Chapter 2 GENERAL ARRANGEMENT DESIGN

Section 1 SUBDIVISION ARRANGEMENT

1. Number and arrangement of transverse watertight bulkheads

1.1 Number of watertight bulkheads

1.1.1 General

All ships, in addition to complying with the requirements of **1.1.2**, are to have at least the following transverse watertight bulkheads:

- one collision bulkhead
- one after peak bulkhead
- two bulkheads forming the boundaries of the machinery space in ships with machinery amidships, and a bulkhead forward of the machinery space in ships with machinery aft. In the case of ships with an electrical propulsion plant, both the generator room and the engine room are to be enclosed by watertight bulkheads.

1.1.2 Additional bulkheads

For ships not required to comply with subdivision requirements, transverse bulkheads adequately spaced, and not less in number than indicated in **Table 1**, are to be fitted.

Table 1 Number of bulkheads

Length (*m*)	Number of bulkheads for ships with aft machinery(1)	Numbers of bulkheads for other ships
$90 \le L < 105$	4	5
$105 \le L < 120$	5	6
$120 \le L < 145$	6	7
$145 \le L < 165$	7	8
$165 \le L < 190$	8	9
$L \ge 190$	To be defined on a case by case basis	
(1) After peak bulkhead and aft machinery bulkhead are the same.		

2. Collision bulkhead

2.1 Arrangement of collision bulkhead

2.1.1

Ref. SOLAS Ch. II-1, Part B, Reg. 11

A collision bulkhead is to be fitted which is to be watertight up to the freeboard deck. This bulkhead is to be located at a distance from the forward perpendicular FP_{LL} of not less than 5% of the length L_{LL} of the ship or 10 *m*, whichever is the less, and not more than 8% of L_{LL}.

2.1.2

Ref. SOLAS Ch. II-1, Part B, Reg. 11

Where any part of the ship below the waterline extends forward of the forward perpendicular, e.g. a bulbous bow, the distances, in metres, stipulated in **[2.1.1]** are to be measured from a point either:

- at the mid-length of such extension, or
- at a distance 1.5% of the length L_{LL} of the ship forward of the forward perpendicular, or
- at a distance 3 *m* forward of the forward perpendicular

2.1.3

Ref. SOLAS Ch. II-1, Part B, Reg. 11

The bulkhead may have steps or recesses provided they are within the limits prescribed in **2.1.1** or **2.1.2**.

No door, manhole, ventilation duct or any other opening is to be fitted in this bulkhead.

3. After peak, machinery space bulkheads and stern tubes

3.1

3.1.1 General

Ref. SOLAS Ch. II-1, Part B, Reg. 11

An after peak bulkhead, and bulkheads dividing the machinery space from the cargo spaces forward and aft, are also to be fitted and made watertight up to the freeboard deck. The after peak bulkhead may, however, be stepped below the bulkhead deck, provided the degree of safety of the ship as regards subdivision is not thereby diminished.

3.1.2 Sterntubes

Ref. SOLAS Ch. II-1, Part B, Reg. 11

Sterntubes are to be enclosed in a watertight space (or spaces) of moderate volume. Other measures to minimise the danger of water penetrating into the ship in case of damage to sterntube arrangements may be taken at the discretion of the Society.

4. Number and arrangement of tank bulkheads

4.1 Bulkheads in compartments intended for the carriage of liquid cargoes

4.1.1

The number and location of transverse and longitudinal watertight bulkheads in compartments intended for the carriage of liquid cargoes are to comply with the subdivision requirements to which the ship is subject.

5. Arrangement of transverse watertight bulkheads

5.1 General

5.1.1

Where it is not practicable to arrange a watertight bulkhead in one plane, a stepped bulkhead may be fitted. In this case, the part of the deck which forms the step is to be watertight and equivalent in strength to the bulkhead.

6. Openings in watertight bulkheads

6.1 General

6.1.1

Ref. SOLAS Ch. II-1, Part B-1, Reg. 25-9 and IMO Res. A.684(17) - Part B

The number of openings in watertight subdivisions is to be kept to a minimum compatible with the design and proper working of the ship. Where penetrations of watertight bulkheads and internal decks are necessary for access, piping, ventilation, electrical cables, etc., arrangements are to be made to maintain the watertight integrity. The Society may permit relaxation in the watertightness of openings above the freeboard deck, provided that it is demonstrated that any progressive flooding can be easily controlled and that the safety of the ship is not impaired.

6.1.2

No door, manhole ventilation duct or any other opening is permitted in the collision bulkhead below the subdivision deck.

6.1.3

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

6.1.4

Valves not forming part of a piping system are not permitted in watertight subdivision bulkheads.

6.1.5

The requirements relevant to the degree of tightness, as well as the operating systems, for doors or other closing appliances complying with the provisions in **6.2** and **6.3** are specified in **Table 2**.

6.2 Openings in the watertight bulkheads below the freeboard deck

6.2.1 Openings used while at sea

Ref. SOLAS Ch. II-1, Part B-1, Reg. 25-9

Doors provided to ensure the watertight integrity of internal openings which are used while at sea are to be sliding watertight doors capable of being remotely closed from the bridge and are also to be operable locally from each side of the bulkhead. Indicators are to be provided at the control position showing whether the doors are open or closed, and an audible alarm is to be provided at the door closure. The power, control and indicators are to be operable in the event of main power failure. Particular attention is to be paid to minimise the effect of control system failure. Each power-operated sliding watertight door is to be provided with an individual hand-operated mechanism. The possibility of opening and closing the door by hand at the door itself from both sides is to be assured.

6.2.2 Openings normally closed at sea

Ref. SOLAS Ch. II-1, Part B-1, Reg. 25-9

Access doors and access hatch covers normally closed at sea, intended to ensure the watertight integrity of internal openings, are to be provided with means of indication locally and on the bridge showing whether these doors or hatch covers are open or closed. A notice is to be affixed to each such door or hatch cover to the effect that it is not to be left open. The use of such doors and hatch covers is to be authorised by the officer of the watch.

6.2.3 Doors or ramps in large cargo spaces

Ref. SOLAS Ch. II-1, Part B-1, Reg. 25-9

Watertight doors or ramps of satisfactory construction may be fitted to internally subdivide large cargo spaces, provided that the Society is satisfied that such doors or ramps are essential. These doors or ramps may be hinged, rolling or sliding doors or ramps, but are not to be remotely controlled.

Such doors are to be closed before the voyage commences and are to be kept closed during navigation. Should any of the doors or ramps be accessible during the voyage, they are to be fitted with a device which prevents unauthorised opening.

The word “satisfactory” means that scantlings and sealing requirements for such doors or ramps are to be sufficient to withstand the maximum head of the water at the flooded waterline.

6.2.4 Openings permanently kept closed at sea

Ref. SOLAS Ch. II-1, Part B-1, Reg. 25-9

Other closing appliances which are kept permanently closed at sea to ensure the watertight integrity of internal openings are to be provided with a notice which is to be affixed to each such closing appliance to the effect that it is to be kept closed. Manholes fitted with closely bolted covers need not be so marked.

6.3 Openings in the bulkheads above the freeboard deck

6.3.1 General

The openings in flooding boundaries located below the waterline at the equilibrium of the final stage of flooding are to be watertight. The openings immersed within the range of the positive righting lever curve are only to be weathertight.

6.3.2 Doors used while at sea

Ref. SOLAS Ch. II-1, Part B-1, Reg. 25-9

The doors used while at sea are to be sliding doors capable of being remotely closed from the bridge and are also to be operable locally from each side of the bulkhead. Indicators are to be provided at the control position showing whether the doors are open or closed, and an audible alarm is to be provided at the door closure. The power, control and indicators are to be operable in the event of main power failure. Particular attention is to be paid to minimise the effect of control system failure. Each power-operated sliding watertight door is to be provided with an individual hand-operated mechanism. It should be possible to open and close the door by hand at the door itself from both sides.

6.3.3 Doors normally closed at sea

Ref. SOLAS Ch. II-1, Part B-1, Reg. 25-9

The doors normally closed at sea are to be provided with means of indication locally and on the bridge showing whether these doors are open or closed. A notice is to be affixed to each door to the effect that it is not to be left open.

6.3.4 Openings kept permanently closed at sea

Ref. SOLAS Ch. II-1, Part B-1, Reg. 25-9

The doors kept closed at sea are to be hinged doors. Such doors and the other closing appliances which are kept closed at sea are to be provided with a notice affixed to each closing appliance to the effect that it is to be kept closed. Manholes fitted with closely bolted covers need not be so marked.

Table 2 Doors

			Sliding type			Hinged type			Rolling type (cargo between deck spaces)
			Remote operation indication on the bridge	Indicator on the bridge	Local operation only	Remote operation indication on the bridge	Indicator on the bridge	Local operation only	
Watertight	Below the freeboard deck	Open at sea	X						
		Normally closed(2)		X			X(3)		
		Remain closed(2)			X(4)(5)			X(4)(5)	X(4)(5)
Weathertight /watertight(1)	Above the freeboard deck	Open at sea	X						
		Normally closed(2)		X			X		
		Remain closed(2)						X(4)(5)	

(1) Watertight doors are required when they are located below the waterline at the equilibrium of the final stage of flooding; otherwise a weathertight door is accepted.

(2) Notice to be affixed on both sides of the door: “to be kept closed at sea”.

(3) Type *A* ships of 150 *m* and upwards, and Type *B* ships with a reduced freeboard may have a hinged watertight door between the engine room and the steering gear space, provided that the sill of this door is above the summer load waterline.

(4) The door is to be closed before the voyage commences.

(5) If the door is accessible during the voyage, a device which prevents unauthorised opening is to be fitted.

Section 2 COMPARTMENT ARRANGEMENT

1. Definitions

1.1 Cofferdam

1.1.1

A cofferdam means an empty space arranged so that compartments on each side have no common boundary; a cofferdam may be located vertically or horizontally. As a rule, a cofferdam is to be properly ventilated and of sufficient size to allow proper inspection, maintenance and safe evacuation.

1.2 Machinery spaces of category *A*

1.2.1

Ref. SOLAS Ch. II-2, Part A, Reg. 3.31

Machinery spaces of category A are those spaces or trunks to such spaces which contain:

- internal combustion machinery used for main propulsion; or
- internal combustion machinery used for purposes other than propulsion where such machinery has in the aggregate a total power output of not less than 375 *kW*; or
- any oil fired boiler or fuel oil unit.

2. Cofferdams

2.1 Cofferdam arrangement

2.1.1

Cofferdams are to be provided between compartments intended for liquid hydrocarbons (fuel oil, lubricating oil) and those intended for fresh water (drinking water, water for propelling machinery and boilers) as well as tanks intended for the carriage of liquid foam for fire extinguishing.

2.1.2

Cofferdams separating fuel oil tanks from lubricating oil tanks and the latter from those intended for the carriage of liquid foam for fire extinguishing or fresh water or boiler feed water may be waived when deemed impracticable or unreasonable by the Society in relation to the characteristics and dimensions of the spaces containing such tanks, provided that:

- the thickness of common boundary plates of adjacent tanks is increased, with respect to the thickness obtained according to **Ch 6**, **Sec 1**, by 2 *mm* in the case of tanks carrying fresh water or boiler feed water, and by 1 *mm* in all other cases
- the sum of the throats of the weld fillets at the edges of these plates is not less than the thickness of the plates themselves
- the structural test is carried out with a head increased by 1 *m* with respect to **Ch 11**, **Sec 3**.

2.1.3

Spaces intended for the carriage of flammable liquids are to be separated from accommodation and service spaces by means of a cofferdam.

2.1.4

Cofferdams are only required between fuel oil double bottoms and tanks immediately above where the inner bottom plating is subjected to the head of fuel oil contained therein, as in the case of a double bottom with its top raised at the sides.

Where a corner to corner situation occurs, tanks are not considered to be adjacent.

Adjacent tanks not separated by cofferdams are to have adequate dimensions to ensure easy inspection.

3. Double bottoms

3.1 General

3.1.1

Ref. SOLAS Ch. II-1, Part B, Reg. 12-1

A double bottom is to be fitted extending from the collision bulkhead to the after peak bulkhead, as far as this is practicable and compatible with the design and proper working of the ship.

3.1.2

Ref. SOLAS Ch. II-1, Part B, Reg. 12-1

Where a double bottom is required to be fitted, its depth is to satisfy the provisions of **Ch 3, Sec 6, 6** and the inner bottom is to be continued out to the ship side in such a manner as to protect the bottom to the turn of the bilge.

3.1.3

Ref. SOLAS Ch. II-1, Part B, Reg. 12-1

Small wells constructed in the double bottom, in connection with the drainage arrangements of holds, are not to extend in depth more than necessary. A well extending to the outer bottom, may, however, be permitted at the after end of the shaft tunnel of the ship. Other wells may be permitted by the Society if it is satisfied that the arrangements give protection equivalent to that afforded by a double bottom complying with **3.1**.

3.1.4

Ref. SOLAS Ch. II-1, Part B, Reg. 12-1

A double bottom need not be fitted in way of watertight compartments used exclusively for the carriage of liquids, provided the safety of the ship in the event of bottom damage is not, in the opinion of the Society, thereby impaired.

4. Compartment forward of the collision bulkhead

4.1 General

4.1.1

The fore peak and other compartments located forward of the collision bulkhead may not be arranged for the carriage of fuel oil or other flammable products.

5. Minimum bow height

5.1 General

5.1.1

Ref. ILLC, as amended (Resolution MSC.143(77) Reg. 39(1))

The bow height F_b, defined as the vertical distance at the forward perpendicular between the waterline corresponding to the assigned summer freeboard and the designed trim and the top of the exposed deck at side, is to be not less than:

$$F_b = (6075(L_{LL}/100) - 1875(L_{LL}/100)^2 + 200(L_{LL}/100)^3)(2.08 + 0.609C_B - 1.603C_{wf} - 0.0129(L/T_1))$$

where:

F_b : Calculated minimum bow height, in *mm*

T_1 : Draught at 85% of the depth for freeboard D_1, in *m*

D_1 : Depth for freeboard, is the moulded depth amidship plus the freeboard deck thickness at side. The depth for freeboard in a ship having a rounded gunwale with a radius greater than 4% of the breadth (B) or having topsides of unusual form is the depth for freeboard of a ship having a midship section with vertical topsides and with the same round of beam and area of topside section equal to that provided by the actual midship section.

C_{wf} : Waterplane area coefficient forward of $L_{LL}/2$:

$$C_{wf} = \frac{A_{wf}}{\frac{L_{LL}}{2} B}$$

A_{wf} : Waterplane area forward of $L_{LL}/2$ at draught T_1, in m^2.

For ships to which timber freeboards are assigned, the summer freeboard (and not the timber summer freeboard) is to be assumed when applying the formula above.

5.1.2

Ref. ILLC, as amended (Resolution MSC.143(77) Reg. 39.(2))

Where the bow height required in paragraph **5.1.1** is obtained by sheer, the sheer is to extend for at least 15% of the length of the ship measured from the forward perpendicular. Where it is obtained by fitting a superstructure, such superstructure is to extend from the stem to a point at least 0.07*L* abaft the forward perpendicular, and is to be enclosed as defined **Ch 9**, **Sec 4**.

5.1.3

Ref. ILLC, as amended (Resolution MSC.143(77) Reg. 39(3))

Ships which, to suit exceptional operational requirements, cannot meet the requirements in **5.1.1** and **5.1.2** will be considered by the Society on a case by case basis.

5.1.4

Ref. ILLC, as amended (Resolution MSC.143(77) Reg. 39(4, a))

The sheer of the forecastle deck may be taken into account, even if the length of the forecastle is less than 0.15*L*, but greater than 0.07*L*, provided that the forecastle height is not less than one half of standard height of superstructure between 0.07*L* and the forward perpendicular.

5.1.5

Ref. ILLC, as amended (Resolution MSC.143(77) Reg. 39(4, b))

Where the forecastle height is less than one half of the standard height of superstructure, the credited bow height may be determined as follows:

a) Where the freeboard deck has sheer extending from abaft 0.15*L*, by a parabolic curve having its origin at 0.15*L* abaft the forward perpendicular at a height equal to the midship depth of the ship, extended through the point of intersection of forecastle bulkhead and deck, and up to a point at the forward perpendicular not higher than the level of the forecastle deck (as illustrated in **Fig. 1**). However, if the value of the height denoted h_t in **Fig. 1** is smaller than the value of the height denoted h_b then h_t may be replaced by h_b in the available bow height, where:

$$h_t = Z_b\left(\frac{0.15L}{x_b}\right)^2 - Z_t$$

Z_b : As defined in **Fig. 1**

Z_t : As defined in **Fig. 1**

h_f : Half standard height of superstructure

b) Where the freeboard deck has sheer extending for less than 0.15*L* or has no sheer, by a line from the forecastle deck at side at 0.07*L* extended parallel to the base line to the forward perpendicular (as illustrated in **Fig. 2**).

Fig. 1 Credited bow height where the freeboard deck has sheer extending from abaft 0.15*L*

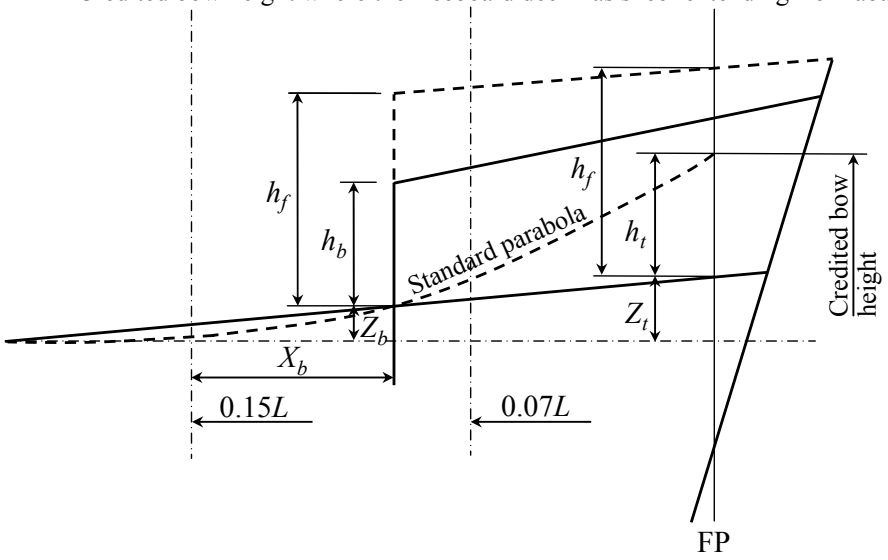
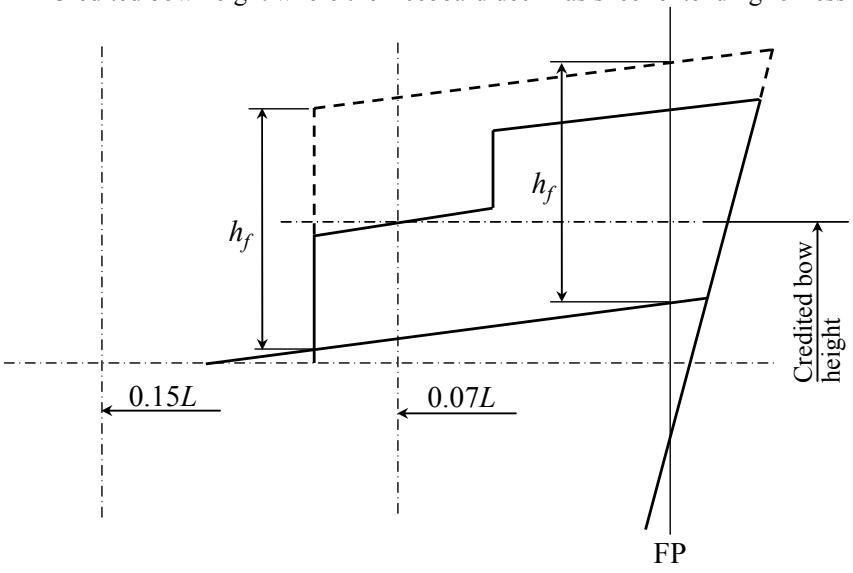


Fig. 2 Credited bow height where the freeboard deck has sheer extending for less than 0.15*L*



6. Shaft tunnels

6.1 General

6.1.1

Shaft tunnels are to be watertight.

7. Watertight ventilators and trunks

7.1 General

7.1.1

Ref. SOLAS Ch. II-1, Part B, Reg. 19.1

Watertight ventilators and trunks are to be carried at least up to the freeboard deck.

8. Fuel oil tanks

8.1 General

8.1.1

Ref. SOLAS Ch. II-2, Part B, Reg. 4.2

The arrangements for the storage, distribution and utilisation of the fuel oil are to be such as to ensure the safety of the ship and persons on board.

8.1.2

Ref. SOLAS Ch. II-2, Part B, Reg. 4.2

As far as practicable, fuel oil tanks are to be part of the ship's structure and are to be located outside machinery spaces of category *A*.

Where fuel oil tanks, other than double bottom tanks, are necessarily located adjacent to or within machinery spaces of category *A*, at least one of their vertical sides is to be contiguous to the machinery space boundaries, they are preferably to have a common boundary with the double bottom tanks and the area of the tank boundary common with the machinery spaces is to be kept to a minimum.

Where such tanks are situated within the boundaries of machinery spaces of category *A*, they may not contain fuel oil having a flashpoint of less than 60°C.

8.1.3

Ref. SOLAS Ch. II-2, Part B, Reg. 4.2

Fuel oil tanks may not be located where spillage or leakage therefrom can constitute a hazard by falling on heated surfaces.

Precautions are to be taken to prevent any oil that may escape under pressure from any pump, filter or heater from coming into contact with heated surfaces.

Fuel oil tanks in boiler spaces may not be located immediately above the boilers or in areas subjected to high temperatures, unless special arrangements are provided in agreement with the Society.

8.1.4

Where a compartment intended for goods or coal is situated in proximity of a heated liquid container, suitable thermal insulation is to be provided.

Section 3 ACCESS ARRANGEMENT

1. General

1.1 Means of access to cargo and other spaces

1.1.1

Ref. SOLAS Reg.II-1/3-6 .2.1 (Resolution MSC.151(78))

Each space is to be provided with means of access to enable, throughout the life of a ship, overall and close-up inspections and thickness measurements of the ship's structures. Such means of access are to comply with **1.3** and **2**.

1.1.2

Ref. SOLAS Reg.II-1/3-6 .2.2 (Resolution MSC.151(78))

Where a permanent means of access may be susceptible to damage during normal cargo loading and unloading operations or where it is impracticable to fit permanent means of access, the Society may allow, in lieu thereof, the provision of movable or portable means of access, as specified in **2**, provided that the means of attaching, rigging, suspending or supporting the portable means of access forms a permanent part of the ship's structure. All portable equipment are to be capable of being readily erected or deployed by ship's personnel.

1.1.3

Ref. SOLAS Reg.II-1/3-6 .2.3 (Resolution MSC.151(78))

The construction and materials of all means of access and their attachment to the ship's structure are to be to the satisfaction of the Society.

1.2 Safe access to cargo holds, ballast tanks and other spaces

1.2.1

Ref. SOLAS Reg.II-1/3-6 .3.1 (Resolution MSC.151(78)) and IACS UI SC191

Safe access to cargo holds, cofferdams, ballast tanks and other spaces in the cargo area are to be direct from the open deck and such as to ensure their complete inspection. Safe access to double bottom spaces or to forward ballast tanks may be from a pump-room, deep cofferdam, pipe tunnel, cargo hold, double hull space or similar compartment not intended for the carriage of oil or hazardous cargoes.

Access to a double side skin space may be either from a topside tank or double bottom tank or from both.

1.2.2

Ref. SOLAS Reg.II-1/3-6 .3.2 (Resolution MSC.151(78))

Tanks, and subdivisions of tanks, having a length of 35 *m* or more, are to be fitted with at least two access hatchways and ladders, as far apart as practicable.

Tanks less than 35 *m* in length are to be served by at least one access hatchway and ladder.

When a tank is subdivided by one or more swash bulkheads or similar obstructions which do not allow ready means of access to the other parts of the tank, at least two hatchways and ladders are to be fitted.

1.2.3

Ref. SOLAS Reg.II-1/3-6 .3.3 (Resolution MSC.151(78))

Each cargo hold is to be provided with at least two means of access as far apart as practicable. In general, these accesses are to be arranged diagonally, for example one access near the forward bulkhead on the port side, the other one near the aft bulkhead on the starboard side.

1.3 General technical specifications

1.3.1

Ref. SOLAS Reg.II-1/3-6 .5.1 (Resolution MSC.151(78)) and IACS UI SC191

For access through horizontal openings, hatches or manholes, the dimensions are to be sufficient to allow a person wearing a self-contained air-breathing apparatus and protective equipment to ascend or descend any ladder without obstruction and also provide a clear opening to facilitate the hoisting of an injured person from the bottom of the space. The minimum clear opening is to be not less than 600 *mm* × 600 *mm*, with corner radii up to 100 *mm* maximum.

In such a case where as a consequence of structural analysis the stress is to be reduced around the opening, it is considered appropriate to take measures to increase the clear opening, e.g. 600 × 800 with 300 *mm* radii, in which a clear opening of 600 × 600 *mm* with corner radii up to 100 *mm* maximum fits.

When access to a cargo hold is arranged through the cargo hatch, the top of the ladder is to be placed as close as possible to the hatch coaming. Access hatch coamings having a height greater than 900 *mm* are also to have steps on the outside in conjunction with the ladder.

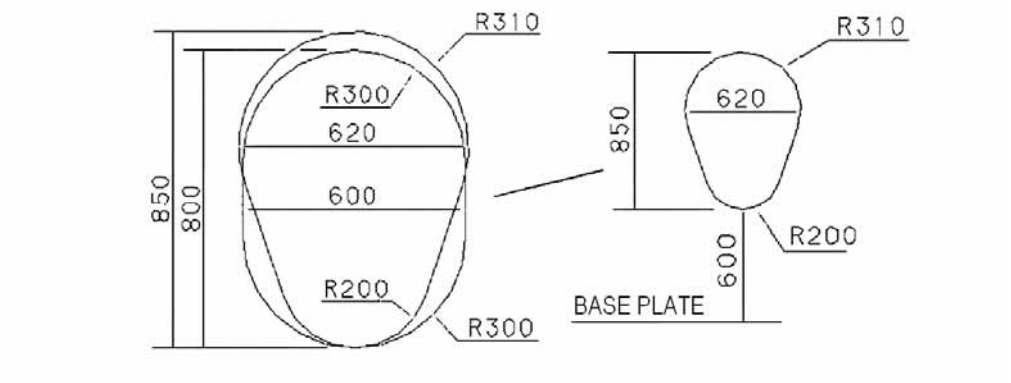
1.3.2

Ref. SOLAS Reg.II-1/3-6 .5.2 (Resolution MSC.151(78)) and IACS UI SC191

For access through vertical openings, or manholes, in swash bulkheads, floors, girders and web frames providing passage through the length and breadth of the space, the minimum opening is to be not less than 600 *mm* × 800 *mm* with corner radii of 300 *mm* at a height of not more than 600 *mm* from the bottom shell plating unless gratings or other foot holds are provided.

Subject to verification of easy evacuation of injured person on a stretcher the vertical opening 850 *mm* × 620 *mm* with wider upper half than 600 *mm*, while the lower half may be less than 600 *mm* with the overall height not less than 850 *mm* is considered acceptable alternative to the opening of 600 *mm* × 800 *mm* with corner radii of 300 *mm* (see **Fig. 1**).

Fig. 1 Alternative vertical opening



2. Technical provisions for means of access

2.1 Definitions

Ref. IMO Technical Provisions, 2 (Resolution MSC.158(78))

2.1.1 Rung

Rung means the step of vertical ladder or step on the vertical surface.

2.1.2 Tread

Tread means the step of inclined ladder, or step for the vertical access opening.

2.1.3 Flight of a ladder

Flight of an inclined ladder means the actual stringer length of an inclined ladder.

For vertical ladders, it is the distance between the platforms.

2.1.4 Stringer

Stringer means:

1) the frame of a ladder; or
2) the stiffened horizontal plating structure fitted on side shell, transverse bulkheads and/or longitudinal bulkheads in the space. For the purpose of ballast tanks of less than 5 *m* width forming double side spaces, the horizontal plating structure is credited as a stringer and a longitudinal permanent means of access, if it provides a continuous passage of 600 *mm* or more in width past frames or stiffeners on the side shell or longitudinal bulkhead. Openings in stringer plating utilized as permanent means of access are to be arranged with guard rails or grid covers to provide safe passage on the stringer or safe access to each transverse web.

2.1.5 Vertical ladder

Vertical ladder means a ladder of which the inclined angle is 70º and over up to 90º. Vertical ladder is to be not skewed by more than 2º.

2.1.6 Overhead obstructions

Overhead obstructions mean the deck or stringer structure including stiffeners above the means of access.

2.1.7 Distance below deck head

Distance below deck head means the distance below the plating.

2.1.8 Cross deck

Cross deck means the transverse area of main deck which is located inboard and between hatch coamings.

2.2 Permanent means of access

2.2.1

Ref. IMO Technical Provisions, 3.1 & 3.2 (Resolution MSC.158(78))

Structural members, except those in double bottom spaces, are to be provided with a permanent means of access to the extent as specified in **2.7** to **2.13**.

Permanent means of access are, as far as possible, to be integral to the structure of the ships, thus ensuring that they are robust and at the same time contributing to the overall strength of the structure, of the ship.

2.2.2

Ref. IMO Technical Provisions, 3.3 (Resolution MSC.158(78)) and IACS UI SC191

Elevated passageways forming sections of a permanent means of access, where fitted, are to have a minimum clear width of 600 *mm*, except for going around vertical webs where the minimum clear width may be reduced to 450 *mm*, and to have guard rails over the open side of their entire length. For stand alone passageways guard rails are to be fitted on both sides of these structures.

Sloping structure providing part of the access and that are sloped by 5 or more *degrees* from horizontal plane when a ship is in upright position at even-keel, is to be of a non-skid construction.

Guard rails are to be 1000 *mm* in height and consist of a rail and intermediate bar 500 *mm* in height and of substantial construction. Stanchions are to be not more than 3 *m* apart.

2.2.3

Ref. IMO Technical Provisions, 3.4 (Resolution MSC.158(78))

Access to permanent means of access and vertical openings from the ship's bottom are to be provided by means of easily accessible passageways, ladders or treads. Treads are to be provided with lateral support for the foot. Where the rungs of ladders are fitted against a vertical surface, the distance from the centre of the rungs to the surface is to be at least 150 *mm*. Where vertical manholes are fitted higher than 600 *mm* above the walking level, access is to be facilitated by means of treads and hand grips with platform landings on both sides.

2.3 Construction of ladders

2.3.1 General

Ref. IMO Technical Provisions, 3.5 (Resolution MSC.158(78))

Permanent inclined ladders are to be inclined at an angle of less than 70º. There are to have no obstructions within 750 *mm* of the face of the inclined ladder, except that in way of an opening this clearance may be reduced to 600 *mm*. Resting platforms of adequate dimensions are normally to be provided at a maximum of 6 *m* vertical height. Ladders and handrails are to be constructed of steel or equivalent material of adequate strength and stiffness and securely attached to the tank structure by stays. The method of support and length of stay is to be such that vibration is reduced to a practical minimum. In cargo holds, ladders are to be designed and arranged so that cargo handling difficulties are not increased and the risk of damage from cargo handling gear is minimized.

2.3.2 Inclined ladders

Ref. IMO Technical Provisions, 3.6 (Resolution MSC.158(78))

The width of inclined ladders between stringers is to be not less than 400 *mm*. The treads are to be equally spaced at a distance apart, measured vertically, of between 200 *mm* and 300 *mm*. When steel is used, the treads are to be formed of two square bars of not less that 22 *mm* by 22 *mm* in section, fitted to form a horizontal step with the edges pointing upward. The treads are to be carried through the side stringers and attached thereto by double continuous welding. All inclined ladders are to be provided with handrails of substantial construction on both sides, fitted at a convenient distance above the treads.

2.3.3 Vertical or spiral ladders

Ref. IMO Technical Provisions, 3.7 (Resolution MSC.158(78))

For vertical ladders or spiral ladders, the width and construction are to be in accordance with international or national standards.

2.4 Access through openings

2.4.1 Access through horizontal openings, hatches or manholes

Ref. IMO Technical Provisions, 3.10 (Resolution MSC.158(78))

For access through horizontal openings, hatches or manholes, the minimum clear opening is to be not less than 600 *mm* × 600 *mm*. When access to a cargo hold is arranged through the cargo hatch, the top of the ladder is to be placed as close as possible to the hatch coaming.

Access hatch coamings having a height greater than 900 *mm* are also to have steps on the outside in conjunction with the ladder.

2.4.2 Access through vertical openings, or manholes

Ref. IMO Technical Provisions, 3.11 (Resolution MSC.158(78))

For access through vertical openings, or manholes, in swash bulkheads, floors, girders and web frames providing passage through the length and breadth of the space, the minimum opening is to be not less than 600 *mm* × 800 *mm* at a height of not more than 600 *mm* from the passage unless gratings or other foot holds are provided.

2.5 Access ladders to cargo holds and other spaces

2.5.1 General

Ref. IMO Technical Provisions, 3.13.1 & 3.13.2 (Resolution MSC.158(78))

Access ladders to cargo holds and other spaces are to be:

a) where the vertical distance between the upper surface of adjacent decks or between deck and the bottom of the cargo space is not more than 6 *m*, either a vertical ladder or an inclined ladder.

b) where the vertical distance between the upper surface of adjacent decks or between deck and the bottom of the cargo space is more than 6 *m*, an inclined ladder or series of inclined ladders at one end of the cargo hold, except the uppermost 2.5 *m* of a cargo space measured clear of overhead obstructions and the lowest 6 *m* may have vertical ladders, provided that the vertical extent of the inclined ladder or ladders connecting the vertical ladders is not less than 2.5 *m*.

2.5.2

Ref. IMO Technical Provisions, 3.13.2 (Resolution MSC.158(78))

The second means of access at the other end of the cargo hold may be formed of a series of staggered vertical ladders, which have to comprise one or more ladder linking platforms spaced not more than 6 *m* apart vertically and displaced to one side of the ladder. Adjacent sections of ladder are to be laterally offset from each other by at least the width of the ladder. The uppermost, entrance section, of the ladder directly exposed to a cargo hold is to be vertical for a distance of 2.5 *m* measured clear of overhead obstructions and connected to a ladder-linking platform.

2.5.3

Ref. IMO Technical Provisions, 3.13.3 (Resolution MSC.158(78))

A vertical ladder may be used as a means of access to topside tanks, where the vertical distance is 6 *m* or less between the deck and the longitudinal means of access in the tank or the stringer or the bottom of the space immediately below the entrance. The uppermost, entrance section from deck, of the vertical ladder of the tank is to be vertical for a distance of 2.5 *m* measured clear of the overhead obstructions and comprises a ladder linking platform unless landing on the longitudinal means of access, the stringer or the bottom within the vertical distance, it should be displaced to one side of a vertical ladder.

2.5.4

Ref. IMO Technical Provisions, 3.13.4 (Resolution MSC.158(78))

Unless allowed in **2.5.3**, an inclined ladder or combination of ladders are to be used for access to a tank or a space where the vertical distance is greater than 6 *m* between the deck and a stringer immediately below the entrance, between stringers, or between the deck or a stringer and the bottom of the space immediately below the entrance.

2.5.5

Ref. IMO Technical Provisions, 3.13.5 (Resolution MSC.158(78))

In case of **2.5.4**, the uppermost, entrance section from deck, of the ladder is to be vertical for a distance of 2.5 *m* clear of the overhead obstructions and connected to a landing platform and continued with an inclined ladder. The flights of inclined ladders are to be not more than 9 *m* in actual length and the vertical height is normally to be not more than 6 *m*. The lowermost section of the ladders may be vertical for a vertical distance of not less than 2.5 *m*.

2.5.6

Ref. IMO Technical Provisions, 3.13.6 (Resolution MSC.158(78))

In double side skin spaces of less than 2.5 *m* width, the access to the space may be by means of vertical ladders that comprises one or more ladder linking platforms spaced not more than 6 *m* apart vertically and displace to one side of the ladder.

Adjacent sections of ladder are to be laterally offset from each other by at least the width of the ladder.

2.5.7

Ref. IMO Technical Provisions, 3.13.7 (Resolution MSC.158(78))

A spiral ladder is considered acceptable as an alternative for inclined ladders. In this regard, the uppermost 2.5 *m* can continue to be comprised of the spiral ladder and need not change over to vertical ladders.

2.6 Access ladders to tanks

2.6.1

Ref. IMO Technical Provisions, 3.14 (Resolution MSC.158(78))

The uppermost, entrance section from deck, of the vertical ladder providing access to a tank should be vertical for a distance of 2.5 *m* measured clear of the overhead obstructions and comprises a ladder linking platform. It should be displaced to one side of a vertical ladder. The vertical ladder can be between 1.6 *m* and 3 *m* below deck structure if it lands on a longitudinal or athwartship permanent means of access fitted within that range.

2.7 Access to underdeck structure of cargo holds

2.7.1

Ref. IMO Technical Provisions, Table 2, 1.1 (Resolution MSC.158(78))

Permanent means of access are to be fitted to provide access to the overhead structure at both sides of the cross deck and in the vicinity of the centerline.

Each means of access is to be accessible from the cargo hold access or directly from the main deck and installed at a minimum of 1.6 *m* to a maximum of 3 *m* below the deck.

2.7.2

Ref. IMO Technical Provisions, Table 2, 1.2 (Resolution MSC.158(78))

An athwartship permanent means of access fitted on the transverse bulkhead at a minimum 1.6 *m* to a maximum 3 *m* below the cross-deck head is accepted as equivalent to **2.7.1**.

2.7.3

Ref. IMO Technical Provisions, Table 2, 1.3 (Resolution MSC.158(78))

Access to the permanent means of access to overhead structure of the cross deck may also be via the upper stool.

2.7.4

Ref. IMO Technical Provisions, Table 2, 1.4 (Resolution MSC.158(78)) and IACS UI SC191

Ships having transverse bulkheads with full upper stools, i.e. stools with a full extension between top side tanks and between hatch end beams, with access from the main deck which allows monitoring of all framing and plates from inside, do not require permanent means of access of the cross deck.

2.7.5

Ref. IMO Technical Provisions, Table 2, 1.5 (Resolution MSC.158(78))

Alternatively, movable means of access may be utilized for access to the overhead structure of cross deck if its vertical distance is 17 *m* or less above the tank top.

2.8 Access to double side skin tanks in double side bulk carriers

2.8.1

Ref. IMO Technical Provisions, Table 2, 2.8 & Table 1, 2.1 (Resolution MSC.158(78))

For double side spaces above the upper knuckle point of the bilge hopper sections, permanent means of access are to be provided in accordance with the following requirements:

a) where the vertical distance between horizontal uppermost stringer and deck head is 6 *m* or more, one continuous longitudinal permanent means of access is to be provided for the full length of the tank with a means to allow passing through transverse webs installed at a minimum of 1.6 *m* to a maximum of 3 *m* below the deck head with a vertical access ladder at each end of the tank;
b) continuous longitudinal permanent means of access, which are integrated in the structure, at a vertical distance not exceeding 6 *m* apart; and
c) plated stringers are to be, as far as possible, in alignment with horizontal girders of transverse bulkheads.

2.9 Access to vertical structures of cargo holds in single side bulk carriers

2.9.1

Ref. IMO Technical Provisions, Table 2, 1.6 (Resolution MSC.158(78))

Permanent means of vertical access are to be provided in all cargo holds and built into the structure to allow for an inspection of a minimum of 25 % of the total number of hold frames port and starboard equally distributed throughout the hold including at each end in way of transverse bulkheads. But in no circumstance is this arrangement to be less than 3 permanent means of vertical access fitted to each side (fore and aft ends of hold and mid-span).

Permanent means of vertical access fitted between two adjacent hold frames is counted for an access for the inspection of both hold frames. A means of portable access may be used to gain access over the sloping plating of lower hopper ballast tanks.

2.9.2

Ref. IMO Technical Provisions, Table 2, 1.7 (Resolution MSC.158(78))

In addition, portable or movable means of access are to be utilized for access to the remaining hold frames up to their upper brackets and transverse bulkheads.

2.9.3

Ref. IMO Technical Provisions, Table 2, 1.8 (Resolution MSC.158(78))

Portable or movable means of access may be utilized for access to hold frames up to their upper bracket in place of the permanent means required in **2.9.1**. These means of access are to be carried on board the ship and readily available for use.

2.9.4

Ref. IMO Technical Provisions, Table 2, 1.9 (Resolution MSC.158(78))

The width of vertical ladders for access to hold frames is to be at least 300 *mm*, measured between stringers.

2.9.5

Ref. IMO Technical Provisions, Table 2, 1.10 (Resolution MSC.158(78))

A single vertical ladder over 6 *m* in length is acceptable for the inspection of the hold side frames in a single skin construction.

2.10 Access to vertical structures of cargo holds in double side bulk carriers

2.10.1

Ref. IMO Technical Provisions, Table 2, 1.11 (Resolution MSC.158(78))

For double side skin construction no vertical ladders for the inspection of the cargo hold surfaces are required. Inspection of this structure should be provided from within the double hull space.

2.11 Access to top side ballast tanks in single side bulk carriers

2.11.1

Ref. IMO Technical Provisions, Table 2, 2.1 (Resolution MSC.158(78))

For each topside tank of which the height is 6 *m* and over, one longitudinal continuous permanent means of access is to be provided along the side shell webs and installed at a minimum of 1.6 *m* to a maximum of 3 *m* below deck with a vertical access ladder in the vicinity of each access to that tank.

2.11.2

Ref. IMO Technical Provisions, Table 2, 2.2 (Resolution MSC.158(78))

If no access holes are provided through the transverse webs within 600 *mm* of the tank base and the web frame rings have a web height greater than 1 *m* in way of side shell and sloping plating, then step rungs/grab rails are to be provided to allow safe access over each transverse web frame ring.

2.11.3

Ref. IMO Technical Provisions, Table 2, 2.3 (Resolution MSC.158(78))

Three permanent means of access, fitted at the end bay and middle bay of each tank, are to be provided spanning from tank base up to the intersection of the sloping plate with the hatch side girder. The existing longitudinal structure, if fitted on the sloping plate in the space may be used as part of this means of access.

2.11.4

Ref. IMO Technical Provisions, Table 2, 2.4 (Resolution MSC.158(78))

For topside tanks of which the height is less than 6 *m*, alternative or a portable means may be utilized in lieu of the permanent means of access.

2.12 Access to bilge hopper ballast tanks

2.12.1

Ref. IMO Technical Provisions, Table 2, 2.5 (Resolution MSC.158(78)) and IACS UI SC191

For each bilge hopper tank of which the height is 6 *m* and over, one longitudinal continuous permanent means of access is to be provided along the side shell webs and installed at a minimum of 1.2 *m* below the top of the clear opening of the web ring with a vertical access ladder in the vicinity of each access to the tank.

An access ladder between the longitudinal continuous permanent means of access and the bottom of the space is to be provided at each end of the tank.

Alternatively, the longitudinal continuous permanent means of access can be located through the upper web plating above the clear opening of the web ring, at a minimum of 1.6 *m* below the deck head, when this arrangement facilitates more suitable inspection of identified structurally critical areas. An enlarged longitudinal frame, of at least 600 *mm* clear width can be used for the purpose of the walkway.

For double side skin bulk carriers the longitudinal continuous permanent means of access may be installed within 6 *m* from the knuckle point of the bilge, if used in combination with alternative methods to gain access to the knuckle point.

2.12.2

Ref. IMO Technical Provisions, Table 2, 2.6 (to Resolution MSC.158(78))

If no access holes are provided through the transverse ring webs within 600 *mm* of the tank base and the web frame rings have a web height greater than 1 *m* in way of side shell and sloping plating, then step rungs/grab rails are to be provided to allow safe access over each transverse web frame ring.

2.12.3

Ref. IMO Technical Provisions, Table 2, 2.7 (Resolution MSC.158(78))

For bilge hopper tanks of which the height is less than 6 *m*, alternative or a portable means may be utilized in lieu of the permanent means of access. Such means of access are to be demonstrated that they can be deployed and made readily available in the areas where needed.

2.13 Access to fore peak tanks

2.13.1

Ref. IMO Technical Provisions, Table 2, 2.9 (Resolution MSC.158(78))

For fore peak tanks with a depth of 6 *m* or more at the centreline of the collision bulkhead, a suitable means of access is to be provided for access to critical areas such as the underdeck structure, stringers, collision bulkhead and side shell structure.

2.13.2

Ref. IMO Technical Provisions, Table 2, 2.9.1 (Resolution MSC.158(78))

Stringers of less than 6 *m* in vertical distance from the deck head or a stringer immediately above are considered to provide suitable access in combination with portable means of access.

2.13.3

Ref. IMO Technical Provisions, Tab 2, 2.9.2 (Resolution MSC.158(78))

In case the vertical distance between the deck head and stringers, stringers or the lowest stringer and the tank bottom is 6 *m* or more, alternative means of access are to be provided.

3. Shaft tunnels

3.1 General

3.1.1

Tunnels are to be large enough to ensure easy access to shafting.

3.1.2

Access to the tunnel is to be provided by a watertight door fitted on the aft bulkhead of the engine room in compliance with **Ch 2, Sec 1, 6**, and an escape trunk which can also act as watertight ventilator is to be fitted up to the subdivision deck, for tunnels greater than 7 *m* in length.

4. Access to steering gear compartment

4.1 General

4.1.1

The steering gear compartment is to be readily accessible and, as far as practicable, separated from machinery spaces.

4.1.2

Suitable arrangements to ensure working access to steering gear machinery and controls are to be provided.

These arrangements are to include handrails and gratings or other non-slip surfaces to ensure suitable working conditions in the event of hydraulic fluid leakage.