fire zones as well as the watertight transverse bulkheads.

14. Please explain a typical propulsion concept for a ro-ro passenger ship.

Conventional Diesel-mechanic: 2 x CPP + Gear + four stroke medium speed diesels + PTO/PTI and additional generator sets. Twin screw for enhanced manoeuvrability. RoPax usually does not have separated times of hotel and propulsion mode. Diesel-mechanic offers better efficiency than diesel-electric propulsion. Four stroke engines require CPP.

15. Which intact stability criterions do passenger ships have to fulfill?

IS Code 2008. Additionally to valid criteria for cargo ships the maximum heel is restricted to 10 degrees for inclining moments in turning circles and passenger accumulation on one side of the ship.