

Ship Watertightness and Damage Stability

Amended Rules and Guidance

Rules for the Survey and Construction of Steel Ships Parts C, CS, and D
Rules for the Survey and Construction of Passenger Ships
Guidance for the Survey and Construction of Steel Ships Part D
Guidance for the Survey and Construction of Passenger Ships

Reason for Amendment

Chapter II-1 of the SOLAS Convention specifies requirements related to damage stability for the purpose of ensuring ship safety after collision and stranding. A comprehensive revision of the chapter was adopted by the IMO in June 2017, but it was subsequently pointed out that there were still some parts of it that needed further clarification and still some wording that needed further revision. The IMO, therefore, began reviewing the chapter once again.

As a result of this review, the IMO adopted amendments to Chapter II-1 as Resolution MSC.474(102) at the 102nd Session of the IMO Maritime Safety Committee (MSC102) held in November 2020. These amendments dealt mainly with revisions to requirements regarding the handling of the probability of survival (s_i) with regard to damage stability and the openings in bulkheads below bulkhead decks for passenger ships. In addition, revised explanatory notes to the damage stability requirements specified in Chapter II-1 were adopted as Resolution MSC.429(98)/Rev.2.

Accordingly, relevant requirements are amended based upon Resolutions MSC.474(102) and MSC.429(98)/Rev.2.

Outline of Amendment

The main amendments are as follows.

- (1) Amends requirements related to ship watertightness and damage stability, and clarifies requirements related to the handling of pipes and valves in damage stability calculations.
- (2) Amends requirements related to the handling of valves fitted on pipes passing through collision bulkheads.

“Rules for the survey and construction of steel ships” has been partly amended as follows:

Part C HULL CONSTRUCTION AND EQUIPMENT

Part 1 GENERAL HULL REQUIREMENTS

Chapter 2 GENERAL ARRANGEMENT DESIGN

2.3 Damage Stability

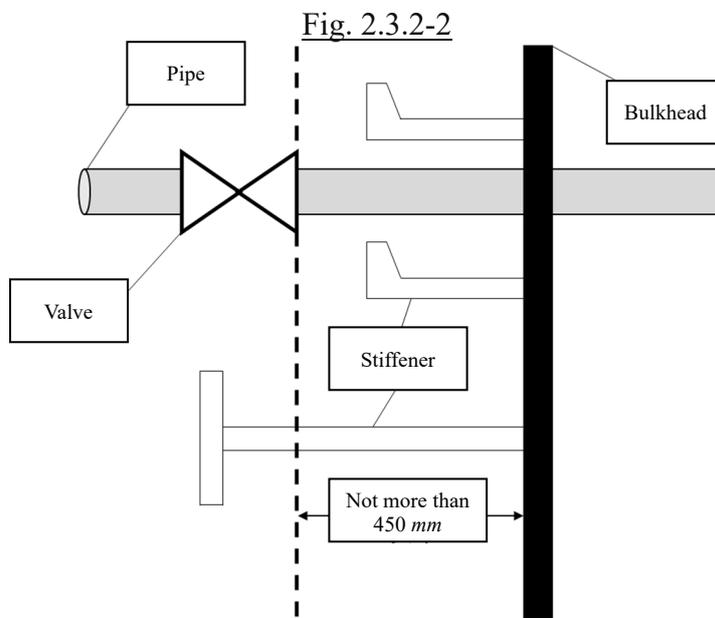
2.3.2 Subdivision Index

2.3.2.1 Subdivision Index

Sub-paragraph -11 has been amended as follows.

11 Pipes and valves directly adjacent or situated as close as practicable to a bulkhead or to a deck can be considered to be part of the bulkhead or deck, provided the separation distance on either side of the bulkhead or deck is of the same order as the bulkhead or deck stiffening structure. The same applies for small recesses, drain wells, etc. In no case is the separation distance on either side of the bulkhead or deck to be more than 450 mm measured from the valve's near end to the bulkhead or deck. An example is shown in Fig. 2.3.2-2.

Fig.2.3.2-2 has been added as follows.



2.3.2.2 Compartment Flooding Probability (p_i)

Sub-paragraph -1(1) has been amended as follows.

1 The Compartment Flooding Probability (p_i) for a compartment or group of compartments is to be determined by the following (1), (2) or (3) according to the number of damaged compartments:

(1) Where the damage involves a single zone only:

$$p_i = p(x_{1j}, x_{2j}) \cdot [r(x_{1j}, x_{2j}, b_k) - r(x_{1j}, x_{2j}, b_{k-1})]$$

Where:

(Omitted.)

b : The mean transverse distance (m) measured at right angles to the centreline at the deepest subdivision draught between the shell and an assumed vertical plane extended between the longitudinal limits used in calculating the factor p_i and which is a tangent to, or common with, all or part of the outermost portion of the longitudinal bulkhead under consideration. (See Fig. 2.3.2-23) This vertical plane is to be so orientated that the mean transverse distance to the shell is a maximum, but not more than twice the least distance between the plane and the shell. In any case, b is not to be taken as greater than $B/2$.

(Omitted.)

Fig.2.3.2-2 has been renumbered to Fig. 2.3.2-3.

Fig. 2.3.2-23 Examples of Assumed Vertical Plane (In Case of Single Damage Zone)

(Omitted.)

2.3.2.3 Probability of Survival (s_i)

Sub-paragraph -6 has been amended as follows.

6 Probability of survival (s_i) is to be taken as 0 in those cases where, ~~taking into account the final waterline (in consideration of sinkage, heel and trim, the openings in accordance with the following (1) and (2) immerse at the final waterline;~~ immerses the lower edge of openings through which progressive flooding may take place and such flooding is not accounted for in the calculation of the probability of survival (s_i). Such openings are to include air pipes, ventilators and openings which to be closed by means of weathertight doors or hatch covers.

~~(1) The openings through which progressive flooding may take place and such flooding is not accounted for in the calculation of the probability of survival (s_i)~~

~~(2) Air pipes, ventilators and the openings which are closed by means of weathertight doors or hatch covers~~

Chapter 14 EQUIPMENT

14.10 Doors

14.10.2 Side Shell Doors and Stern Doors

14.10.2.2 Arrangement of Doors

Sub-paragraph -2 has been amended as follows.

1 Doors are to be made weathertight.

2 Where the lower edges of any openings of the doors are situated below the freeboard deck, the doors are to be so designed as to ensure the same watertightness and structural integrity as the surrounding shell plating.

3 Notwithstanding the requirements in -2, the lower edges of the doors are not to be below a line drawn parallel to the freeboard deck at side, which has at its lowest point at least 230 *mm* above the upper edge of the uppermost load line, unless additional measures for ensuring watertightness such as the following (1) to (4) are implemented. However, notwithstanding the additional measures in (1) to (4), in no case are such doors to be fitted so as to have their lowest point below the deepest subdivision draught specified in 2.3.1.2(3).

(1) A second door of equivalent strength and watertightness is fitted inside the watertight door

(2) A leakage detection device is provided in the compartment between the two doors

(3) Drainage of this compartment to the bilges is controlled by a readily accessible screw-down valve

(4) The outer door opens outwards

4 The number of door openings is to be kept to the minimum compatible with design and proper operation of the ship.

5 Doors are generally to open outwards.

6 Shipside doors used for pilot transfer are to be in accordance with Regulation 23.5, Chapter V, *SOLAS* Convention.

Part CS HULL CONSTRUCTION AND EQUIPMENT OF SMALL SHIPS

Chapter 4 SUBDIVISIONS

4.2 Subdivision Index

4.2.3 Probability of Survival (s_i)

Sub-paragraph -6 has been amended as follows.

6 Probability of survival (s_i) is to be taken as 0 in ~~these cases where, taking into account the final waterline (in consideration of sinkage, heel and trim, the openings in accordance with the following (1) and (2) immerse at the final waterline:~~ immerses the lower edge of openings through which progressive flooding may take place and such flooding is not accounted for in the calculation of the probability of survival (s_i). Such openings are to include air pipes, ventilators and openings which to be closed by means of weathertight doors or hatch covers.

~~(1) The openings through which progressive flooding may take place and such flooding is not accounted for in the calculation of the probability of survival (s_i)~~

~~(2) Air pipes, ventilators and the openings which are closed by means of weathertight doors or hatch covers~~

Chapter 21 BULWARKS, GUARDRAILS, FREEING ARRANGEMENTS, CARGO PORTS AND OTHER SIMILAR OPENINGS, SIDE SCUTTLES, RECTANGULAR WINDOWS, VENTILATORS AND GANGWAYS

21.4 Side Shell Doors and Stern Doors

21.4.2 Arrangement of Doors

Sub-paragraph -2 has been amended as follows.

- 1** Doors are to be made weathertight.
- 2** Where the lower edges of any openings of the doors are situated below the freeboard deck, the doors are to be so designed as to ensure the same watertightness and structural integrity as the surrounding shell plating.
- 3** Notwithstanding the requirements in -2, the lower edges of the doors are not to be below a line drawn parallel to the freeboard deck at side, which has at its lowest point at least 230 *mm* above the deepest subdivision draught specified in 4.1.2(3), unless the implementation of additional measures for ensuring watertightness such as the following (1) to (4).
 - (1) A second door of equivalent strength and watertightness is to be fitted inside the watertight door
 - (2) A leakage detection device is provided in the compartment between the two doors
 - (3) Drainage of this compartment to the bilges is controlled by a readily accessible screw-down valve
 - (4) The outer door opens outwards
- 4** The number of door openings is to be kept to the minimum compatible with design and proper operation of the ship.
- 5** Doors are generally to open outwards.

Part D MACHINERY INSTALLATIONS

Chapter 13 PIPING SYSTEMS

13.2 Piping

13.2.5 Bulkhead Valves*

Sub-paragraph -2 has been amended as follows.

- 2** Pipes passing through collision bulkheads are to be ~~in accordance with the following (1) or (2):~~
- ~~(1) A suitable screw down valves or butterfly valves suitably supported by a seat or flanges that are operable from above the freeboard deck are to be fitted with and valve chests are to be secured to a bulkhead located inside the forepeak. However, these valves may be fitted on the aft side of the collision bulkhead in question provided that the valves are readily accessible under all service conditions, and that the space in which they are located is not a cargo space. Remote control devices for these valves may be omitted.~~
- ~~(2) Notwithstanding (1) above, in case where deemed appropriate by the Society, fitted with a remotely controlled valve capable of being operated from above the freeboard deck is to be fitted. The valve is to be normally closed. If the remote control system failure during operation of the valve, the valve is to be close automatically or be capable of being closed manually from a position above the freeboard deck. The valve may is to be located at the collision bulkhead on either the forward or aft side, provided the space on the aft side is not a cargo space.~~

13.4 Scuppers, Sanitary Discharges, etc.

Paragraph 13.4.4 has been amended as follows.

13.4.4 Ash-shoots and Rubbish-shoots

~~1 Inboard openings of ash shoots, rubbish shoots, etc. are to be provided with an efficient cover.~~
~~2 If the inboard openings prescribed in 1 are situated below the freeboard deck, the cover is to be watertight. In addition, automatic non-return valves are to be fitted in ash shoots, rubbish shoots, etc. in an easily accessible position above the tropical load line.~~

31 For ash-shoots and rubbish-shoots, instead of a non-return valve with a positive means of closing from a position above the freeboard deck, two gate valves, which comply with the following requirements, are acceptable.

- (1) The two gate valves are to be controlled from the working deck of the chute.
- (2) The lower gate valve is to be controlled from a position above the freeboard deck. An interlock system between the two valves is to be arranged.
- (3) The inboard end is to be located above the waterline formed by an 8.5 *degrees* heel to port or starboard at a draft corresponding to the assigned summer freeboard, but not less than 1,000 *mm* above the summer waterline. Where the inboard end exceeds 0.01 L_f above the summer waterline, valve control from the freeboard deck is not required provided that the inboard gate valve is always accessible under service conditions.

42 A hinged weathertight cover at the inboard end of the chute together with a discharge flap may be acceptable in lieu of the upper and lower gate valves that comply with the requirements in ~~31~~. In this case, the cover and flap are to be arranged with an interlock so that the discharge flap cannot be operated until the hopper cover is closed.

~~53~~ Controls for the gate valves and/or hinged covers are to be clearly marked: “Keep closed when not in use.”

~~64~~ For those ships in which the damage stability requirements specified in **2.3, Part 1, Part C** are applied; the following requirements are to be satisfied in cases where the inboard end of the chute is below the freeboard deck.

- (1) Inboard-end hinged covers/valves are to be watertight.
- (2) Valves are to be a screw-down non-return valve fitted in an easily accessible position above the deepest load line.
- (3) Screw-down non-return valves are to be controlled from positions above the bulkhead deck and provided with open/closed indicators. Valve controls are to be clearly marked: “Keep closed when not in use.”

“Rules for the survey and construction of passenger ships” has been partly amended as follows:

Part 3 HULL CONSTRUCTION AND EQUIPMENT

Chapter 6 WATERTIGHT BULKHEAD AND THE OPENING

6.3 Openings of Watertight Bulkhead

Paragraph 6.3.1 has been amended as follows.

6.3.1 Arrangement of Openings (*SOLAS* Chap. II-1 Regs. 12.4, 12.5, 12.6, 12.8, 13.1, 13.2, 13.3, 13.4 and 15.8.5)*

1 The number of openings in watertight ~~bulkheads~~ boundaries is to be reduced to the minimum compatible with the design and proper working of the ship, and the closing appliances for closing these openings such as manholes and watertight doors are to be provided.

2 No doors, manholes, or access openings are permitted:

- (1) in the collision bulkhead below the bulkhead deck;
- (2) in watertight transverse bulkheads dividing a cargo space from an adjoining cargo space, except as provided in paragraphs 6.4.6-1 and -3.

3 Except as provided in paragraph ~~4~~, ~~pipes passing through collision bulkheads are to be in accordance with the following (1) or (2):~~

~~(1) the collision bulkhead may be pierced below the bulkhead deck by not more than one pipe for dealing with fluid in the fore peak tank, provided that the pipe is fitted with a screw down valve capable of being operated from above the bulkhead deck, the valve chest being secured inside the fore peak to the collision bulkhead. The Society may, however, authorize the fitting of this valve on the after side of the collision bulkhead provided that the valve is readily accessible under all service conditions and the space in which it is located is not a cargo space.~~

~~(2) Notwithstanding (1) above, in case where deemed appropriate by the Society, the collision bulkhead may be pierced below the bulkhead deck by not more than one pipe for dealing with fluid in the forepeak tank, provided that the pipe is fitted with a remotely controlled valve capable of being operated from above the bulkhead deck. The valve is to be normally closed. If the remote control system failure during operation of the valve, the valve is to be close automatically or be capable of being closed manually from a position above the bulkhead deck. The valve ~~may~~ is to be located at the collision bulkhead on either the forward or aft side, provided the space on the aft side is not a cargo space.~~

4 If the fore peak is divided to hold two different kinds of liquids, the Society may allow the collision bulkhead to be pierced below the margin line by two pipes, each of which is fitted a screw down valve required by paragraph -3, provided the Society is satisfied that there is no practical alternative to the fitting of such a second pipe and that, having regard to the additional subdivision provided in the fore peak, the safety of the ship is maintained.

(-5 is omitted.)

Paragraph 6.3.2 has been amended as follows.

6.3.2 Penetration (SOLAS Chap. II-1 Regs. 13.2 and 15.8.5)*

1 Where pipes, scuppers, electric cables, etc., are carried through watertight subdivision ~~bulkheads~~ boundaries, arrangements are to be made to ensure the watertight integrity of ~~bulkheads~~ boundaries for design pressure by using weld and sleeve or penetration metallic material.

2 Valves not forming part of a piping system are not to be permitted in watertight subdivision ~~bulkheads~~ boundaries, even if the operation is possible from the above of bulkhead deck.

3 Lead or other heat sensitive materials are not to be used in systems which penetrate watertight subdivision ~~bulkheads~~ boundaries, where deterioration of such systems in the event of fire would impair the watertight integrity of the ~~bulkheads~~ boundaries.

4 The valve installed in the pipe penetrating the collision bulkhead is to be made from steel, bronze and the ductile material approved by the Society, except for the valve made from normal cast iron or resemblance.

6.4 Watertight Door

Paragraph 6.4.1 has been amended as follows.

6.4.1 General (SOLAS Chap. II-1 Regs. 13.5, ~~13.6~~, 13.7.4 and 16.1.3)*

1 Watertight doors, except as provided in paragraphs 6.4.6-1 or -3, are to be power-operated sliding doors complying with the requirements of paragraphs 6.4.2 and 6.4.3 ~~capable of being closed simultaneously from the central operating console at the navigating bridge in not more than 60 seconds with the ship in the upright position.~~

2 The means of operation whether by power or by hand of any power-operated sliding watertight door is to be capable of closing the door with the ship listed to 15 *degrees* either way. Consideration is also to be given to the forces which may act on either side of the door as may be experienced when water is flowing through the opening applying a static head equivalent to a water height of at least 1 *m* above the sill on the centreline of the door.

3 Watertight door controls, including hydraulic piping and electric cables, is to be kept as close as practicable to the bulkhead in which the doors are fitted, in order to minimize the likelihood of them being involved in any damage which the ship may sustain. The positioning of watertight doors and their controls are to be such that if the ship sustains damage within one fifth of the breadth of the ship, as defined in Part 4, such distance being measured at right angles to the centreline at the level of the deepest subdivision load line, the operation of the watertight doors clear of the damaged portion of the ship is not impaired.

~~4 All power-operated sliding watertight doors are to be provided with means of indication which will show at all remote operating positions whether the doors are open or closed. Remote operating positions are only to be at the navigating bridge as required by paragraph 6.4.2(5) and, at the location where hand operation above the bulkhead deck is required by paragraph 6.4.2(4).~~

~~5~~4 Control handles are to be provided at each side of the bulkhead at a minimum height of 1.6 *m* above the floor and are to be so arranged as to enable persons passing through the doorway to hold both handles in the open position without being able to set the power closing mechanism in operation accidentally. The direction of movement of the handles in opening and closing the door is to be in the direction of door movement and is to be clearly indicated.

~~6~~5 The frames of vertical watertight doors are to have no groove at the bottom in which dirt might lodge and prevent the door closing properly.

Paragraph 6.4.2 has been amended as follows.

6.4.2 Power-operated Sliding Watertight Door (SOLAS Chap. II-1 Regs. 13.76.1 and 22.2)*

Each power-operated sliding watertight door:

- (1) is to have a vertical or horizontal motion;
- (2) is to, subject to the requirement in 6.5.2, be normally limited to a maximum clear opening width of 1.2 *m*. The Society may permit larger doors only to the extent considered necessary for the effective operation of the ship provided that other safety measures, including the following, are taken into consideration:
 - (a) special consideration is to be given to the strength of the door and its closing appliances in order to prevent leakages;
 - (b) the door is to be located inboard the damage zone *B/5*;
 - (c) watertight doors located below the bulkhead deck having a maximum clear opening width of more than 1.2 *m* is to be kept closed when the ship is at sea;
- (3) is to be fitted with the necessary equipment to open and close the door using electric power, hydraulic power, or any other adequate form of power;
- (4) is to be provided with an individual hand-operated mechanism. It is to be possible to open and close the door by hand at the door itself from either side, and in addition, close the door from an accessible position above the bulkhead deck with an all round crank motion or some other movement providing the same degree of safety acceptable to the Society. Direction of rotation or other movement is to be clearly indicated at all operating positions. The time necessary for the complete closure of the door, when operating by hand gear, is not to exceed 90 *seconds* with the ship in the upright position. Visual indicators to show whether the door is open or closed are to be provided at the accessible position above the bulkhead deck;
- (5) is to be provided with controls for opening and closing the door by power from both sides of the door and also for closing the door by power from the central operating console(s) ~~at the navigating bridge~~ specified in 6.4.4;
- (6) is to be provided with an audible alarm, distinct from any other alarm in the area, which will sound whenever the door is closed remotely by power and which is to sound for at least 5 *seconds* but no more than 10 *seconds* before the door begins to move and is to continue sounding until the door is completely closed. In the case of remote hand operation it is sufficient for the audible alarm to sound only when the door is moving. Additionally, in passenger areas and areas of high ambient noise are to have the audible alarm to be supplemented by an intermittent visual signal at the door; and
- (7) is to have an approximately uniform rate of closure under power. The closure time, from the time the door begins to move to the time it reaches the completely closed position, is to in no case be less than 20 *seconds* or more than 40 *seconds* with the ship in the upright position.

Paragraph 6.4.3 has been amended as follows.

6.4.3 Power Control System (SOLAS Chap. II-1 Regs. 13.76.2, 13.76.3 and 13.76.5 to 13.76.8) (See Table 3.6.1)*

1 Power-operated ~~watertight-sliding~~ sliding watertight doors are to have either power system specified in the following (1) to (3). In addition, power systems for power-operated ~~watertight-sliding~~ sliding watertight doors are to be separate from any other power system. A single failure in the electric or hydraulic power-operated systems excluding the hydraulic actuator is not to prevent the hand operation of any door.

- (1) A centralized hydraulic system with two independent powers sources each consisting of a motor and pump capable of simultaneously closing all doors. In this case, the following requirements are to be supplied;
 - (a) There are to be for the whole installation hydraulic accumulators of sufficient capacity to operate all the doors at least three times, i.e. closed-open-closed, against an adverse list of 15 *degrees*. This operating cycle is to be capable of being carried out when the accumulator is at the pump cut-in pressure;
 - (b) The fluid used is to be chosen considering the temperatures liable to be encountered by the installation during its service.
 - (c) The power operating system is to be designed to minimize the possibility of having a single failure in the hydraulic piping adversely affect the operation of more than one door.
 - (d) The hydraulic system is to be provided with a low-level alarm for hydraulic fluid reservoirs serving the power-operated system and a low gas pressure alarm or other effective means of monitoring loss of stored energy in hydraulic accumulators. These alarms are to be audible and visual and are to be situated on the central operating console(s) ~~at the navigating bridge~~ specified in 6.4.4; or
- (2) An independent hydraulic system for each door with each power source consisting of a motor and pump capable of opening and closing the door. In this case, the following requirements are to be complied with:
 - (a) There is to be a hydraulic accumulator of sufficient capacity to operate the door at least three times, i.e. closed-open-closed, against an adverse list of 15 *degrees*. This operating cycle is to be capable of being carried out when the accumulator is at the pump cut-in pressure.
 - (b) The used fluid is to be chosen considering the temperatures liable to be encountered by the installation during its service.
 - (c) A low gas pressure group alarm, a low fluid level alarm for operating the oil tank of the accumulator, or other effective means of monitoring loss of stored energy in hydraulic accumulators are to be provided at the central operating console(s) ~~on the navigating bridge~~ specified in 6.4.4. Such alarms are to be both audible and visible. Loss of stored energy indication at each local operating position is also to be provided; or
- (3) An independent electrical system and motor for each door with each power source consisting of a motor capable of opening and closing the door. In this case, the power source is to be capable of being automatically supplied by the transitional source of emergency electrical power as required by 2.3.4, Part 6 in the event of failure of either the main or emergency source of electrical power and with sufficient capacity to operate the door at least three times, i.e. closed-open-closed against an adverse list of 15 *degrees*.

2 The electrical power required for power-operated sliding watertight doors is to be supplied from the emergency switchboard either directly or by a dedicated distribution board situated above the bulkhead deck. The associated control, indication and alarm circuits are to be supplied from the emergency switchboard either directly or by a dedicated distribution board situated above the bulkhead deck and be capable of being automatically supplied by the transitional source of emergency

electrical power required by 2.3.4, Part 6 in the event of failure of either the main or emergency source of electrical power.

3 As far as practicable, electrical equipment and components for watertight doors are to be situated above the bulkhead deck and outside hazardous areas and spaces.

4 The enclosures of electrical components necessarily situated below the bulkhead deck are to provide suitable protection against the ingress of water.

5 Electric power, control, indication and alarm circuits are to be protected against fault in such a way that a failure in one door circuit will not cause a failure in any other door circuit. Short circuits or other faults in the alarm or indicator circuits of a door are not to result in a loss of power operation of that door. Arrangements are to be such that leakage of water into the electrical equipment located below the bulkhead deck will not cause the door to open.

6 A single electrical failure in the power operating or control system of a power-operated sliding watertight door is not to result in a closed door opening. Availability of the power supply is to be continuously monitored at a point in the electrical circuit as near as practicable to each of the motors required by paragraph -1. Loss of any such power supply is to activate an audible and visual alarm at the central operating console(s) ~~at the navigating bridge~~ specified in 6.4.4.

Table 3.6.1 has been amended as follows.

Table 3.6.1 The Requirement for Watertight Power-control System

		Concentration hydraulic method	Hydraulic method	Electro motion system
Driving force		(Electric motor and hydraulic pump)×2	(Electric motor and hydraulic pump)×each door	(Electric motor)×each door
Supply power source	Power source system	Main power supply and emergency power supply		Main power supply, emergency power supply and temporary emergency power supply
	Operation, Display, Alarm device	Main power supply, emergency power supply and temporary emergency power supply		
	Blackout alarm device	○ (Center console of the bridge <u>navigation bridge safety centre</u>)		
Hydraulic accumulator	Number of hydraulic accumulator (close-open-close, three batches)	2 pieces	Each door	(Temporary emergency power supply)
	Low pressure visible and audible alarm system	○ (Central operating console at the navigation bridge <u>navigation bridge safety centre</u>)	○(Either an alarm or another effective means) (Central operating console at the navigation bridge <u>navigation bridge safety centre</u>)	—
	A low-level alarm for operating oil tank	○ (Central operating console at the navigation bridge <u>navigation bridge safety centre</u>)		—
Open operation of the door	Door side (*1) (*2)			
Close operation of the door	Door side (*2) and central operating console at the navigation bridge <u>navigation bridge safety centre</u> (*3)			
Door closure visible and audible alarm device	Door side (*4)			
Switching display unit	Central operating console at the navigation bridge <u>navigation bridge safety centre</u>			

Notes:

- (*1) : The doors are to be operated only at the door side.
- (*2) : The operation is to be carried out both by “local control mode” and by “doors closed mode”.
- (*3) : The doors are to be operated only by “doors closed mode”.
- (*4) : In the high noise level spaces like a machinery room, the blinking visual indicators are to be situated.

Paragraph 6.4.4 has been amended as follows.

6.4.4 Remote Control System (SOLAS Chap. II-1 Reg. 13.87)*

1 A central operating console for all power-operated sliding watertight doors is to be located in the safety centre in accordance with Regulation 23, Chapter II-2, SOLAS Convention. If the safety centre is located in a separate space adjacent to the navigation bridge, a central operating console is also to be located on the navigation bridge. The central operating console(s) ~~at the navigating bridge~~ is to have a “master mode” switch with two modes of control: a “local control” mode which is to allow any door to be locally opened and locally closed after use without automatic closure, and a “doors closed” mode which is to automatically close any door that is open in not more than 60 seconds with the ship in an upright position. The “doors closed” mode is to permit doors to be opened locally and shall automatically re-close the doors upon release of the local control mechanism. The “master mode” switch is to normally be in the “local control” mode. The “doors closed” mode is to only be used in an emergency or for testing purposes. ~~Special consideration is to be given to the reliability of the “master mode” switch.~~ Signboards or instructions are to be placed in way of the door advising how to act when the door is in the “doors closed” mode.

2 The central operating console(s) ~~at the navigating bridge~~ is to be provided with a diagram showing the location of each power-operated sliding watertight door, with visual indicators to show whether each door is open or closed. A red light is to indicate a door is fully open and a green light shall indicate a door is fully closed. When the door is closed remotely the red light is to indicate the intermediate position by flashing. The indicating circuit is to be independent of the control circuit for each door. Indication is also to be provided to the onboard stability computer, if installed in accordance with 2.5.1, Part 4.

3 It is not to be possible to remotely open any door from the central operating console.

Title of Paragraph 6.4.6 has been amended as follows.

6.4.6 Watertight Door in Cargo Space (SOLAS Chap. II-1 Regs. 13.98.1, 13.98.2, 14 and 22.65)*

Sub-paragraph -1 has been amended as follows.

1 If the Society is satisfied that such doors are essential, watertight doors having strength not less effective than the boundary members of the doors which are provided with the openings may be fitted in watertight bulkheads dividing cargo ~~between-deck~~ spaces on tween decks. Such doors may be hinged, rolling or sliding doors but are not to be remotely controlled. They are to be fitted at the highest level and as far from the shell plating as practicable, but in no case is to the outboard vertical edges be situated at a distance from the shell plating which is less than one fifth of the breadth of the ship, as defined in Part 1, such distance being measured at right angles to the centreline at the level of the deepest subdivision draught.

6.5 Trunk and Miscellaneous

Title of Paragraph 6.5.1 has been amended as follows.

6.5.1 Trunk (*SOLAS* Chap. II-1 Regs. 13.140 and 16-1)*

Sub-paragraph -1 has been amended as follows.

1 Where trunkways or tunnels for piping, or for any other purpose are carried through watertight bulkheads, they are to be watertight and in accordance with the requirements in -4 to -6. The access to at least one end of each such tunnel or trunkway, if used as a passage at sea, is to be through a trunk extending watertight to a height sufficient to permit access above the bulkhead deck. The access to the other end of the trunkway or tunnel may be through a watertight door ~~of the type required by its location in the ship~~. Such trunkways or tunnels are not to extend through the first subdivision bulkhead abaft the collision bulkhead.

Paragraph 6.5.2 has been amended as follows.

6.5.2 Portable Plates on Bulkhead (*SOLAS* Chap. II-1 Regs. 13.409 and 22.4)*

Portable plates on bulkheads are not to be permitted except in machinery spaces. Such plates always are to be in place before the voyage commences and are not to be removed during navigation except in case of urgent necessity at the discretion of the master. When any such portable plates are removed and replaced, the necessary precautions are to be taken in replacing them to ensure that the joints are watertight. The Society may permit not more than one power-operated sliding watertight door ~~in each main transverse bulkhead~~ larger than those specified in paragraph 6.4.2(2) to be substituted for these portable plates in each watertight bulkhead, provided these doors are closed before the voyage commences and remain closed during navigation except in case of urgent necessity at the discretion of the master. These doors need not meet the requirements of paragraph 6.4.2(4) regarding complete closure by hand-operated gear in 90 *seconds*. Power-operated sliding watertight doors permitted in machinery spaces in accordance with the provisions under this paragraph is to be closed before the voyage commences and is to remain closed during navigation except in case of urgent necessity at the discretion of the master.

Chapter 7 OPENINGS IN THE SHELL PLATING AND THE WATERTIGHT INTEGRITY

7.2 Openings below the Bulkhead Deck

Title of Paragraph 7.2.2 has been amended as follows.

7.2.2 Side Scuttle (*SOLAS* Chap. II-1 Regs. 15.3 to 15.6, ~~15.9~~, 22.6 and 22.13 to 22.15)*

Paragraph 7.2.3 has been amended as follows.

7.2.3 Gangway and Cargo Ports, etc. (*SOLAS* Chap. II-1 Regs. ~~15.9~~10 and ~~22.6~~7)

1 Gangway and cargo and fuelling ports fitted below the bulkhead deck and all watertight hatches are to be effectively closed and secured watertight before the voyage commences, and are to be kept closed during navigation. However, the master may permit a watertight hatch to be opened during navigation for a limited period of time sufficient to permit passage or for access. It is then to be closed.

2 ~~Ports provided in paragraph 1 are to be watertight and in no case be so fitted as to have their lowest point below the deepest subdivision draught.~~ Cargo ports and other similar openings (e.g. gangway and fuelling ports) in the side of ships below the bulkhead deck are to comply with following (1) to (3):

- (1) They are to be fitted with doors so designed as to ensure the same watertightness and structural integrity as the surrounding shell plating. Unless otherwise granted by the Society, these openings are to open outwards;
- (2) The number of such openings are to be the minimum compatible with the design and proper working of the ship;
- (3) In no case are these openings to be so fitted as to have their lowest point below the deepest subdivision draught.

7.3 Watertight Integrity and Openings above Bulkhead Deck

Paragraph 7.3.1 has been amended as follows.

7.3.1 Watertight Integrity above Bulkhead Deck (*SOLAS* Chap. II-1 Regs. ~~17.4~~2 to 17.3)

~~1 All reasonable and practicable measures are to be taken to limit the entry and spread of water above the bulkhead deck. Such measures may include partial bulkheads or webs. When partial watertight bulkheads and webs are fitted on the bulkhead deck, above or in the immediate vicinity of watertight bulkheads, they are to have watertight shell and bulkhead deck connections so as to restrict the flow of water along the deck when the ship is in a heeled damaged condition. Where the partial watertight bulkhead does not line up with the bulkhead below, the bulkhead deck between are to be made effectively watertight. Where openings, pipes, scuppers, electric cables etc. are carried through partial watertight bulkheads or decks within the immersed part of the bulkhead deck, arrangements is to be made to ensure the watertight integrity of the structure above the bulkhead deck.~~

1 The internal watertight subdivision arrangements to limit the entry and spread of water above the bulkhead deck is to be in accordance with the design arrangements necessary for compliance with the stability requirements in parts B-1, and B-2, Chapter II-2, *SOLAS* Convention if applicable. Where pipes, scuppers, electric cables, etc. are carried through internal watertight boundaries that are immersed at any intermediate or final stage of flooding in damage cases that contribute to the attained subdivision index (*A*), arrangements are to be made to ensure their watertight integrity.

2 Doors in internal watertight subdivision arrangements above the bulkhead deck, and also above the worst intermediate or final stage of flooding waterlines, are to be capable of preventing the

passage of water when immersed in the required range of positive stability for any damage cases contributing to the attained subdivision index (A). These doors may remain open provided they can be remotely closed from the navigation bridge. They are always to be ready to be immediately closed.

~~23~~ All openings in the exposed weather deck are to have coamings of ample height and strength and are to be provided with efficient means for expeditiously closing them weathertight. Freeing ports, open rails and scuppers are to be fitted as necessary for rapidly cleaning the weather deck of water under all weather conditions.

~~34~~ Air pipes terminating within a superstructure which are not fitted with watertight means of closure are to be considered as unprotected openings when applying 2.3.4-6, Part 4.

Title of Paragraph 7.3.2 has been amended as follows.

7.3.2 Openings above Bulkhead Deck (SOLAS Chap. II-1 Regs. 17.46, 17.57, 22.7 and 22.8)

7.4 Watertight Integrity of Ro-ro Passenger Ships

Paragraph 7.4.1 has been amended as follows.

7.4.1 Watertight Integrity from the Ro-ro Deck (Bulkhead Deck) to Spaces below (SOLAS Chap. II-1 Regs. 17-1.1 and 23.3)

1 In Ro-Ro passenger ships ~~subject to the provisions of subparagraphs (1) and (2)~~, all accesses from the ro-ro deck that leads to spaces below the bulkhead deck are to have a lowest point which is not less than 2.5 m above the bulkhead deck, unless the access is covered by the provisions of subparagraphs (1) or (2).

(1) ~~Where~~ vehicle ramps are installed to give access to spaces below the bulkhead deck, their openings are to be able to be closed weathertight to prevent ingress of water below, ~~alarmed and indicated to the navigation bridge~~ and fitted with alarms and open/close indicators on the navigation bridge. The means of closure is to be watertight if the deck is intended as a watertight horizontal in accordance with 2.3.6-6, Part 4;

(2) Subject to the following -2, the Society may permit the fitting of particular accesses to spaces below the bulkhead deck provided they are necessary for the essential working of the ship, e.g. the movement of machinery and stores, and subject to such accesses being made watertight, ~~alarmed and indicated to the navigation bridge~~ fitted with alarms and open/close indicators on the navigation bridge;

2 All accesses from the Ro-Ro deck and vehicle ramps that lead to spaces below the bulkhead deck are to be closed before the voyage commences and is to remain closed until the ship is at its next berth.

Part 4 SUBDIVISION AND STABILITY

Chapter 2 SUBDIVISION

2.3 Damage Stability

Paragraph 2.3.6 has been amended as follows.

2.3.6 Probability of Survival (s_i) (*SOLAS* Chap. II-1 Reg. 7-2)*

(-1 to -9 are omitted.)

10 Probability of survival (s_i) is to be taken as 0 in ~~those cases where, taking into account the final waterline (in consideration of sinkage, heel and trim, any of the following (1) to (3) immerse at the final waterline)~~ immerses any of the bulkhead deck considered a horizontal evacuation route for compliance with Chapter II-2, *SOLAS* Convention.

- ~~(1) The openings through which progressive flooding may take place and such flooding is not accounted for in the calculation of probability of survival (s_i)~~
~~(2) Air pipes, ventilators and the openings which are closed by means of weathertight doors or hatch covers~~
~~(3) Any of the bulkhead deck considered a horizontal evacuation route for compliance with Chapter II-2, *SOLAS* Convention~~

11 The probability of survival (s_i) is to be taken as 0 if, taking into account sinkage, heel and trim, any of the following (1) to ~~(3)~~ **(4)** occur in any intermediate stage or in the final stage of flooding:

- (1) Immersion of any vertical escape hatch in the bulkhead deck.
- (2) Any controls intended for the operation of watertight doors, valves on piping or on ventilation ducts intended to maintain the integrity of watertight bulkheads from above the bulkhead deck become inaccessible or inoperable.
- (3) Immersion of piping or ventilation ducts located within the assumed extent of damage and carried through a watertight boundary if this can lead to the progressive flooding of compartments not assumed as flooded.
- (4) Immersion of the lower edge of openings through which progressive flooding may take place and such flooding is not accounted for in the calculation of probability of survival (s_i). Such openings include air pipes, ventilators and openings which to be closed by means of weathertight doors or hatch covers.

(-12 to -13 are omitted.)

Chapter 3 DAMAGE CONTROL PLANS

3.2 Booklet and Plan for Damage Control

Paragraph 3.2.2 has been amended as follows.

3.2.2 Booklets

1 The booklet containing the information defined in 3.2.1 is to be provided which is made available to the officers of the ship.

2 With respect to the provision of 2.5.1(2), Part 4, the booklet is to include a reference to activation of damage stability support from the onboard stability computer, if installed, and to shore-based support when provided.

Part 5 MACHINERY INSTALLATIONS

Chapter 2 SCUPPERS, SANITARY DISCHARGES, ETC., BILGE AND BALLAST PIPING SYSTEMS

2.2 Scuppers, Sanitary Discharges, etc.

Paragraph 2.2.4 has been amended as follows.

2.2.4 Ash-shoot and Rubbish-shoot (~~SOLAS Reg. II-1/15.10~~ and **LOAD LINE Reg. 22-1**)

~~1~~ The inboard opening of each ash-shoot, rubbish-shoot, etc. is to be provided with an efficient cover.

~~2~~ If the inboard opening prescribed in ~~1~~ is situated below the bulkhead deck, the cover is to be watertight, and in addition an automatic non-return valve is to be fitted in the ash-shoot, rubbish-shoot, etc. at an easily accessible position above the deepest subdivision load line.

~~3~~**1** For ash-shoot and rubbish-shoot, two gate valves instead of the non-return valve with a positive means of closing from a position above the freeboard deck which comply with the following requirements are acceptable.

- (1) Two gate valves are to be controlled from the working deck of the chute.
- (2) The lower gate valve is to be controlled from a position above the freeboard deck. An interlock system between the two valves is to be arranged.
- (3) The inboard end is to be located above the waterline formed by an 8.5° *degrees* heel to port or starboard at a draft corresponding to the assigned summer freeboard, but not less than 1,000 mm above the summer waterline. Where the inboard end exceeds 0.01L_f above the summer waterline, valve control from the freeboard deck is not required, provided the inboard gate valve is always accessible under service conditions.

~~4~~**2** A hinged weathertight cover at the inboard end of the chute together with a discharge flap may be acceptable in lieu of the upper and lower gate valves complying with the requirements in ~~3~~**1**. In this case, the cover and flap are to be arranged with an interlock so that the discharge flap cannot be operated until the hopper cover is closed.

~~5~~**3** The controls for the gate valves and/or hinged covers are to be clearly marked: "Keep closed when not in use".

~~6~~**4** Where the inboard end of the chute is below the freeboard deck, following requirements are to be satisfied.

- (1) The inboard end hinged cover/valve is to be watertight.
- (2) The valve is to be a screw-down non-return valve fitted in an easily accessible position above the deepest load line.
- (3) The screw-down non-return valve is to be controlled from a position above the bulkhead deck and provided with open/closed indicators. The valve control is to be clearly marked: "Keep closed when not in use".

“Guidance for the survey and construction of steel ships” has been partly amended as follows:

Part CS HULL CONSTRUCTION AND EQUIPMENT OF SMALL SHIPS

CS4 SUBDIVISIONS

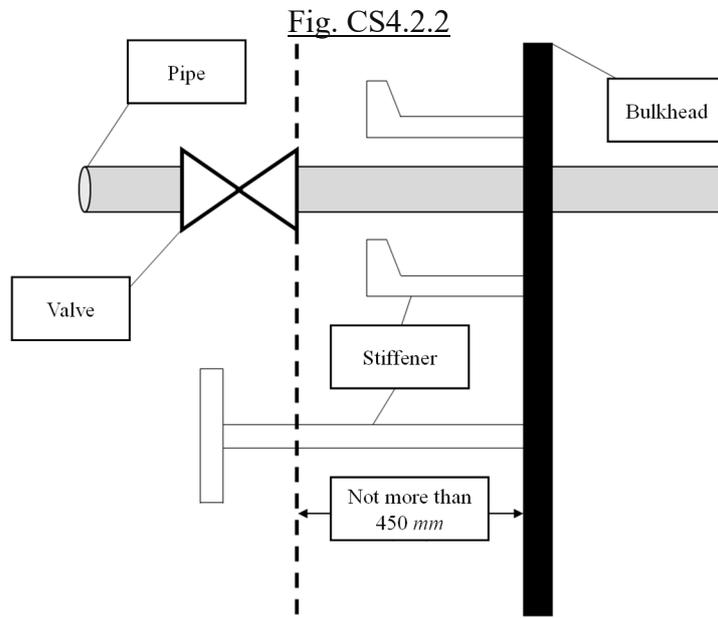
CS4.2 Subdivision Index

CS4.2.1 Subdivision Index

Sub-paragraph -8 has been amended as follows.

8 Pipes and valves directly adjacent or situated as close as practicable to a bulkhead or to a deck can be considered to be part of the bulkhead or deck, provided the separation distance on either side of the bulkhead or deck is of the same order as the bulkhead or deck stiffening structure. The same applies for small recesses, drain wells, etc. In no case is the separation distance on either side of the bulkhead or deck to be more than 450 mm measured from the valve's near end to the bulkhead or deck. An example is shown in Fig. CS4.2.2.

Fig. CS4.2.2 has been added as follows.



Paragraph CS4.2.2 has been amended as follows.

CS4.2.2 Compartment Flooding Probability (p_i)

In application of the requirement of 4.2.2-1, Part CS of the Rules, in case where the longitudinal bulkhead is not paralleled to the side shell plating, the assumed vertical plane which is considered in the determination of transverse distance (b) between longitudinal bulkhead and side shell plating is to be refer to a example specified in **Fig.CS4.2.23**.

Fig. CS4.2.2 has been renumbered to Fig. CS4.2.3.

Fig. CS4.2.23 Examples of Assumed Vertical Plane (In case of Single Damage Zone)
(Omitted.)

Part D MACHINERY INSTALLATIONS

D13 PIPING SYSTEMS

D13.2 Piping

D13.2.5 Bulkhead Valves

Sub-paragraph -5 has been deleted.

~~5 The wording “where deemed appropriate by the Society” in 13.2.5-2(2), Part D of the Rules means cases where the Administration has decided on the voluntary early implementation of the amendments in resolution in accordance with MSC.8/Circ.1.~~

“Guidance for the survey and construction of passenger ships” has been partly amended as follows:

Part 3 HULL CONSTRUCTION AND EQUIPMENT

Chapter 6 WATERTIGHT BULKHEAD AND THE OPENING

6.3 Openings of Watertight Bulkhead

6.3.1 Arrangement of Openings

Sub-paragraph -3 has been deleted.

1 “One pipe for dealing with fluid in the fore peak tank” specified in **6.3.1-3, Part 3** of the Rules means the pipe for ballasting. And, a void and a similar place are not included in the place meaning the wording “readily accessible under all service conditions” in **6.3.1-3, Part 3** of the Rules.

2 “One door, apart from the doors to shaft tunnels, may be fitted in each main transverse bulkhead” specified in **6.3.1-5, Part 3** of the Rules means the entrance for access or construction. However, the entrance for construction is not to be installed in the transverse bulkhead having the openings closed by the removable plate which is fixed by the bolt.

~~**3** The wording “where deemed appropriate by the Society” in **13.2.5 2(2), Part D of the Rules** means cases where the Administration has decided on the voluntary early implementation of the amendments in resolution in accordance with *MSC.8/Circ.1*.~~

6.4 Watertight Door

6.4.1 General

Sub-paragraph -5 has been amended as follows.

5 In the application of **6.4, Part 3 of the Rules**, the relevant part of the latest IMO Resolution MSC.429(98) “REVISED EXPLANATORY NOTES TO THE SOLAS CHAPTER II-1 SUBDIVISION AND DAMAGE STABILITY REGULATIONS” is to be referred to meet the requirements of Regulation ~~17.1~~ 17.2 and 17.3, Chapter II-1, of SOLAS Convention.

Chapter 7 OPENINGS IN THE SHELL PLATING AND THE WATERTIGHT INTEGRITY

7.2 Openings below the Bulkhead Deck

Paragraph 7.2.3 has been added as follows.

7.2.3 Gangway and Cargo Ports, etc.

Requirement of 7.2.3-1, Part 3 of the Rules applies to any hatches that are considered watertight in the damage stability calculations.

7.4 Watertight Integrity of Ro-ro Passenger Ships

Paragraph 7.4.1 has been added as follows.

7.4.1 Watertight Integrity from the Ro-ro Deck (Bulkhead Deck) to Spaces Below

If a non-watertight vehicle ramp closure is assumed to restrict the flow of water during the calculation of the attained subdivision index (A), the vehicle ramp opening is to be in accordance with 2.3.6-11(4), Part 4 of the Rules.

Part 4 SUBDIVISION AND STABILITY

Chapter 2 SUBDIVISION

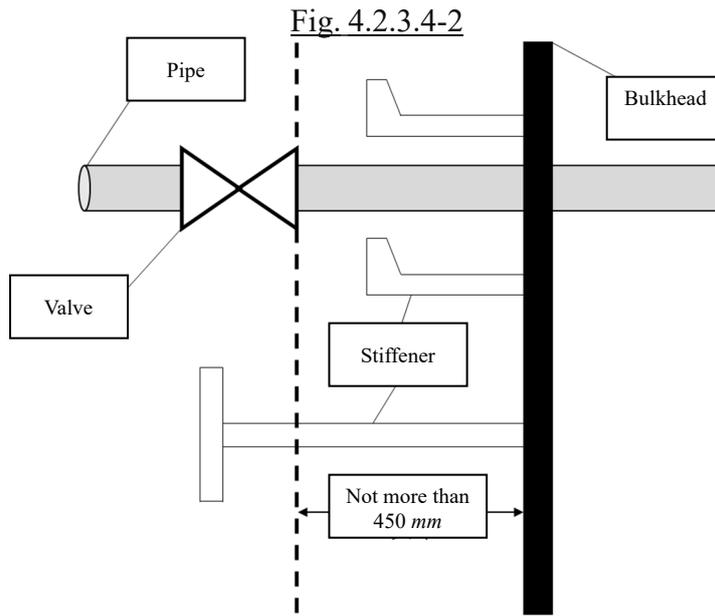
2.3 Damage Stability

2.3.4 Subdivision Index

Sub-paragraph -6 has been amended as follows.

6 Pipes and valves directly adjacent or situated as close as practicable to a bulkhead or to a deck can be considered to be part of the bulkhead or deck, provided the separation distance on either side of the bulkhead or deck is of the same order as the bulkhead or deck stiffening structure. The same applies for small recesses, drain wells, etc. In no case is the separation distance on either side of the bulkhead or deck to be more than 450 mm measured from the valve's near end to the bulkhead or deck. An example is shown in Fig. 4.2.3.4-2.

Fig. 4.2.3.4-2 has been added as follows.

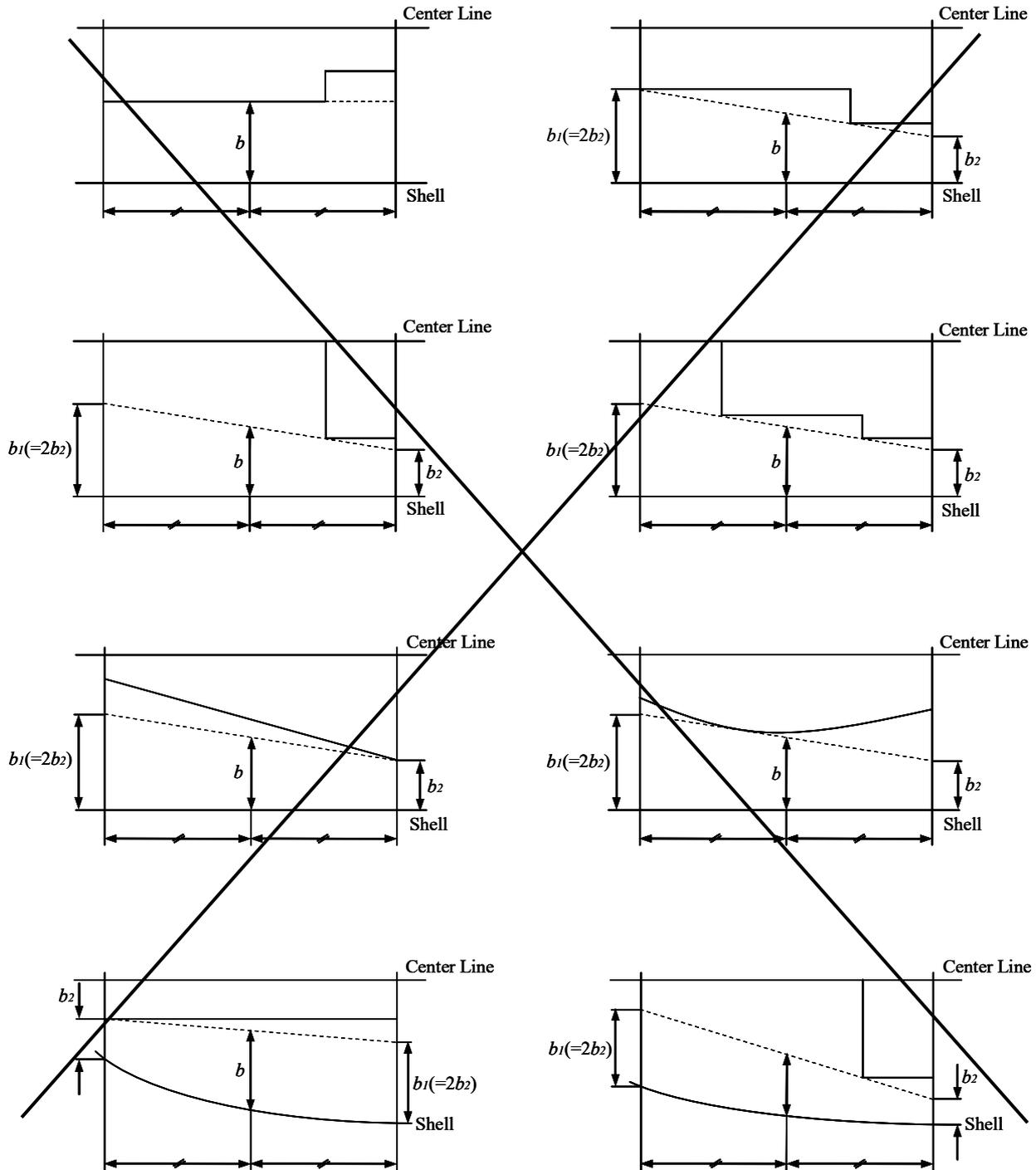


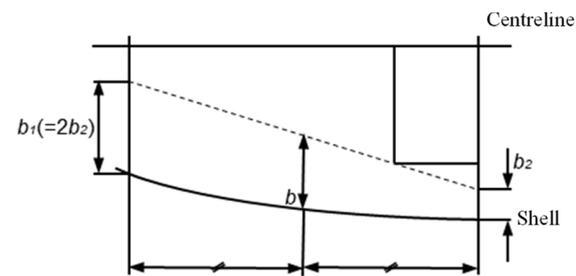
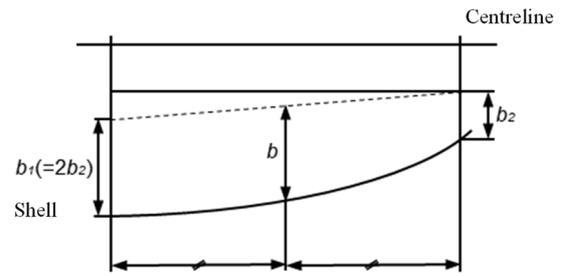
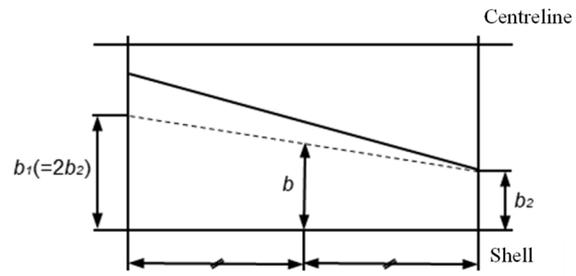
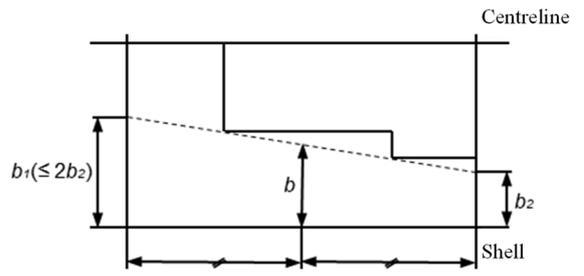
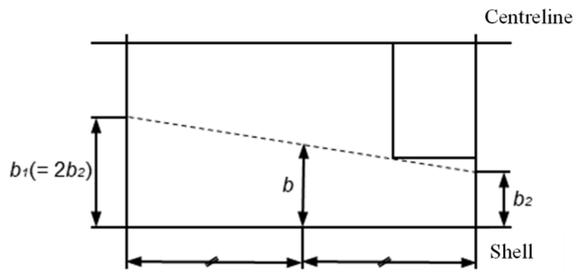
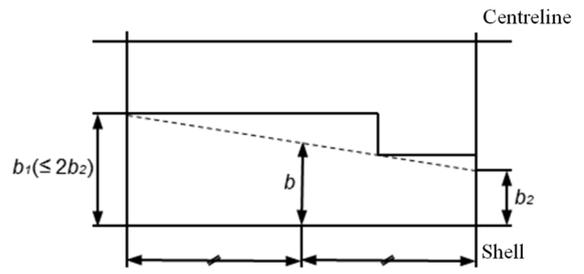
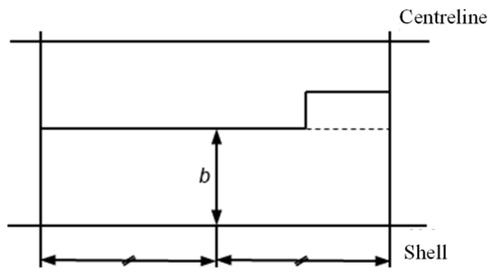
2.3.5 Compartment Flooding Probability (p_i)

In application of the requirement of 2.3.5-1, Part 4 of the Rules, in case where the longitudinal bulkhead is not paralleled to the side shell plating, the assumed vertical plane which is considered in the determination of transverse distance (b) between longitudinal bulkhead and side shell plating is to be refer to a example specified in Fig. 4.2.3.5.

Fig. 4.2.3.5 has been amended as follows.

Fig. 4.2.3.5 Examples of Assumed Vertical Plane (In case of single damage zone)





Chapter 3 DAMAGE CONTROL PLANS

Section 3.2 has been added as follows.

3.2 Booklet and Plan for Damage Control

3.2.1 Damage Control Plans

Damage control plans are to be prepared in consideration of the following:

- (1) Provide the plan in colour and ensure that it is legible when printed;
- (2) Provide a legend describing each symbol used within the plan;
- (3) Clearly identify the location of damage control equipment and damage equipment lockers on the plan;
- (4) Provide compartment identification consistent with the damage control booklet and the stability computer information, as applicable;
- (5) Highlight access points (stairways and ladders) as follows:
 - (a) Indicate the compartment and deck to be accessed;
 - (b) Indicate whether an access point represents both up and down or only one way transit (at the bottom of the stair or ladder); and
 - (c) Indicate all hatches;
- (6) Shading of key features may be used on the damage control plan to clearly depict essential information regarding the ship's watertight subdivision and related equipment;
- (7) Depict watertight doors and semi-watertight doors;
- (8) Indicate the locations of sounding pipes for all spaces with a sounding pipe, including void spaces;
- (9) In addition to the bilge and ballast pumps, indicate the location of any other relevant pumps referred to in the damage control booklet; and
- (10) The inboard profile plan is to indicate the compartment boundaries with the list of watertight closing appliances necessary to ensure the watertight integrity of the compartment and the list of tanks and description of spaces within the compartment (See Fig. 4.3.2.1).
- (11) Where fittings or equipment are common in both fire and damage control plans of passenger ships, the graphical symbols used in damage control plans are to be in accordance with the "Graphical symbols for shipboard fire control plans" (IMO Resolution A.952(23)).

Fig.4.3.2.1 has been added as follows.

Fig. 4.3.2.1 Example of Inboard Profile Plan

