



CHINA CLASSIFICATION SOCIETY INTERNATIONAL SHIP
CLASSIFICATION

**GUIDELINES FOR STATUTORY
SURVEYS OF INLAND WATERWAY
SHIPS**

2015

PART FIVE SAFETY OF THE SHIP

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CHAPTER 1 GENERAL PRINCIPLES

Section 1 GENERAL PROVISIONS

1.1.1 General requirements

1.1.1.1 The classes of ships to which each chapter of this Part applies are more precisely defined, and the extent of the application and definitions are in shown, in each chapter.

1.1.1.2 In addition, unless expressly provided in this Part, the strength, structures, arrangement, scantlings of the structure, outfits, boilers and other pressure vessels and their appurtenances, main and auxiliary machinery, shaft gearing, piping, electrical installation, automation systems, materials and welding and so on are to comply with the provisions of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

1.1.1.3 For all ships, new installation of materials which contain asbestos is to be prohibited.

1.1.1.4 The design speed of self-propelled ships is to satisfy the needs of safe navigation and service.

1.1.1.5 A ship is to be loaded and navigate (or work or take shelter from the wind) on the basis of the service for which it is intended.

1.1.1.6 A ship carrying dangerous goods is to be loaded and arranged in accordance with the approved categories, quantity of goods and cargo spaces, and any other ship is not to carry dangerous goods.

1.1.1.7 Where a ro-ro passenger ship type 1 or type 2 or a vehicle-passenger ferry carries vehicles, the parking places are to be arranged according to the balance principle of loading, in order to ensure the vehicles located within the vessel space and secured efficiently.

1.1.1.8 The following ships are to be provided with a loading manual, which is to be prepared by the designers or shipyard on the basis of the final data of the ship and be submitted to [CCSISC](#) for approval:

- (1) ro-ro passenger ships type 1;
- (2) ro-ro passenger ships type 2;
- (3) vehicle-passenger ferries
- (4) container ships with a length of 40 m or over;
- (5) bulk carriers with a length of 40 m or over and carrying ores;
- (6) dry cargo ships with a length of 80 m or over;
- (7) tankers with a length of 80 m or over.

1.1.2 Definitions

1.1.2.1 A *passenger ship of category I* is a passenger ship engaged on the voyages of continuous upstream duration more than 24 hours, calculated from departure port to destination port (excluding the port time in transit).

1.1.2.2 A *passenger ship of category II* is a passenger ship engaged on the voyages of continuous upstream duration more than 12 hours but not exceeding 24 hours, calculated from departure port to destination port (excluding the port time in transit).

1.1.2.3 A *passenger ship of category III* is a passenger ship engaged on the voyages of continuous upstream duration more than 4 hours but not exceeding 12 hours, calculated from departure port to destination port (excluding the port time in transit).

1.1.2.4 A *passenger ship of category IV* is a passenger ship engaged on the voyages of continuous upstream duration more than a half hour but not exceeding 4 hours, calculated from departure port to destination port (excluding the port time in transit).

1.1.2.5 A *passenger ship of category V* is a passenger ship engaged on the voyages of continuous upstream duration not exceeding a half hour (excluding the port time in transit).

1.1.2.6 A *large size passenger ship* is a passenger ship with a gross tonnage of more than 1000.

1.1.2.7 A *middle size passenger ship* is a passenger ship with a gross tonnage of more than 200 but less than or equal to 1000.

1.1.2.8 A *small size passenger ship* is a passenger ship with a gross tonnage of less than or equal to 200.

1.1.2.9 A *passenger ferry* is a passenger ship carrying passengers or passengers and cargoes and engaged on the voyage between ferries (urban ferries and country ferries) and of continuous upstream duration less than or equal to 2 hours (excluding the port time in transit) or of a distance less than or equal to 20 km.

1.1.2.10 A *sightseeing cruise ship* is a passenger ship engaged on the voyage of the waters in urban districts, reservoirs, public parks and scenic resorts etc. and of continuous upstream duration less than or equal to 12 hours (excluding the port time in transit) to provide the services such as tour, sightseeing and

entertainment.

1.1.2.11 A *cruise ship* is a passenger ship relying on receiving the passengers for holidays, relaxation, sightseeing and commercial affairs and engaged on the voyage of continuous upstream duration more than 12 hours (excluding the port time in transit) to provide the services such as tour, sightseeing, entertainment and accommodation.

1.1.2.12 A *general passenger ship* is a passenger ship other than passenger ferries, sightseeing cruise ships, cruise ships, ro-ro passenger ships type 1 and type 2 and vehicle-passenger ferries.

1.1.2.13 A *bulk cement carrier* is a ship constructed for the carriage of bulk cement in holds.

Section 2 CLASSIFICATION OF PASSENGER SHIPS

1.2.1 General classification

1.2.1.1 Passenger ships are divided into five categories according to the voyage of duration: passenger ships of category I, passenger ships of category II, passenger ships of category III, passenger ships of category IV and passenger ships of category V.

1.2.1.2 Passenger ships are divided into three categories according to the gross tonnage: large size passenger ships, middle size passenger ships and small size passenger ships.

1.2.1.3 Passenger ships are divided into seven categories according to their purposes and engage of duration: passenger ferry, sightseeing cruise ships, cruise ships, general passenger ships, ro-ro passenger ships type 1 and ro-ro passenger ships type 2.

CHAPTER 2 STRUCTURES

Section 1 HULL

2.1.1 Application

2.1.1.1 This Chapter is applicable to the material, welding, structure and outfitting of civil ships navigating in inland waterways.

2.1.2 Definitions

2.1.2.1 Bulkhead deck means the uppermost deck to which the transverse watertight bulkhead reaches (including the transverse watertight bulkhead in compartment); it generally refers to the first complete deck adjacent to water.

2.1.2.2 Main transverse bulkhead means the transverse watertight bulkhead leading to bulkhead deck from the hull bottom.

Where the cargo area is fitted with longitudinal hatch (or similar to longitudinal large hatch, for instance the hatch type of well-deck ship), the transverse bulkhead may also be taken as main transverse bulkhead in case any of followings is met at the same time:

(1) fitted with watertight inner side plate (longitudinal bulkhead) and the watertight inner bottom plate (well-deck ship refers to cargo deck);

(2) watertight transverse bulkhead and double bottomed watertight solid floor (well-deck ship refers to the watertight transverse bulkhead below cargo deck) are at the same frame; and

(3) the distance from watertight inner side plate (longitudinal bulkhead) above full loaded waterline to shipboard is equal or greater than $0.1B$ (B refers to breadth of ship) or 0.1m, whichever is the less; the distance from watertight inner bottom plate to baseline is equal or greater than $1/15$ or 0.76, whichever is the less.

The transverse bulkhead may also be taken as main transverse bulkhead in case any of followings is met at the same time, provided that the passenger area adopts a falling cabin (for instance the passenger deck is below the bulkhead deck):

(1) the height of passenger deck is equal or greater than $0.5D$ (D is the moulded depth) or d (d is the full load draught), whichever is the greater; and

(2) the watertight transverse bulkhead is fitted under the passenger deck.

2.1.2.3 Permeability of a space is the proportion of the immersed volume of that space which can be occupied by water.

2.1.2.4 An non-watertight opening means an opening of the air tube, vent pipe and weathertight door or hatch closing, excluding the openings closed for watertight manhole covers, hatch covers, small watertight liquid cargo tanks and permanent portholes.

2.1.3 Material and welding

2.1.3.1 When hull structure adopts steel or aluminum alloy, its material, welding operation and welding design are to comply with relevant provision specified in [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

2.1.3.2 Special consideration are to be taken based on equivalence principle for the ships adopted with materials other than steel or aluminum alloy.

2.1.3.3 The ship equipment and product material are to comply with relevant provision specified in [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

2.1.3.4 The personnel to be engaged in the welding operation of a ship and its products may perform the welding operation appropriate to the qualified type of work defined in the certificate if they hold the approved Qualification Certificate of Welder.

2.1.3.5 The personnel to be engaged in the non-destructive testing of a ship and its products may perform the non-destructive testing appropriate to the qualified type of work defined in the certificate if they hold the approved Qualification Certificate of NDT Personnel.

2.1.4 Hull structure tests

2.1.4.1 Different test methods are to be adopted for ship structure in accordance with different requirements for tightness and structural strength.

2.1.4.2 The test for hull structure is to comply with relevant provision specified in [CCSISC](#) Regulations for Classification of Inland Waterway Ships.

2.1.5 Hull structural strength

2.1.5.1 Ships are to be built with sufficient structural strength. The ship's structures are to be so designed in such a manner that it can be capable of working under the maximum external force of nature throughout the period of navigation.

2.1.5.2 The hull members layout is to keep fine structural continuity. The longitudinal members are to keep its continuity within ship length. The framing of deck, side and bottom are to be connected effectively to form rigid integral. The arrangement and scantlings of hull structural members are to be checked.

2.1.5.3 When the ship is in the loading/unloading or navigating mode, the adverse effect upon the longitudinal strength and torsion strength of the hull are to be avoided.

2.1.5.4 The ship is to be of sufficient midship section inertia and midship modulus, which serves the purpose of checking the ship longitudinal strength and buckling strength in case when there is a need.

2.1.5.5 In addition to the requirement of 2.1.5.4, the ship having a large hatch which carries container and metals is to have bending-tensional strength calculated.

2.1.6 Arrangement of bulkheads

2.1.6.1 A ship is to be provided with watertight bulkheads at fore and aft ends and the fore and after bulkheads of engine room are to be watertight. For ships of 30m or less in length, the after bulkheads of engine rooms need not to be watertight.

2.1.6.2 For passenger ships, the space of the adjacent main transverse watertight bulkheads is to be not greater than that obtained from the following formula. When the space is greater than l , the ship is to comply with the relevant requirements of 2.1.9 of this Section.

$$l = 0.75\left(1 - \frac{d}{D}\right)L \quad \text{m}$$

When $l > 6D$, to be taken as $l = 6D$, and when $l < 0.15L$, to be taken as $l = 0.15L$

where: L ---length of the ship, in m

D ---moulded depth of the ship, in m;

d ---draught, in m.

2.1.6.3 For cargo ships with a length of over 30m and equal or less than 60m, while fitting the ship with aft peak bulkhead and after bulkhead of engine room according to the provision of 2.1.6.1 of the Section, the aft peak bulkhead may also be served as after bulkhead of engine room if one of the followings is met:

(1) The distance from the fore bulkhead of the engine room to the bulkhead of the aft peak is less than $0.15L$ (L refers to ship length), and the distance from fore hatch to after perpendicular is less than $0.20L$, or:

(2) The damage stability is to meet relevant requirement specified in 2.1.9.9 of this Section when the space between the fore bulkhead of the engine room and the bulkhead of the aft peak is damaged.

2.1.6.4 The height of watertight bulkhead mentioned in 2.1.6.1 of this Section (except for after bulkhead of engine room) is to be extended to freeboard deck or raised fore deck or raised quarter deck.

2.1.6.5 Collision bulkheads are to be fitted within $0.05 \sim 0.1L$ from forward perpendicular; If any part below full load water line extends ahead from forward perpendicular, for instance bulbous bow, then the distance required above is to be calculated from any of following points, whichever is the less:

(1) the midpoint of extension part in length

(2) forward perpendicular along 1.5% of fore ship length

The distance from the collision bulkhead to the forward perpendicular is to be less than 3.0m for the ships with a length of 30m or less.

2.1.6.6 Bulkheads of an aft peak are to be fitted within $0.1L$ from after perpendicular. For the ships equipped with propulsion devices at fore and after bulkheads, the requirements for collision bulkheads specified in 2.1.6.5 of this Section are to be met.

2.1.6.7 In addition to the provisions specified in 2.1.6.1 and 2.1.6.2 of this Section, the number of main transverse bulkheads of the ship mentioned in 2.1.9.1 of this Section and its arrangement along the ship's length are to comply with the requirements specified in 2.1.9.3 and 2.1.9.9.

2.1.7 Arrangement of double bottom or collision side tank

2.1.7.1 The following ships navigating in torrent are to be fitted with double bottom; or the bilge space are to be fitted with collision wing tank

- (1) self-propelled ships of more than 40m in length (including passenger ships);
- (2) self-propelled ships of 40m or less in length

2.1.7.2 The double bottom and collision side tank are to extend from the collision bulkhead to aft peak as far as practicable. Its pattern and dimension are to comply with relevant requirement of **CECISCS** Rules for Construction of Inland Waterway Steel Ships.

2.1.7.3 For the ships mentioned in 2.1.7.1(1) of this Section, the engine room is to be fitted with a double bottom or a collision side tank complying with relevant requirement for the ships having a length of over 60m; for ships having a length of 60m or less, the relevant requirements specified in 2.1.9 of this Section accepted by **CECISCS** are to be met in the case that there is a difficulty in equipping the engine room with a double bottom or a collision side tank; where the compartment outside of the engine room is not fitted with the double bottom or collision side tank, it is to comply with the relevant requirements of 2.1.9 of this Section.

2.1.7.4 Where the ships mentioned in 2.1.7.1(2) are not fitted with a double bottom or a collision side tank as required, the relevant requirements of 2.1.9 of this Section are to be met.

2.1.7.5 Where the inner bottom plate is provided with a bilge well, the distance from the bottom plate of the well to the ship's bottom is to be not less than 300mm.

2.1.8 Reserve buoyancy

2.1.8.1 The reserve buoyancy of passenger ships having a length of less than 40m which navigate in torrent sections is to be equal to or greater than the displacement corresponding to the full load waterline. Where the reserve buoyancy fails to reach the displacement corresponding to the full load waterline, the ship is to meet relevant requirements for damage stability specified in 2.1.9 of this Section.

2.1.8.2 The compartment of which buoyancy reserve is taken into account is to comply with the followings :

- (1) The compartment is to be located below freeboard deck, and;
- (2) its structure scantlings and arrangement are to be sufficient to keep its watertight integrity.

2.1.9 Damage stability

2.1.9.1 The damage stability of the following ships are to be calculated and to comply with the requirements of 2.1.9.3 to 2.1.9.10 of this Section:

(1) the passenger ships of 40m or over in length navigating in torrent sections; the mono-hull passenger ships of 80m or over in length and double-hull passenger ships of 60m or over in length navigating in other sections;

(2) the cargo ships of more than 80m in length navigating in torrent sections;

(3) ships carrying dangerous goods; and

(4) oil tankers (including oil barges) navigating in torrent sections and oil tankers (including oil barges) with a capacity of 600t or over in other service spaces

2.1.9.2 Unless otherwise specified, other ships may refer to the provisions of 2.1.9.3 to 2.1.9.9 of this Section when the damage stability is needed to be checked.

2.1.9.4 The damage stability of a ship is to be checked under normal loading conditions. Refer to the provision of CHAPTER 8 for the details of loading condition.

2.1.9.4 When calculating the ship's damage stability, the effects upon the metacentric height and residual righting level of the free surface are to be taken into account.

2.1.9.5 Assumed extent of damage

(1) Assumed extent of damage of passenger ships are to be as follows:

① side damage extent:

a. longitudinal extent: $0.1L$, or $3\text{m} + 0.03L$, whichever is the less

b. transverse extent measured inboard from the ship's side, at right angles to the centerline at the level of subdivision load line): $0.1B$, or 1.0m , whichever is the less.

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

② bottom damage extent¹

a. longitudinal extent: $0.1L$, or $3\text{m} + 3\%L$, whichever is the less:

b. transverse extent: at any position, $\frac{1}{6}B$, or 2.0m , whichever is the less;

c. vertical extent: from the base line upwards, $\frac{1}{15}B$ or 0.7m , whichever is the less

(2) assumed extent of damage of double-hull passenger ships

a. one is damaged within the extent as specified in 2.1.9.5 (1)

b. fore peak or after peak of two sheets is damaged at the same time

(3) Assumed extent of damage of oil tankers and cargo ships are to be as follows:

① side damage extent:

a. longitudinal extent: $\frac{1}{3}L^{2/3}$

b: transverse extent measured inboard from the ship's side, at right angles to the centreline at the level of the subdivision load line): $0.1B$, or 1.0m , whichever is the less;

c: vertical extent: from the base line upwards without limit.

② bottom damage extent²:

a: longitudinal extent: $\frac{1}{3}L^{2/3}$

b. transverse extent: at any position, $\frac{1}{6}B$, or 2.0m , whichever is the less;

c. vertical extent: from the base line upwards, $\frac{1}{15}B$, or 0.7m , whichever is the less

(4) If any damage of lesser extent than that indicated in 1.3.1 and 1.3.2 would result in a more severe condition regarding heel or loss of metcentric height, such damages are to be assumed in the calculations.

2.1.9.6 Assumed conditions of flooding

(1) For the purpose of making damage stability calculations, the volume and space permeability of each space are to be in general as Table 2.1.9.6(1)

Table 2.1.9.6(1)

Space	Permeability
Appropriated to stores	0.60
Occupied by machinery	0.85
Void spaces	0.95
Occupied by accommodation	0.95
Dry cargo spaces	0.70
Intended for liquids	0~0.95*

Note: * The permeability of the tank loaded partly is to be consistent with the quantity of the liquids carried in this tank. In case the liquid tank damaged, the liquids are to be assumed to lose wholly, and the fresh water will inflow to the equalization.

(2) The buoyancy of the superstructure which is immediately above the damaged compartment at side is not to be taken into account.

¹ The assumed extent of damage of passenger ships only applies to passengers ships navigating in torrent sections.

² The assumed extent of damage of oil tankers and cargo ships only applies to oil tankers.

(3) If pipes, ducts, or tunnels are situated within assumed flooded compartments, arrangements are to be made to ensure that progressive flooding cannot thereby extend to compartments other than those assumed flooded.

(4) If the bilge well which complies with the provision of 2.1.7.5 of this Section is situated within assumed flooded compartments, then the effect of bilge may be ignored.

(5) If watertight ventilator and air tube is situated within assumed flooded compartments and that the distance from ventilator and air tube is greater than 760mm, the effect of ventilator and air tube may be ignored.

2.1.9.7 Where the following position is damaged and flooded as specified in 2.1.9.5 and 2.1.9.6, the ship is to comply with the requirements specified in 2.1.9.9 of this Section:

(1) For ships of category I, assumed to be damaged at any part within the length of the ship, except for the bulkheads of the engine room.

(2) For ships of category II, assumed to be damaged at any part between the adjacent main transverse bulkheads. Except the boundary bulkheads of the engine room, when the space of adjacent main transverse bulkheads is less than the longitudinal extent as specified in 2.1.9.5, either of which is to be assumed to be damaged.

(3) For ships of category III, assumed to be damaged at any part between the adjacent main transverse bulkheads. Except the engine room(including the boundary bulkheads of the engine room), when the space of adjacent main transverse bulkheads is less than the longitudinal extent as specified in 2.1.9.5 of the Section, either of which is to be assumed to be damaged.

Refer to Table 2.1.9.7 for the corresponding types of ships of category I, II and III.

Table 2.1.9.7

Category	Ships types
Ship of category I	ships navigating in torrent with a length 80m or over or the passenger ship capable of accommodating the number of 400 passengers
Ship of category II	oil tank (including tank barge) ships carrying dangerous goods the passenger ship navigating in torrent with a length of less than 80m which can accommodate the number of less than 400 passengers. The mono-hull passenger ship navigating in other water spaces with a length of 80m or over and the double-hull passenger ship with a length of 60m or over.
Ship of category III	the cargo ship navigating in torrent with a length of 80m or over.

2.1.9.8 When it is necessary to provide equalization measures for correcting large angles of heel, the controls are to be operable from above the bulkhead deck.

2.1.9.9 The floating condition and residual stability are to comply with following requirement:

(1) In the final stage of flooding, the waterline is to be below the bulkhead deck at side, and for oil tanks, cargo ships, the waterlines of oil tankers and cargo ships etc. are to be below the lower limb of any non-watertight opening(including air tube, ventilator, weather tight door or the weather tight hatch;

(2) In the final stage of flooding, the angle of heel in the case of unsymmetrical flooding is not to exceed 10° for passenger ships, and 15°for oil tanks;

(3) In the final stage of flooding, there is to be a metcentric height of at least 0.1m as calculated by the constant

(4) In the final stage of flooding, the positive residual righting lever curve is to have a minimum range of 10° beyond the angle of equilibrium and to the angle of flooding or angle of vanishing stability, whichever is less, and the space under the righting lever curve is to be at least 0.01 m·rad; in calculating the space under the residual righting lever curve, when the angle beyond the angle of equilibrium and to the angle of flooding or angle of vanishing stability, whichever is less, is more than 20°, it is to be taken as 20°.

(5) The range mentioned in above (4) may be reduced to a minimum of 5° and in the case, the space under the righting lever curve is not to be less than that calculated by the following formula:

$$a = 0.02 - 0.001\theta \quad \text{m·rad}$$

where: θ --the angle beyond the angle of equilibrium and to the angle of flooding or angle of vanishing stability, whichever is less, in deg.

(6) In intermediate stages of flooding, there is to be sufficient residual stability.

(7) The angle of flooding mentioned in this Article is to be calculated in way of the water entries within the extent of undamaged. If one water entry is located within the extent of assumed damage, the influence of water entry may not be calculated.

2.1.10 Ship watertight and weather tight integrity

2.1.10.1 The openings of shell plating below the freeboard deck (porthole, gangway and other similar openings) and the openings above the freeboard deck (hatch, ventilator, air tube, drain hole and side discharging opening etc) are to meet relevant requirements specified in PART FOUR of this Regulations.

2.1.10.2 The number of openings on watertight bulkheads is to be reduced to the minimum, and they are to be provided with reliable closing devices.

2.1.10.3 A device is to be fitted to ensure the compartment watertight integrity when pipes, drain pipe and cables pass through watertight compartment. For the ships having a length of equal to or less than 40m, the rudder chain, telegraph chain and control wire of main engines are to be laid below the freeboard deck when passing through watertight compartments.

2.1.10.4 The collision bulkhead is not to be fitted with a door, manhole, passenger opening, air conduit or other types of openings. An easy-to-operate stop valve is to be fitted on the collision bulkhead when pipes pass through it. It is necessary for the collision bulkhead of other types of ship be fitted with watertight bulkhead due to ship arrangement, except for passenger ship, oil tanker, chemical tanker and liquefied gas carrier,. Such manholes are to be fitted as high as possible and be approved by [CCSISC](#).

2.1.10.5 The fore bulkheads of engine rooms of passenger ships navigating in service area A and B and of ships navigating in torrent sections are not to be fitted with a door, except that mentioned in 2.1.10.9 of this Section.

2.1.10.6 Any door other than watertight doors leading to the shaft tunnel is not to be fitted on the after bulkhead of the engine room. The watertight door leading to the shaft tunnel is to be capable of being manually opened at both sides and be fitted as much high as practicable.

2.1.10.7 Except that mentioned in 2.1.10.9 of this Section, doors are not permitted to be fitted on the two adjacent main transverse bulkheads for passenger ships navigating in service area A and B and ships navigating in torrent sections; where the after bulkhead of the engine room is fitted with a door leading to the shaft tunnel, the bulkhead adjacent to the after bulkhead of the engine room is not to be fitted with a door. The main transverse bulkhead refers to the watertight bulkhead specified in 2.1.6 of this Section.

2.1.10.8 For the ships fitted with propulsion unit at fore and aft peak, the watertight integrity of after peak bulkhead are to meet the requirement for collision bulkhead as specified in 2.1.10.4 of this Section.

2.1.10.9 For vehicle-passenger ferries navigating in Service Area A and B and torrent sections and engaged on the voyages of continuous duration not more than half an hour, a watertight door may be permitted to be fitted on the main transverse bulkhead except for collision bulkheads and bulkheads of the after peaks, provided that:

(1) propulsion arrangements are fitted at fore and aft, and the engine room is located amidships;

(2) Watertight tanks on each side are fitted between the collision bulkhead and the bulkhead of the after peak, and the distance from the longitudinal bulkhead (inner side bulkhead) to the shell plating in the full load waterline plane is not less than $0.1B$ or 1.0 m, whichever is the less; and

(3) Watertight doors are fitted on the transverse bulkhead between the longitudinal bulkheads (inner side bulkheads) on each side.

2.1.10.10 Where watertight doors are fitted on the fore or/and after bulkhead of the engine room, a device

is to be provided in the wheelhouse to indicate open or closed positions of the watertight door(s), and hand gear is to be provided on the freeboard deck to control the watertight door(s).

2.1.10.11 The watertight boundaries defined in 2.1.6 to 2.1.9 of this Section (including the transverse or longitudinal watertight bulkheads\ inner bottom plating, platforms and decks) are to have appropriate strength, it's the scantlings of which are to comply with relevant requirements specified in [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

2.1.10.12 Watertight doors are to be tested by water pressure to a head of water required 2.1.10.11 of this Section.

2.1.10.13 Vent pipes, located within the extent of damage specified in 2.1.9.5 of this Section and be part of the watertight bulkhead, and the shaft tunnels mentioned in 2.1.10.7 of this Section, are to be watertight and have the strength equivalent to that of the corresponding watertight bulkheads.

2.1.11 Damage control

2.1.11.1 On the ships mentioned in 2.1.9.1 of this Section, there is to be a damage control plan permanently exhibited on board or being available in the wheelhouse at all times.

2.1.11.2 The damage control plan is to show clearly for each deck and hold the boundaries of the watertight compartments, the openings therein with the means of closure and position of any control thereof, and the arrangements for the correction of any list due to flooding (if applicable).

2.1.11.3 All watertight doors are to be kept closed during navigation. When some mechanical work necessitates it being opened, a watertight door may be opened during navigation provided that efficient monitoring have been taken and that the safety of the ship is not impaired. The door is to be immediately closed when transit through the door is complete or when the task which necessitated it being open is finished. The time of opening such doors and of closing them are to be entered in the log-book.

2.1.12 Equipment and outfits

2.1.12.1 Self-propelled ships are to be fitted with rudders or other equivalent equipment, non-self-propelled ships are to be generally fitted with rudders, and rudders may be omitted for integrated barges. The material, strength, installation, welding and arrangement of the rudder are to comply with the technical requirements for its safety.

2.1.12.2 In general, ships are to be fitted with anchoring equipment. For ships navigating in small rivers or tributaries, harbor work boats and ships of which the safety can be ensured without any anchor under the restrictions, [CCSISC](#) may permit no anchoring equipment to be fitted on board considering the channel and anchoring conditions.

2.1.12.3 Ships are to be fitted with a sufficient number of mooring equipment which have sufficient strength.

2.1.12.4 The towropes and towing posts of towing trains towing alongside and the tying arrangements and tying cables of pusher trains are to have enough strength.

2.1.13 Additional requirements for ro-ro passenger ships type 1 and type 2 and vehicle-passenger ferries

2.1.13.1 For ro-ro passenger ships type 1 and type 2, when a sponson deck, used as an access, is provided at each side of the ro-ro space, intercostal vertical coamings are to be fitted between the access and the ro-ro space. For vehicle-passenger ferries, when an access is provided at each side of the ro-ro space, intercostal vertical coamings or railings or prominent mark lines and signboards are to be provided between the access and the ro-ro space. Where a passenger space is provided at each side of the ro-ro space, continuous vertical coamings or railings are to be fitted between the access and the ro-ro space.

2.1.13.2 Vehicle ramps and their lifting gears are to comply with the following requirements:

(1) The load test for vehicle ramps is to comply with relevant requirements of [CCSISC](#) Rules for Lifting Appliances of Ships and Offshore Installations;

(2) The lifting gear of vehicle ramps are to comply with relevant requirements of [CCSISC](#) Rules for Lifting Appliances of Ships and Offshore Installations;

(3) Anti-slip arrangements are to be fitted on vehicle ramps; and

(4) For ro-ro passenger ships type 1 and type 2, the vehicle ramp is to be packed up during navigation so that the damage due to the collision with other ships will be reduced to a minimum.

2.1.13.3 For ro-ro passenger ships type 1 and type 2, the vehicles are to be secured in accordance with the following requirements:

(1) All vehicles are to be secured efficiently without danger to the safety of the ship and persons on board;

(2) The securing devices at both sides of the vehicle are to be of such sufficient strength as to prevent the vehicle from moving transversely at rolling.

(3) The wooden wedges (or adopt other effective ways) are to be provided on board, which are used to fix the fore or aft tires to prevent the vehicle from moving back and forth.

(4) The vehicle are to be braked reliably by using a parking brake in navigating.

2.1.13.4 For vehicle-passenger ferries, the vehicles are to be secured in accordance with the followings:

(1) Anti-slip arrangements are to be fitted on the vehicle deck;

(2) The wooden wedges are to be provided on board, which are used to fix the fore or aft tires to prevent the vehicle from moving back and forth.

(3) The vehicle wedges are to braked reliably by using a parking brake in navigating;

(4) Efficient measures are to be taken to ensure the vehicles being fixed reliably in rough weather.

2.1.14 Additional requirements for container ships

2.1.14.1 The securing devices are to be of sufficient strength.

2.1.14.2 The containers carried on board are to be effectively secured.

2.1.15 Additional requirements for oil tankers

2.1.15.1 For oil tankers/barges navigating in torrent sections and oil tankers/barges with a tonnage of 600 or over navigating in other waters, the cargo space is to be fitted with double sides. Its pattern and dimension are to comply with relevant requirements of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

2.1.16 Additional requirements for ships carrying dangerous goods

2.1.16.1 The structural forms for deck cargo ships or double-skin construction are to be adopted in the cargo spaces. Its pattern and dimension are to comply with relevant requirements of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

2.1.17 Additional requirements for pontoons

2.1.17.1 For the pontoon with oil product stowed on board, the cargo space is to be constructed with double sides of which the construction and dimensions are to meet the provisions specified in [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

Section 2 MARINE ENGINES

2.2.1 General Requirements

2.2.1.1 All machinery and their piping systems and fittings are to be of a design and construction applicable for the service for which they are intended and are to be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surface and other hazards. The design is to have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

2.2.1.2 The main and auxiliary engines, shafting and machinery equipment essential to the safety of the ship are to be so designed, type selected and arranged as to ensure the normal operation under the inclination

condition as follows:

list, up to 10°; trim, up to 5°.

2.2.1.3 The diesel engine of emergency generating sets and emergency fire pumps and their prime movers are to ensure ship normal working at the heel of 10° and trim of 5°

2.2.1.4 The arrangement of main and auxiliary engines and other equipment is to be reserved with enough passageway for convenient operation, maintenance and servicing.

2.2.1.5 It is to be ensured that the engine base, thrust bearing seat and other supporting structure are secured. The machinery are to be secured to the ship base.

2.2.1.6 The water tightness of watertight bulkheads is to be ensured when different kinds of pipelines and driving rods pass through.

2.2.1.7 For each part of boilers and machinery, all steamy, hydraulic, pneumatic fittings and other systems which withstand internal pressure are to be subject to relevant test apart from pressure test.

2.2.2 Astern means

2.2.2.1 The main propulsion machinery are to be capable of producing sufficient astern power to ensure proper control of the ship in all normal conditions.

2.2.2.2 For the main propulsion systems with reversing gears or controllable pitch propellers, running asterns are not to lead to the overload of the propulsion machinery.

2.2.2.3 The reversal time of main engines or main propulsion units is not to exceed 15 seconds. Such devices are to be capable of making ship from maximum ahead service speed to halt within proper distance.

2.2.3 Communication

2.2.3.1 At least two independent devices are to be provided for communicating orders from the navigating bridge to the main engine control position in engine room. One of these is to be an engine room telegraph which provides visual indication of the orders and responses both in the engine room and on the navigating bridge.

The ships having a total rated output of main engines of not more than 220kW may be provided with only one communicating device.

2.2.3.2 Where the engine room is separated from the auxiliary engine room or the auxiliary boiler room by bulkheads in which no means is provided for passengers, necessary communicating devices are to be provided.

2.2.4 Ventilation

2.2.4.1 Important machinery spaces are to be adequately ventilated so as to ensure that the machinery or boiler operates at its full power regardless of rough weather and that an adequate supply of air is maintained to the spaces for the safety and comfort of personnel and the operation of machinery.

2.2.4.2 Where a machinery space other than that specified above is to be provided with sufficient ventilation according to its use.

2.2.4.3 All places, where steam or flammable or toxic gases may be accumulated, are to be provided with ventilation system of mechanical extraction type.

2.2.4.4 A room, that is entered only occasionally, is to be adequately ventilated before the entry.

2.2.5 Additional requirements for ships navigating in torrent sections

2.2.5.1 Passenger ships (including ro-ro passenger ships type 1 and type 2 and vehicle-passenger ferries) navigating in torrent sections, oil tankers, ships carrying liquefied gas and ships carrying chemicals are to be provided with at least double main propulsion machinery.

2.2.5.2 For ships having a total output of main engines of more than 440kW, an air receiver for air sirens is to be independent, and a gauge showing air pressure in the receiver is to be fitted in the bridge. The air receiver for air sirens may be used for miscellaneous purpose provided that the charging air compressor is

independent and automatically controlled.

2.2.5.3 For ships navigating in torrent sections and with a rated output of each main engine of more than 220kW, the shafting are to be fitted with braking devices, and the indicators are to be provided in the main engine control position, showing whether brakes are put on or taken off.

2.2.6 General requirements for pumping and piping systems

2.2.6.1 Except where otherwise stated in this Chapter, pipes, valves and fittings are to be made of steel, cast iron, copper, copper alloy, or other approved material suitable for the intended service.

2.2.6.2 The piping of which pressure may exceed design pressure are to be provided with safety valve at outlet end of pump. The fuel oil overflow from the safety valve of fuel oil piping is to reflow to pump suction or tank. The set pressure of safety valve is not to exceed the piping design pressure.

2.2.6.3 Piping are to be fixed and are to avoid the damage caused by the thermal variations or hull deformation.

2.2.6.4 The penetration of watertight or gastight structures is to be fitted with through pieces or benches, the integrity of the structures is to be ensured.

2.2.6.5 When the non-metallic pipes of the piping penetrating through the watertight bulkheads, fireproof bulkheads or decks are damaged, the integrity of these bulkheads and deck is to be not damaged.

2.2.6.6 For ships being necessary to meet the requirements for damage stability, if pipes are situated within assumed damaged region, arrangements are to be made to ensure that progressive flooding cannot thereby extend to compartments other than those assumed flooded.

2.2.6.7 It is suggested that the steam pipe, oil pipe, water pipe, oil tank and other fluid containers are not to fitted above or behind distribution board. Where piping has to pass above or behind distribution board, then the detachable fitting are to be removed. Likewise, oil pipe and oil tank are not advised to installed above boiler, flue pipe, steam pipe, diesel engine supercharging, exhaust pipe and noise silencer. In case there is difficulty in doing so, certain measures are to be adopted to prevent oil from dropping onto above pipes or equipment.

2.2.6.8 All steam pipes, exhaust pipes and pipes with high temperature are to be banded with insulation material or be adopted with protective measures. The insulation material used for detachable fitting and valves are to be convenient to replace.

2.2.6.9 The standby fuel oil supply pumps are to be fitted for the ship with a set of main engine, providing that the capacity of individual main engine exceeds 370kW; for the capacity of ships corresponding to two or more sets of main engines, the standby fuel oil pump or spare pump (except for passenger ship and tugboat/push boat) may be exempted, providing that the main engines are equipped with fuel oil supply pump.

2.2.6.10 The ship with a set of main engine is to be fitted standby lubricant pump for the capacity of individual main engine exceeding 370kW; for the capacity of ships corresponding to two or more sets of main engines, the standby lubricant pump or standby pump (except for passenger ship and tugboat/push boat) may be exempted.

2.2.6.11 The ship with a set of main engine is to be fitted with standby cooling water pump for the capacity of individual main engine exceeding 370kW; for the capacity of ships corresponding to two or more sets of main engines, the standby cooling water pump or standby pump (except for passenger ship and tugboat/push boat) may be exempted.

2.2.6.12 The sea water tank is to be so arranged as to ensure sufficient water supply for equipment. Its opening is to have sufficient areas. For ships navigating in the service section in which water plants and other debris bloom, the flow area is to be effectively enlarged. For ships navigating in ice zone, the deicing equipment is to be equipped if necessary. While, the freeze-proofing measures are to be adopted for the ship subjecting to shipping suspension (mooring) during the period of grounded ice.

2.2.7 Bilge piping systems

2.2.7.1 All ships are to be provided with effective bilge drainage device so that the water within any

watertight sections can be pumped or drained out, except for the spaces in which the fresh water, ballast water, fuel oil or liquid goods are loaded and in which the effective measures for drainage under practical conditions can be adopted.

2.2.7.2 The arrangement of bilge drainage pumps is to be capable of preventing the water or in ballast compartment from entering cargo space, machinery space or other compartment.

2.2.7.3 Where the peak tanks are used as dry compartments, the chain locker and the watertight compartments above the fore peak tank are to be drained by hand pump of sufficient displacement.

2.2.7.4 The bilge water under enclosed compartment and steering engine room may be drained by manually operated pump having sufficient displacement capacity.

2.2.7.5 The spaces like closed empty compartment, which is less associated with ship safety, may be adopted with manually operated pump or other effective drainage facilities, providing it is approved by [CCSISC](#).

2.2.7.6 All valve boxes and manually operated valves in connection with the bilge pumping arrangements are to be in positions which are accessible under ordinary circumstances.

2.2.7.7 The calculation of bilge pipes, the selection of bilge pumps and arrangement of non-return systems are to meet relevant requirements specified in [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

2.2.7.8 Sanitary, ballast and general service pumps may be accepted as independent bilge pumps, providing they have sufficient displacement and that bilge drainage system is properly connect. Ejectors of required capacity may also be accepted as bilge pumps, provided that sufficient water supply from pump with adequate discharge pressure is arranged, but it is not to be used for suction of oily sewage.

2.2.7.9 Machinery spaces are to be provided with direct bilge suction(s) and the diameter of the suction is not to be less than the internal diameter of the main bilge pipes of the ship.

2.2.7.10 The bilge drainage arrangement in machinery space is to be such that any water which may enter this apartment can be pumped out at least two bilge suction when the ship is either upright or has a heel of not more than 5°. One of these suction is to be branch bilge suction, and the other is to be direct bilge suction.

2.2.7.11 In ships where the total rated output of main engine is more than 440kW and the powered propulsion ships where the total rated output of propulsion motor is more than 440kW, a branch bilge suction is to be fitted at the single and double bottom machinery space where the hull bottom rising to both side is less than 5°.

2.2.7.12 Machinery spaces are to be provided with emergency bilge suction(s), the suction is to be connected to the pump having the maximum capacity in the space(except bilge pump at ro-ro space and drainage pump of self-unloading sand ship and open-top containerhips; the diameter of the suction is not to be less than that of the inlet of the pump.

2.2.7.13 In ships where the total rated output of main engines is not more than 440kW and the powered propulsion ships where the total rated output of propulsion motor is less than 440kW, the emergency bilge suction(s) in machinery space may be dispensed with.

2.2.7.14 The side discharges in connection with direct bilge pump suction and emergency bilge suction are to be mutually independent providing that the ship is fitted emergency bilge water suction, and as possibly as fitted at both sides.

2.2.7.15 All bilge suction pumps up to the connection to pumps are to be independent of other pipes

2.2.7.16 Bilge water may be drained by hand pumps for non-self-propelled ships without auxiliary power. The bilge pump and piping are to be provided as per the relevant requirements of this Section for non-self-propelled ships with auxiliary power.

2.2.7.17 Open-top container ships and open-topcontainer barges are to be fitted at least two power pumps for discharging the rainwater and fire water accumulated in cargo space, and the total capacity of the bilge pump is to be taken as the groundwater in cargo space calculated in accordance with rainfall 100mm per hour or total capacity of fire pump, whichever is the greater.

2.2.8 Ballast and scupper systems

2.2.8.1 The arrangement of ballast piping and the number of suction are to be such that any ballast tank

can be filled or emptied under normal service conditions, whether the ship is upright or heeled.

2.2.8.2 The arrangement of ballast piping is to be such as to prevent the water from the sea or from ballast tanks sea water entering into dry cargo holds, machinery spaces or other dry compartments.

2.2.8.3 The arrangement of scuppers is to be such that water accumulated on decks can be rapidly drained under normal service conditions, whether the ship is upright or listed. The arrangement of scuppers and bulwark openings also are to meet the relevant provision specified in CHAPTER 3 of PART FOUR of the Guidelines.

2.2.8.4 Scuppers and discharges which drain spaces within super-structures or deckhouses situated on the freeboard deck and not fitted with efficient watertight doors are to be led overboard.

2.2.9 Steam piping

2.2.9.1 Every steam pipe and every fitting connected thereto through which steam may pass are to be so designed, constructed and installed as to withstand the maximum working stress to which it may be subjected.

2.2.9.2 Means are to be provided for draining every steam pipe in which dangerous water hammer action might otherwise occur.

2.2.9.3 If a steam pipe or fitting may receive steam from any source at a higher pressure than that for which it is designed a suitable reducing valve, relief and pressure gauges are to be fitted.

2.2.10 Compressed air systems

2.2.10.1 In every ship means are to be provided to prevent overpressure in any part of compressed air systems and wherever water jackets or casings of air compressors and coolers might be subjected to dangerous overpressure due to leakage into them from air pressure parts. Suitable pressure relief arrangements are to be provided for all systems.

2.2.10.2 For starting air device of which cylinder has a diameter of 230mm of the main propulsion diesel engine, certain measures are to be adopted to prevent starting air pipe from backfiring or internal explosion.

2.2.10.3 All discharge pipes from starting air compressors are to lead directly to the starting air receivers. The starting air pipes from the receivers to main or auxiliary engines are to be entirely separate from the compressor discharge pipe system.

2.2.10.4 Provisions are to be made to reduce to a minimum the entry of oil and water into the compressed air systems and to drain these systems.

2.2.11 Boilers, pressure vessels and boiler feed water systems

2.2.11.1 Boilers, boiler components, fittings and pressure vessels are to have sufficient strength and reliable structure.

2.2.11.2 Each boiler is to be fitted with not less than two safety valves being capable of enough relief. For small auxiliary boilers (namely the boilers having an evaporation capacity not exceeding 1000kg/h and a design pressure not exceeding 0.78 MPa). Safety valves are to be provided with hand gears which are to be operable at a safe position.

2.2.11.3 Each boiler essential to the safety of ship with which special water level is designed is to be fitted with at least two glass water gauges, of which at least one can directly read water level. For small auxiliary boilers, one glass water gauge with shield and a set of test cocks no less than two will be accepted.

2.2.11.4 A set of independent feed water system including feed pump may be provided for the auxiliary boiler serving as an important use or the auxiliary boiler providing the heating of fuel oil and cargo oil. A set of water feed standby pumps which are easy to be installed and connected are to be equipped. The small auxiliary boiler and exhaust boiler may not be equipped with spare pump.

2.2.11.5 Feed piping systems are to be so arranged that it could prevent oil or other sewage which may exert adverse impact on boiler from entering boiler as practicable as possible

2.2.11.6 Each oil-fired boiler which is intended to operate without manual supervision is to have safety arrangements which shut off the fuel supply and give an alarm in the case of low water level, air supply failure or flame failure.

2.2.12 Diesel engines

2.2.12.1 Diesels are to be capable of running under the power of 110% of its rated output.

2.2.12.2 Devices for quickly cutting off fuel oil supply or other effective arrangements for emergency stopping are to be provided near the main engine control station. Such devices are to be independent from the control system in wheelhouse.

2.2.12.3 The linear vibration of diesel engines and vibration isolators (steady-state value and instantaneous value) are not to exceed certain value required by manufacturer; also, the axial deviation caused by vibration is not to make different system parts excessively loaded.

2.2.12.4 For diesel engines of which the air cylinder has a diameter of over 230mm, each cylinder head is to be fitted with safety valve. The air outlet of safety valves is to be located at somewhere people may be freed from the influence of the gas exhausted.

2.2.12.5 Approved explosion relief valves having enough free space are to be arranged on the crankcase when the diesel engines having cylinders equal or greater than 200mm or the crankcase with gross volume exceeding 0.6. The arrangement and protection of explosion relief valves are to be so arranged that the least personal injury can be caused by the outburst gas.

2.2.12.6 Main engines arranged for starting simply by compressed air are to be provided with at least two air receivers. In ships having only a single main engine with a rated output less than 220kW and clutches, one air receiver provided may be acceptable (except passenger ships). Air receivers are to be of sufficient total capacity.

At least two sets of air charging equipment are to be provided for main engine started simply by compressed air, one of which is to be an air compressor driven by power other than main engine. For main engines having a rated output less than 110kW, one of the air charging equipment may be a manual air compressor. Air charging apparatus are to be of sufficient total displacement.

2.2.12.7 Batteries for engine starting are to be capable of being charged at any time by charging facilities provided on board, and are to be used exclusively for diesel engine starting and the monitoring equipment of the engine. Measures are to also be adopted to ensure it has always been energy stored.

2.2.12.8 The main engine started both by compressed air and batteries is to have sufficient capacity.

2.2.12.9 The diesel engine of emergency generating sets and prime mover of emergency fire pumps are to be capable of starting under low temperature.

2.2.12.10 For each main engine of the rated output exceeding 220kW which drives a controllable pitch propeller or which can be declutched from the transmission shafting, an over-speed protective device is to be provided in addition to the governor, so as to prevent the rated speed from being exceeded by more than 120%.

2.2.12.11 For each diesel engine of the rated output exceeding 220kW which drives an electric generator, an over-speed protective device is to be provided, so as to prevent the rated speed from being exceeded by more than 115%.

2.2.13 Gear Assemblies

2.2.13.1 The gear assembly are to be designed and constructed in such a manner that it can be capable of working under maximum operating stress in any conditions.

2.2.13.2 The lubricating oil system of transmission gearing is to be independent.

2.2.13.3 The gear assembly with an input power of over 370kW which has independent force-circulation lubricating system are to be fitted a set of standby lubricant pump. Standby lubricant pump or standby pump (except for passenger ship and tugboat/push boat) may be exempted, providing that the ship is equipped with several sets of gear assembly, each of which has independent force-circulation lubricating system.

2.2.13.4 An alarm device for high temperature of lubricating oil is to be fitted where its input power is more than 370kW. An alarm device for high temperature of lubricating oil is to be fitted where its input power is more than 1470kW.

2.2.13.5 For hydraulically controlled transmission gearing, emergency mechanical means are to be provided to ensure that the ship can run at a reasonable speed in the event of failure of the hydraulic control system.

2.2.14 Shafting and propellers

2.2.14.1 The main propulsion shafting together with its transmission gears are to be designed and constructed in such a manner that it is to be capable of supporting the maximum operating stress occurring in any operating condition.

2.2.14.2 For main propulsion shafting and auxiliary machinery shafting of which the rated output is equal or greater than 220kW, the excessive torque vibration is not to be allowed for in the whole range of working speeds. Otherwise red bands are to be imposed or suitable means for reducing the amplitudes are to be provided as appropriate;

2.2.14.3 For main propulsion shafting fitted with a bracket or with a ratio of the space of stern bearings to the diameter of stern of more than 40 or fitted with an universal jointed shaft which the rated output is equal or greater than 220kW, the excessive whirling vibration is to be prevented in the whole range of working speeds. Otherwise red band are to be imposed or suitable means for reducing the amplitudes are to be provided as appropriate;

2.2.14.4 Propeller blades are to be of sufficient strength.

2.2.14.5 Certain measures are to be adopted to prevent the fixed bolt and nuts of propeller and its fittings from loosening or corroding.

2.2.15 Steering gears

2.2.15.1 The definition of the terms in this Section are as follows:

(1) Steering gear is the equipment, necessary for effecting movement of the rudder for the purpose of steering the ship under normal service conditions, including steering gear control system, steering gear power units and ancillary equipment and the means of applying torque to the rudder stock.

(2) Steering gear control system is the equipment by which orders are transmitted from the navigation bridge to the steering gear power units. Steering gear control systems comprise of transmitters, receivers, hydraulic control pumps and their associated motor, motor controllers, piping and cable.

(3) Emergency steering gear control system is the control equipment for emergency steering gear power units;

(4) Steering gear power unit is:

① in the case of electro steering, an electric motor and its associated electrical equipment;

② in the case of electro hydraulic steering gear, an electric motor and its associated electrical equipment and connected pump;

③ in the case of other hydraulic steering gear, a driving engine and connected pump;

(5) Emergency steering gear power unit is an electrical motor and its associated electrical equipment and connected pump, which is driven by emergency power;

(6) Steering unit is the tiller, quadrant and stock or other parts with the same function, which turn electric power or hydraulic into mechanical action to effect movement of the rudder.

(7) Maximum working pressure is the maximum pressure inside the steering system when steering gear is working in accordance with the provision defined in 2.2.15.2 (3) ⑥.

(8) Maximum ahead service speed is the greatest speed which the ship is designed to maintain in service at sea at the deepest seagoing draught and in the case of the maximum speed of propeller and the maximum continuous output of the corresponding main engine;

2.2.15.2 Arrangement and basic performance of main steering gear

(1) of adequate strength and capable of steering the ship at maximum draught and maximum ahead service speed.

(2) capable of being brought speedily into action by controlling in the navigating bridge.

(3) power steering gears are to comply with following requirement

① provided with at least two steering gear power units with a capacity meeting the requirement of 2.2.15.2(3) ⑥ for alternate use.

② for electric type steering gear, it is to be so arranged that after a failure in one of the power units the defect can be isolated and steering capability can be maintained or speedily regained; the time for regaining the steering capability is not to be more than 12s;

③ mutual independent pipes and associated parts for electric type steering gear with a rudder torque of more than 16kN·m. They are to only join at isolating valve located in entry of oil cylinder;

④ for ships navigating in non-torrent service section, its hydraulic and mechanical type steering gear with a rudder torque of more than 16kN·m are to be fitted with standby reversing valve which are to be effectively isolated from standby reversing valve. A switching equipment is to also be fitted between them for conversion.

⑤ steering gear power units are to be the manner of hydraulic pumps being driven respectively by two main (or ancillary) engines, or the manner of one hydraulic pump being driven by main (or ancillary) engine and the other being driven by independent power. The hydraulic pump driven by a main (or ancillary) engine is to be a constant flow pump, or else a pressure accumulator or hand pump is to be provided.

⑥ at maximum draught and maximum ahead service speed, the time of rudder movement of each steering gear power unit is to meet the requirement of Table 2.2.15.2 (3) ⑥.

Table 2.2.15.2(3) ⑥

		Ships navigating in torrent	Ships navigating in spaces other than torrent
the rudder put from 35° on one side to 30° on the other side	$l \geq 30m$	$\leq 12s$	$\leq 20s$
	$l < 30m$	$\leq 15s$	

(4) Manual (mechanical or hydraulic) steering gears are to comply with the requirements in Table 2.2.15.2

(4) when the rudder is put over from 35° on one side to 30° on the other side with the ship at its maximum draught and running ahead at maximum ahead service speed.

Table 2.2.15.2(4)

	Ships navigating in torrent	Ships navigating in spaces other than torrent
Force on steering gear operation wheel, in N	≤ 147	≤ 147
Time of rudder movement, in s	≤ 15	≤ 20

2.2.15.3 Construction and arrangement

(1) steering gear control system

① Electric type steering gears are to be provided with two independent steering gear control systems, which can be controlled in the navigation bridge, however, it is not necessary to provide two steering hand wheels or steering handles.

② for electric type and hydraulic type steering gears, steering handles or buttons are to be fitted at the steering gear to control the rudder; in addition, the rudder is to be capable of being controlled in the navigation bridge. For electric type steering gear, the control of the rudder in the navigation bridge is to be interlocked with that at steering gear, and the control at steering gear is to be in prior.

③ When steering units put the rudder at the angle required, the angle of the rudder is to be capable of being remained unchanged.

④ For electric or electric & hydraulic steering gears, the motor, control equipment, power supply and cable lying are to comply with the provisions of CCS/ISC Rules for Construction of Inland Waterway Steel Ships.

(2) All parts of steering gears and rudder stock are to have sufficient strength and reliable structure. The

reliability of any non-double important parts of in the navigation bridge is to be particularly considered. It is to be adopted with wear-resistant bearing if applicable, like long-lasting lubricated ball bearing, roller bearing or sleeve bearing with lubrication fittings.

(3) The design pressure of the components subjected to internal pressure is to be at least 1.25 times the maximum working pressure.

(4) For ships of which rudders can be controlled in the steering gear room, a means of communication are to be provided between the navigation bridge and the steering gear room.

(5) The rudder angle indicator is to be provided in the navigation bridge. For powered steering gear, the wheelhouse is to be fitted with rudder angle indicator. It is to be independent to steering gear control system along with its power. When it is necessary to control the rudder at steering gear, another rudder gear indicator is to be provided at steering gear.

(6) Hydraulic systems

- ① The hydraulic oil used for hydraulic transmission pipes is to be not used as the lubrication for any other components except for the hydraulic system.
- ② It is to be ensured that the dimension, structure and arrangement of hydraulic pipes still maintain in good condition regardless of mechanical motion or fire.
- ③ The approved flexible hose components are allowed to be installed at the place where the flexibility of two parts is required, and that vibration absorption or free motion of important parts and not endure distortion under the circumstance of normal operation.
- ④ The oil filter is to be fitted in hydraulic transmission system, with the arrangement so conducted that its cleaning would not hinder the system normal operation.
- ⑤ Relief valves are to be fitted to any part of the hydraulic system which can be isolated and in which pressure can be generated from the power supply or from external forces. The setting of the relief valves are to be at least 1.25 times the maximum working pressure but not exceed the design pressure. The minimum capacity of the relief valves are to be not less than the total capacity of all the pumps discharging through these relief valves and at this case, the rising of the pressure are to not exceed 10% of the setting of the relief valves.
- ⑥ A liquid meter and a low-level alarm are to be provided or each working oil-box of the steering gear to give the earliest practicable indication of hydraulic fluid leakage. Audible and visual alarms are to be given on the navigation bridge and in the machinery space where they can be readily observed.

(7) The steering gear compartments are to be:

- ① readily accessible and, as far as practicable, separated from machinery spaces; and
- ② For ships that need to be steered in steering gear compartments, they are to be provided with suitable arrangements to ensure working access to steering gear machinery and controls. 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.

2.2.15.4 Additional requirements for ships navigating in torrent

(1) For ships navigating in torrent, the steering gears driven electrically or electro-hydraulically, in addition to complying with the requirements in 2.2.15.2(3), are to be provided with emergency power. Moreover, the emergency steering gear control system and emergency steering gear power units are to be fitted for ships of which the steering gear has a stock torque of more than 16kN·m. The arrangements and performance are to meet the followings:

- ① Except that the ships with a stock torque of more than 16kN·m are to be provided with batteries as emergency power source, other ships may be provided with pressure accumulators or handle hydraulic pumps as emergency power source.
- ② the pipes and fittings of the emergency steering gear control system and emergency steering gear power unit provided for the ships with a stock torque of more than 16kN·m, are to mutually independent of the common steering gear, and are to be joined only at the isolated valves at the entry of the oil tanks. Whereas, it can exempt from the requirement of 2.2.15.2 ②, ③. The pipes and fittings are to be so arranged that the defect can be speedily and efficiently isolated after a failure in the common power unit or pipes, and the emergency steering gear system is to be started automatically to maintain the steering capability within 10s.

(2) For the emergency steering gear power units of the ships with a stock torque of more than 16kN·m, the time of rudder movement isto comply with the requirements of 2.2.15.2⑥ of this Section. For the ships with

a stock torque of less than 16kN·m, the emergency steering gear is to be capable of putting the rudder over from 15° on one side to 15° on the other side with the ship running ahead at 60% of the maximum ahead service speed in less than 15s.

(3) For the ships with a stock torque of less than 16kN·m, the steering gear power unit can be exempted from the requirement of 2.2.15.4 (1) ① of this Section when being equipped in accordance with 2.15.2 (3) ⑤.

Section 3 ELECTRICAL EQUIPMENT

2.3.1 General Requirements

2.3.1.1 Unless otherwise specified, the electrical equipment involving navigation and safety of ships are to be designed, manufactured, commissioned and installed in accordance with CCS Rules for Construction of Inland Waterway Steel Ships or other equivalent standards accepted by the Administration .

2.3.1.2 The electrical equipment are to be capable of being safely operated and the safety of the passengers, crews and ship from electrical hazards is to also be ensured.

2.3.2 General requirements for main power supply

2.3.2.1 The installation of main power supply is to be sufficient to ensure the supply of all electrical services necessary for normal operation and habitability.

2.3.2.2 Two sets of main power supply installations are to be provided to the self-propelled ships at least, and the main power supply installations of the non-propelled ships are to be fitted as necessary.

2.3.2.3 The main power supply installations may be:

- (1) generator driven by independent primary mover;
- (2) generator driven by main engines;
- (3) storage batteries.

2.3.2.4 When the main power supply consists of A.C. generating sets, the excessive system voltage drop on the system is not to cause any motor other equipment in operation to stall or become ineffective when the motor of maximum capacity is started under any condition of the designed operating mode.

2.3.3 Provisions for main power supply

2.3.3.1 When the power steering gear and the equipment necessary for the ship's normal running, such as auxiliaries, fire pumps and bilge pumps, are supplied by the power supply, at least two generating sets are to be fitted along with independent of the main engine.

The number and capacity of these generating sets are to be such that in the event of any one generating set being stopped, it will still be possible to supply those services necessary to provide normal operational conditions of propulsion and safety and cargo refrigeration. Minimum comfortable conditions of habitability are to also be ensured which include at least adequate services for cooking, heating, domestic refrigeration, mechanical ventilation, sanitary and fresh water.

2.3.3.2 The ship may be supplied with only one self-contained generating set when one of the following is met:

(1) one of the following equipment is driven by the propulsion machinery: steering oil pump, the equipment servicing for the main engine, such as auxiliaries, fire pumps and bilge pumps, and electric equipment necessary for the ship's safety and capable of being supplied by batteries, such as navigating signal appliances, communicating and alarm devices and lightings;

(2) when a main shaft driven generator is fitted, the fluctuation of voltage and frequency of generator driven by a propulsion machinery makes the equipment mentioned in 2.3.2.1 be in normal working conditions regardless of the speed and direction of rotation of the propulsion machinery or shafting.

2.3.3.3 When all the power equipment necessary for the ship's safety are supplied not by electrical power, two accumulator batteries are to be fitted as the main power supply.

2.3.3.4 The capacity of each accumulator battery mentioned in 2.3.3.2(1) and 2.3.3.3 of this Section is

sufficient to provide the electrical services necessary to maintain the ship's safety during the adaptable time of the whole voyage, and can supply power to these electrical equipment for a period of at least 4 hours.

2.3.3.5 When converting equipment are the necessary part of the main power supply system which is required for the safety of navigation of ships. Minimum comfortable conditions, the number and capacity of converting equipment are to ensure adequate power supply to the equipment essential to the safety of navigation of ships even if one of them is failed. Minimum comfortable conditions of habitability are to also be ensured which include at least adequate services for cooking ,heating, domestic refrigeration, mechanical ventilation, sanitary and fresh water.

If the main power supply is provided in accordance with 2.3.3.2(1) of this Section, it is allowable to provide only one set of converting equipment.

2.3.4 General requirement for emergency power supply

2.3.4.1 The emergency power supply is to adopt a self-contained accumulator battery or generator.

2.3.4.2 The emergency power supply is to supply automatically upon failure of the electrical supply from the main power supply. An indicator showing an audible and visual signal is to be mounted in a suitable place on the main switchboard or in the machinery control room to indicate when the emergency power supply is being discharges, and a noise-abatement equipment is to be fitted.

2.3.4.3 Where the emergency power supply is a generator unit, it is to be started automatically upon failure of the electrical supply from the main power supply and is to be automatically connected to the power networks to supply.

The overall process of the automatic starting and automatic connection to electric networks is not to exceed 20 seconds (starting times are not required), and audible and visible alarms are to be given if automatic starting and connection fail.

2.3.4.4 The emergency power supply is to be of sufficient capacity to supply the emergency electrical load mentioned in 2.3.7 of this Section for at least 1 hour. The emergency fire pump is to be power supplied for at least 3 hours in case there is a need. Where the emergency power supply is an accumulator battery, it is to be capable of carrying the emergency electrical load without recharging and operate while maintaining the voltage of the battery throughout the discharge period within 12% above or below its rated voltage.

2.3.4.5 The emergency circuits are to be not provided with switches (except those in the wheelhouse). Emergency lights are to be marked with obvious red signs or be constructed different from other lights.

2.3.5 Equipment for emergency power supply

2.3.5.1 The ships with a stock torque of more than 16kN·m navigating in the torrent are to be fitted with accumulator batteries as emergency power supply in

2.3.5.2 Passenger ships of category I, including ro-ro passenger ships, are to be equipped with emergency power supply.

2.3.6 Installation of emergency power supply

2.3.6.1 The emergency generating units or emergency storage battery and their distribution devices are to be installed behind the collision bulkhead, outside the engine and boiler rooms, on freeboard deck, or in rooms above freeboard deck as far as possible.

2.3.6.2 The emergency storage battery is to be not installed in one room with the emergency switchboard and charging device but is to be installed as closely to them as possible. When there is a fire or other accidents in the space where the main switchboard is installed, the function of the emergency switchboard is not to be affected.

2.3.6.3 The emergency generating units and the emergency switchboards are to be installed in one room.

2.3.7 Scopes of supply by emergency sources of electrical power

2.3.7.1 The emergency power loads are to specially considers the followings:

(1) The power installations and control devices of steering gear;

(2) Rotary converters (if any) supplying power for communication and navigation equipment, emergency lighting loads, etc;

(3) Electric Emergency fire pumps (emergency generating set is equipped, and only when the emergency fire pump is of electrical drive).

2.3.7.2 The emergency loads are to specially consider the followings:

(1) Emergency lighting loads:

- ① Above the main engine console;
- ② Before and behind the main and emergency switchboards;
- ③ In engine rooms and at their entrances and exits, at emergency exits;
- ④ In broadcast room and radio room;
- ⑤ In all service and accommodation alleyways, stairways and exits;
- ⑥ In all alleyways, stairways and exits leading to the storage position of life boats (life crafts);
- ⑦ In the storage position of life boats (life crafts);
- ⑧ In public spaces and in cabins accommodating more than 16 persons;
- ⑨ In steering gear rooms;
- ⑩ In the wheelhouse;
- ⑪ In engine room central control space and central monitoring space;
- ⑫ In fire control rooms;
- ⑬ In open ro-ro spaces, closed ro-ro spaces.

(2) The emergency power supply for the following equipment:

- ① Navigation lights and signal lights;
- ② Magnetic compass;
- ③ Telegraph;
- ④ Pre-warning signal devices for CO₂ releasing;
- ⑤ Fire detection and fire alarm system, handle fire alarm button;
- ⑥ Emergency mustering alarm devices;
- ⑦ Wireless communication equipment.

2.3.8 Equipment for temporary emergency source of electrical power

2.3.8.1 For ships fitted with the main source of electrical power in accordance with the provisions of 2.3.3.1 or 2.3.3.2(2) of this Section, an accumulator battery is to be provided as temporary emergency source of electrical power, excluding the ships having been provided with emergency source of electrical power.

2.3.8.2 For restaurant pontoons with a length of 50m or more, an accumulator battery is to be provided as temporary emergency source of electrical power.

2.3.8.3 The temporary emergency source of electrical power (accumulator batteries) is to be connected automatically to the equipment provided in 2.3.9 of this section upon failure of the electrical supply from the main source of electrical power, and is to be capable of carrying the emergency electrical load without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage.

2.3.8.4 The temporary emergency storage battery and their distribution devices are to be installed on freeboard deck or in rooms above freeboard deck, and the room of which is to be behind the collision bulkhead and outside the engine.

2.3.8.5 The emergency circuits are to be not provided with switches (except those in the wheelhouse). Emergency lights are to be marked with obvious red signs or be constructed different from other lights.

2.3.9 Scope of supply by temporary emergency source of electrical power

2.3.9.1 In addition to the requirements specified in 2.3.9.3 of this Section, the capacity of temporary emergency source of electrical power (accumulator battery) is to be sufficient to simultaneously supply to the equipment of the article (1) to (7) for 0.5h, and is to be sufficient to supply to the article (8) for 1h;

- (1) Temporary emergency lighting;
- (2) Emergency mustering alarm devices;
- (3) Fire detection and fire alarm system, handle fire alarm button;
- (4) Failure detecting and alarm systems for mechanical and electrical equipment;
- (5) Internal communication systems;
- (6) Control systems of steering gear;
- (7) Out-of-control signal lights;
- (8) Wireless communication equipment.

2.3.9.2 Special considerations are to be given to the following spaces when the temporary emergency power source is provided:

- (1) At the main engine console;
- (2) Before and behind the main switchboards (emergency switchboard);
- (3) In public spaces and in cabins accommodating more than 16 persons;
- (4) In all service and accommodation alleyways, stairways and exits;
- (5) In engine room central control space and central monitoring space;
- (6) In the wheelhouse.

2.3.9.3 For restaurant pontoons, the capacity of temporary emergency source of electrical power (accumulator battery) is to be sufficient to simultaneously supply to the following equipment for 0.5h:

(1) Temporary emergency lighting:

- ① In galley;
- ② In guest rooms and recreational spaces more than 16 persons;
- ③ In all service and accommodation alleyways, stairways and exits;
- ④ At the anchor lamps.

(2) Fire detection and fire alarm system, handle fire alarm button;

(3) Public address system (if any);

(4) Emergency mustering alarm devices (if any); (5) Pre-warning signal devices for CO₂ releasing (if any).

2.3.9.4 Restaurant pontoons with a length of less than 50m may not be fitted with temporary emergency source of electrical power, but are to be provided with temporary emergency lighting required in 2.3.9.3 (1) of this Section, which may use the lighting lamps with built-in battery (being chargeable).

2.3.10 Lighting

2.3.10.1 The main lighting system is to provide enough illumination for all the locations and spaces which are easy of access and use for passengers and crew, and is to be supplied by the main power source.

2.3.10.2 The arrangement of the main lighting system is to be such that a fire or other casualty in spaces containing the main power source, associated converting device (if any), the main switchboard and the main lighting switchboard, will not render the emergency lighting system inoperative.

2.3.10.3 The emergency lighting and temporary emergency lighting are to be provided in accordance with the relevant provisions of this Section.

2.3.10.4 The arrangement of the emergency lighting system is to be such that a fire or other casualty in spaces containing the emergency power source, and associated-converting device (if any), the emergency switchboard and the emergency lighting switchboard will not render the main light system inoperative.

2.3.10.5 The normal lighting circuit of the ship is to be not served as the emergency lighting circuit.

2.3.10.6 For the ro-ro passenger ships of type 1 or 2, passenger ships of category I and passenger ships of category II with a length of 50m or over, restaurant pontoons with a length of 50m or over, the means of escape, including stairways and exits are to be marked by standard lighting or photo luminescent strip indicators approved by the Administrator placed not more than 0.3m above the deck at all points of the escape route, including angles and intersections. The marking must enable passengers to readily identify the escape exits.

If electric illumination is used, it is to be supplied by the emergency or temporary emergency source of electrical power.

2.3.10.7 Ro-ro passenger ships type 1 are to be provided with supplementary emergency lightings, which are to meet the followings:

(1) The passenger public spaces and alleyways are to be provided with supplementary emergency lighting that can operate for at least 1h when all other sources of electrical power have failed and under any condition of heel;

(2) The illumination provided are to be such that the approach to the means of escape can be readily seen;

(3) The source of power for the supplementary lighting is to consist of accumulator batteries located within the lighting units that are continuously charged and can ensure to work automatically upon failure of the electrical supply from all of the other sources of electrical power;

(4) The supplementary lighting are to be such that any failure of the lamp will be immediately apparent;

(5) Any accumulator battery fitted inside is to be replaced at intervals having regard to the specified service life in the ambient conditions that they are subject to in service;

(6) A portable rechargeable battery operated lamp is to be provided in every crew space alleyway, recreational space and every working space which is normally occupied unless supplementary emergency lighting, as required above, is provided.

2.3.11 Navigation Lights and Signal Lights

2.3.11.1 The arrangement and installation of the navigation lights and signal lights are to comply with the relevant requirements for signal lights of CHAPTER 7 of this Part.

2.3.11.2 The control box of the navigation lights is to be supplied by two feeder circuits. For the ships that

do not require any setting of the emergency power source, one of the two circuits must be directly supplied by main switchboard, while another one is to be supplied by the section box of the main switchboard; for the ships that require emergency power source, one circuit is to be supplied by the main switchboard, and another one is to be supplied by the emergency switch board.

For the ship of which main power source complied with the provisions of 2.3.3.2 (1)、2.3.3.3, when the navigation lights and signal lights of this ship are all powered by one control box, only one feeder circuit is to be set up.

2.3.11.3 The control box of navigating lights is to be provided with audible and visible alarm devices for each navigating light.

2.3.11.4 Separate control switches, fuse and on-off indicators with corresponding nameplate or label for every navigating light are to be provided in the control box.

2.3.11.5 Each signal light is to be controlled and protected by the separate circuit from the signal light control boxes installed in the wheelhouse. The operating indicator lights of which colors are the same as that of the signal lights are to be provided in the control boxes of signal lights.

2.3.11.6 Control boxes of flash lights are to be installed in the wheelhouse and are to be provided with power supply indicator lights and operation indicator lights which are arranged at the positions facing the steersman for easy view.

Automatic control devices are to be provided for the flash lights, and if there is any failure of the control devices, the flash lights are to be capable of being controlled manually.

2.3.11.7 For ships with no wheelhouse such as unmanned barges, non-self-propelled engineering boats and pontoons, the signal control boxes are permissible to be installed in the duty room or other easily-managed locations.

2.3.12 Precautions against electrical shock, fire and other hazards

2.3.12.1 Earthing measures:

(1) All accessible metal parts of electrical equipment other than the live metal parts are to be earthed except the followings:

① Electrical equipment with working voltage not exceeding 50V (for alternating current, the voltage is the r.m.s. value), and the voltage is to be not obtained by means of self-coupling transformers;

② Electrical equipment supplied from an isolating transformer supplying only one device, and its voltage does not exceed 250V;

③ Portable equipment with double insulation and (or) reinforced insulation;

④ Bearing housings which are insulated in order to prevent the circulation of shaft currents.

(2) The earthing of electrical equipment is to comply with the following requirements:

① When the electrical equipment is directly fixed on the metal structures of ship hull or securely fixed on bedplates (or supports) which have a solid electrical contact with the metal structures of ship hull, a special conductor for earthing may not be installed;

② Whether the earthing is achieved through a special conductor or by the equipment bedplates (or supports), the surfaces in contact are to be clean, flat and smooth so as to ensure an effective contact, and means are to be taken to prevent the contact from loosening and corrosion;

③ If special conductors are used for earthing, the conductors are to be made of copper or other well-conductive and corrosion-resistant materials, and if necessary, means are to be taken to prevent the conductors from mechanical damage and corrosion. The normal cross-sectional area of copper earthing conductors of different types are to be not less than the values specified in Table 2.3.12.1;

Cross-sectional areas of earthing conductors

Table 2.3.12.1

Types of earthing conductors	Cross-sectional area of corresponding current carrying conductor S , in mm^2	Minimum cross-sectional area of copper earthing conductor Q , in mm^2
Continuous earthing conductors in flexible cables or wires	$S \leq 16$	$Q = S$
	$S > 16$	$Q = S/2$ but not less than 16
Continuous earthing conductors in cables fixed permanently	$S \leq 16$	$Q = S$ but not less than 1.5
	$S > 16$	$Q = S/2$ but not less than 16
Earthing conductors fixed independently	$S \leq 2.5$	$Q = S$ but not less than 1.5
	$2.5 < S \leq 120$	$Q = S/2$ but not less than 4
	$S > 120\text{mm}^2$	$Q = 70\text{mm}^2$

④ The non-live naked metal parts of movable and portable electrical equipment are to be earthed through plugs and sockets by means of the continuous earthing conductors in the flexible cables or wires, the cross-sectional area of the earthing conductors are to comply with the requirements of Table 2.3.12.1.

(3) The cable earthing is to comply with the following requirements:

① Metal sheaths or covering of cables are to be earthed effectively at both ends of the cables, but the cables in final sub-circuits are permitted to be earthed only at the power supply end. The cables for controls and instruments need not be earthed at both ends if one end earthing is favorable for technical reasons;

② The metal sheathing or covering of cables may be earthed by one of the means described below:

(a) Gripped with metal clamps and the clamps are connected to the metal structure of ship hull with a special copper earthing conductor. The relation between the cross-sectional area Q of the earthing conductor and the cross-sectional area S of the current-carrying conductor of the cable are to comply with the following requirements:

If $S \leq 25\text{mm}^2$, $Q \geq 1.5\text{mm}^2$;

If $S > 25\text{mm}^2$, $Q \geq 4\text{mm}^2$;

(b) By means of special earthing glands which can ensure the effective earthing connection;

(c) To be earthed by cable fasteners which are to be made of corrosion-resistant metallic materials, the fasteners are to ensure good contact between the metal sheathing or covering of the cables and the earth.

(4) In order to prevent from static discharging, the cargo tank (or cabinet), processing equipment and piping used for flammable fluid and solid which may amiss flammable gas and/or flammable fine dust and not fixed directly or welded by the supporting on the hull, are to be fitted with special earthing strap (the earthing straps are also fitted among the pipe sections of flange joints), which are to be made of brass or corrosion-resistant material with well electric conductivity and have a cross-area of not less than 10mm^2 ;

(5) The metal shells of electrical equipment of non-metallic ship and all other accessible metal parts excepting for live parts are to be connected together by bonding conductors, so as to form a continuous and integrated grounding system. They are to be connected to a metal grounding plate with area not less than 0.2m^2 , and thickness not less than 2 mm. The installation position of the metal grounding plate are to be submerged in the water under any navigation conditions and are to have corrosion resistance performance.

2.3.12.2 Precautions against electrical shock and fire:

(1) The electrical equipment are to be so designed and installed that it is capable of effectively preventing operators and related persons from accidentally touching the live parts and the parts with broiling surface, and the insulation resistance between its operation components (such as push buttons, operation handles etc.) and the live parts are to be in good condition;

(2) Electrical equipment having an operating voltage exceeding 50V are to be provided with suitable protective means for safety. The live parts are to be not exposed outside;

(3) The power systems and control circuits for the electrical equipment are to be so designed that when electrical equipment are switched off by the switch or control units, in principle, the electrical equipment are not to remain alive via system and self control circuits or indicating light, except for the control circuits of synchrometer switch and of 24V storage battery;

(4) Portable electrical equipment are to be one of the following modes:

① equipment earthed by means of continuous earthing conductor in the flexible cables or wire³;

② equipment with double insulation;^①

③ equipment supplied from an isolating transformer supplying only one device;^①

④ equipment with working voltage not exceeding 50V ⁴.

(5) Where A.C. high voltage equipment with rated voltage of 1kV up to 11kV is adopted, it is to be provided with special protection means recognized by the Administration to ensure normal operation and safety of personnel;

(6) Electrical equipment are to be not in direct contact with the exterior surfaces of fuel oil compartments, oil tanks and double bottom oil compartments. If absolutely necessary, it is to be installed at least 50mm apart from these surfaces;

(7) Rheostats, starting resistors, charging resistors, heating appliances and other equipment likely to cause high temperatures are to be installed with the protection for adjacent objects against overheat or fire. All the equipment mentioned above are strictly prohibited to be installed directly on the exterior surfaces of fuel oil compartments, oil tanks or double bottom oil compartments;

(8) If the temperature of the enclosure of electrical equipment exceeds 80°C , suitable means are to be provided for heat isolation;

(9) Electrical equipment are to be not installed in the spaces where any flammable mixed gas is likely to

³ Equipment's working voltage does not exceed 250V.

⁴ Portable equipment with voltage not exceeding 24V are to be adopted in especial easy-shock and moist spaces.

accumulate, including such spaces on board oil tankers, storage battery room, paint room, acetylene room, or similar locations, unless the Administration confirms that the equipment:

- ① is indispensable for operation;
- ② will not ignite flammable mixed gases;
- ③ is applicable to related location;
- ④ has been tested for safe usage in dust, vapor or gases.

(10) Sockets are to be not fitted in explosion hazardous zones;

(11) Independent air-conditioning equipment are to be power supplied by the independent circuit of distribution board.

2.3.12.3 System and circuit protection measures:

(1) For passenger ships of category I, ro-ro passenger ships type 1 and type 2, ro-ro ships, oil tankers (barges), ships carrying liquefied gas in bulk, ships carrying dangerous chemicals in bulk and ships carrying dangerous cargoes in bulk, the distribution system insulated from earth isto be adopted;

(2) For the distribution system insulated from earth, whether primary system or secondary system, a megohmmeter or indicator indicating the insulating situation from earth or a monitoring device for continuously monitoring the insurance is to be provided. If an indicator is used, its power is to be not more than 15W and is to be controlled by a button. For all the ships aforesaid in the article (1), a monitoring device for continuously monitoring the insurance is to be provided, which can send out visible or audible alarms when the insurance is exceptionally low;

(3) Each independent circuit is to be provided with reliable short-circuit and overload protection; the power supply circuit for steering gear is to be fitted only with the short-circuit protection;

(4) Selection, arrangement and function of each protection device are to render the system protection selective. In the event of a fault somewhere, protective devices are to take discrimination actions to cut off the unhealthy circuits and to keep the continuity of power supply for healthy circuits. At the same time, protective devices are to eliminate the effect of faults and hazard of fire as far as possible;

(5) There are to be durable labels indicating the ratings or the corresponding settings of overload protection devices of each circuit, which are to be fitted at the locations where the protective devices are installed;

(6) All the cables and wires of electrical equipment are to be at least of flame-retardant type. Radio frequency cable may be dealt with properly under special conditions;

(7) The cables and wires of electrical equipment are to be installed as far as possible from galley and high hazardous zones which can cause fire;

(8) The laying of cables is to avoid chafe and other damages. Cables laid in spaces with the risk of mechanical damage and on open deck are to be provided with protection;

(9) All terminals and connections of cables are to be provided with effective measures to protect the cable's intrinsic electrical, mechanical and flame-retardant properties from damages;

(10) Cables of Lighting circuits and electrical heating devices' circuits are to be provided with measures to avoid the heat emission of bulb and heating elements exceeding permissible temperature of cables, and avoid the surrounding materials to be overheated;

(11) For passenger ships of category I, II and III, ro-ro passenger ships type 1 and type 2, halogen free cables are to be laid in the accommodation and service spaces;

(12) For the cables of the equipment necessary to work in the fire condition⁵, including its supply cables⁶, when they pass through the spaces with greater fire risks⁷ and main vertical zones, they are to be fire-resisting cable, excluding the cables outside these spaces and zones. However, the following equipment are excluded: fail safe systems, systems with self-testing function and double-state equipment with cables laid from each far away;

The equipment necessary to work in the fire condition include: emergency mustering alarm devices; fire detection and fire alarm system; pre-warning signal devices for CO₂ releasing; public address system, emergency lighting; low-level lighting mentioned in 2.3.10.6 of this Section (if lamplight is used);

(13) For ro-ro passenger ships of type 1 and type 2, the cables that require to continually work under the fire condition of ro-ro places, including its supply cables are to be fire-resisting cables. These cables are to at least include the supply cables and controlling cables of the equipment mentioned in 2.3.12.3 (12) of this section, television monitoring systems, steering gear systems, control telephones and emergency fire pumps;

⁵ 1 When cables are required to be used for the equipment working under fire condition, the fire resistant cables are to extend from the control/monitor screen to the relevant places or areas closest to the distribution board.

⁶ When cables are required to be used for the equipment working under fire condition, the fire resistant cables are to extend from the power supply terminals to the relevant places or areas closest to the distribution board.

⁷ Spaces with greater fire risks refer to the machinery spaces, service spaces with fire risks, the enclosed or partially enclosed dangerous places which are required to be installed with qualified explosion-proof electrical equipment.

(14) The television monitor is to be arranged inside the open/closed vehicle spaces of ro-ro passenger ship type 1, so that any movement of vehicles and unauthorized access by passengers thereto can be detected whilst the ship is under way.

2.3.12.4 Measures of lightning prevention

(1) Reliable lightning conductors are to be provided on each mast for the electrical equipment installed on the top of steel mast or non-metal mast;

(2) Lightning protection devices are to be composed of air termination (lightning rod), down conductor and grounding device;

(3) The lightning rods are to be made with copper, steel or other metals of good conductive properties (e.g. aluminum alloy). The copper lightning rods are to be not less than 12mm in diameter and the steel lightning rod are to be not less than 25mm in diameter, and the lightning rod of aluminum alloy is to be not less than 16mm in diameter. The tips of lightning rods are to be treated against corrosion;

(4) The tips of lightning rods are to be at least 300mm higher than the top of the masts or the electrical equipment installed on top;

(5) The copper wire connecting lightning rod and hull are to be not less than 70mm² in cross-sectional area, while for the steel and aluminum alloy wire, the cross-sectional area is to be not less than 100 mm² and 84 mm² respectively;

(6) When metal masts are fitted in the ship, the lightning rods are to be directly welded or riveted to the masts. For example, down conductors may not be provided if the masts are welded on the hull;

(7) When collapsible masts are fitted in the ship, they are to have a reliable electrical connection with the hull and the cross-sectional area of connecting soft cable is same as the wire of down conductor;

(8) For non-metallic ship, the down conductor of lightning protection devices is to be permanently connected to the special grounding plate underwater.

2.3.12.5 Protection against fire from electrical heating appliances

(1) Every complete set of electrical heating appliance and electrical cooking appliance, whether permanently fixed or removable, is to be supplied by separate feeder circuits from distribution switchboards, and is to be controlled by a permanently fixed multi-pole inter-linked switch which can cut off all the insulated poles at the same time. If electrical heating appliances and electrical cooking appliances are connected to the power supply by sockets, the multi-pole inter-linked switches are to be fitted before the sockets or the sockets with interlinked switches are to be used;

(2) The installation of electrical heating appliances and electrical cooking appliances are not to cause overheat and fire hazard to adjacent decks, bulkheads or other surroundings. The use of the electrical heating and electrical cooking appliances with exposed heating elements is prohibited;

(3) Electrical heating and electrical cooking appliances are to be not installed in the spaces where inflammable gases and dusts are likely to accumulate;

(4) All the electrical heaters are to be permanently fixed, and are to comply with the relevant requirements of the provisions of 2.3.12.5 (1) in this Section;

(5) The construction, protection and installation of electrical heaters are to ensure that clothing and other inflammable materials will not inflame due to contact with the heater, and the construction of the heater top are to be such that nothing can be placed on it;

(6) The electrical heaters are to be equipped with means to cut off the power supply when the temperature exceeds the permissible limit;

(7) If electrical heaters are installed inside the bulkhead linings, the protective plates made of non-inflammable materials are to be provided to prevent heat accumulation inside the inner layer of linings;

There is to be at least 25mm free gap between the rear of electrical heaters and bulkhead in order to prevent the bulkhead from overheats and to keep air circulation;

(8) Galley electrical cooking appliances are to be provided with robust protective cases, and both the appliances and cables are to be permanently fixed; the movable electrical cooking appliances are to comply with the relevant requirements of 2.3.12.2 (4), 2.3.12.5(1) in this Section;

(9) Electrical cooking appliances are to be so constructed that the spilling or overflowing of liquid or food will not cause short-circuit or insulation failure.

Section 4 CONTROL, MONITORING, ALARM AND SAFETY SYSTEMS

2.4.1 General Requirements

2.4.1.1 This Section applies to the inland waterway ships installed with the control, monitoring, alarm,

and safety systems.

2.4.1.2 The safety of the ship with the control, monitoring, alarm, and safety systems is to be equivalent to that of the ships in which the machinery and electrical equipment are controlled and inspected directly by watch keeper. Means are to be taken to ensure that watch keeper can manually operate the equipment just at engine side when there is a failure of these systems.

2.4.1.3 Unless otherwise specified herein in this Section, all items concerned are to be in compliance with the current regulations of ~~CCS~~ISC or other equivalent standards.

2.4.2 General requirements for control, monitoring, alarm, and safety systems

2.4.2.1 The control systems are to ensure that mechanical and electrical equipment operates stably throughout their operating ranges.

2.4.2.2 In the event of any failure of the power supply, the actuators of the control system are not to put the equipment controlled into an unsafe condition.

2.4.2.3 In the event of any failure of the power supply of the control systems, audible and visible alarms are to be given off.

2.4.2.4 The mechanical and electrical equipment with remote and automatic control are to also be provided with control at engine side in order that the equipment can be controlled in the event of any failure of the remote and automatic control systems.

2.4.2.5 Where remote and automatic control is provided, corresponding display instruments are to be fitted in the relevant control spaces to ensure the reliable monitoring and controlling.

2.4.2.6 The alarm system is to be designed as far as independent with the control system. When the control system comes with any failure or malfunction, the operation of alarm systems is to be not interfered.

2.4.2.7 All alerts of the alarm systems are to be both audible and visible simultaneously, and the acknowledge-silence devices are to be provided for the alarm systems. When alarms are acknowledged by the duty personnel, the audible alarms are to be silenced but the visible alarms are to be retained until the failure is eliminated. After the failure has been eliminated, the audible and visible alarms are to be capable of resetting automatically.

2.4.2.8 Each visible alarm of the alarm system is to be provided with obvious address of the alarm point; if an alarm has been acknowledged by the duty personnel and the second failure occurs while the first has not been eliminated, the audible and visible alarms are to operate again.

2.4.2.9 For the alarm systems which are associated with the machinery and its safety and control systems and which can send alerts to several spaces, when the alarms are acknowledged and silenced in spaces other than engine rooms and the monitoring room (watch room), the audible and visible alarm signals are to be not eliminated in engine rooms and in the monitoring room (watch room).

2.4.2.10 Fault alarms associated with the machinery and its safety and control systems are to be distinguished easily from normal signals, telephones and noises. Fire alarms and the advanced acoustic alarm of releasing fire extinguishing agent are to be clearly distinguished from other alarms.

2.4.2.11 The alarm systems are to be designed to have self-checking functions, when the fuses of the power supply circuits of the alarm systems themselves have blown out and the circuits between the sensors and the alarm devices are short-circuit or open-circuit, the alarm devices are to take actions.

All the audible and visible signals of the alarm systems are to be capable of being tested while the systems are monitoring the equipment.

2.4.2.12 Means to close senseless signals automatically are to be provided for the alarm systems, e.g. the signal of the low-pressure of the lubricating oil system during the normal stopping process of diesel engines.

2.4.2.13 For looking up the transient failures which are subsequently self-corrected, the corresponding alarms are to be locked until acknowledged when the automatic remedial devices are provided for the failure points of the equipment.

2.4.2.14 The safety systems are to be designed as far as possible to be independent with the control systems and the alarm systems. A failure or malfunction of the control systems and alarm systems are not to interfere with the operations of the safety systems.

2.4.2.15 When there is any serious failure which is dangerous to the mechanical and electrical equipment, the safety systems are to take protective actions automatically or manually, so that:

(1) Normal operating conditions are restored, e. g. by starting and putting (forced running) in standby equipment; or the operation of the equipment is temporarily adjusted to the prevailing conditions, e.g. by reducing the output power or speed of the equipment;

(2) The fuel oil and power supply are cut off, thereby the equipment is stopped.

When a safety system is activated, audible and visual alarms are to be given off to indicate the cause of the actions.

2.4.2.16 Each safety system is to be provided with a manual reset. When a safety system is activated to make some equipment stop operation, the equipment are to be not started again automatically before the manual reset is restored.

2.4.2.17 If overriding advices are provided in order to override some safety protective actions of safety systems, they are to be prevented from being activated by a careless operation. Indications are to be provided at the relevant control spaces and give alarms when the overriding advices of the safety system take actions. After the overriding is over, the protective actions of safety systems are to be restored automatically.

2.4.3 Power supply for control, monitoring, alarm and safety systems

2.4.3.1 The control systems of the main engine are to be supplied by two independent feeder circuits, one of them is to be from the main switchboards and the other may be from the emergency switchboard or distribution boxes. The two circuits may be changed over by manual or automatic changing-over switches fitted in or adjacent to the control console.

2.4.3.2 For the ships fitted with emergency power source or temporary emergency power source, the power supply of the control systems of the main engine are to be capable of changing over automatically to the emergency power source or temporary emergency power source or emergency converting sets in the event of a failure of the main power source in other to ensure operating effectively and continuously.

2.4.3.3 The alarm systems and the control systems of diesel generating sets are to be capable of being automatically continuously supplied by storage battery when there is a failure of the main power source. The supplying from the storage battery is to be indicated.

The safety and monitoring systems are to also be changed over automatically to storage battery sets when there is a failure of the main power source.

2.4.3.4 Audible and visible alarms are to be given when there is a failure of the main power source for the systems mentioned in 2.4.3.1~2.4.3.3.

2.4.4 Control spaces

2.4.4.1 The control spaces refer to the wheelhouse, monitoring room (watch room) and control spaces at engine side.

2.4.4.2 The monitoring room (watch room), in general, is to be located in engine rooms or in spaces which are adjacent to engine rooms and where there is least vibration under normal operation of ship as far as possible.

2.4.4.3 The monitoring room (watch room) is to be designed to be of soundproof property. The bulkheads and windows of the room and frame of doors are to be made of steel or other metals, and the glass in the bulkheads are to be of the shatter-resistant type. The room is to be provided with sufficient ventilation and emergency illumination.

2.4.4.4 The arrangement of monitoring devices, location of signal displaying, operating handles, switches and instruments etc. is to be such that the operation, monitoring and maintenance and safety of personnel are to be ensured as far as possible.

2.4.4.5 The monitoring room (watch room) is to be provided with two means of access which are convenient to lead to the open areas of the ship. For ships which are less than 30m in length, it is permitted that only one access is provided.

2.4.4.6 When ships navigate under any condition, the control is to be capable of being transferred effectively between the control spaces where the main propulsion installation can be controlled remotely, and the transferring is not to affect the normal operation of ships.

2.4.4.7 When the control at engine side needs to be transferred to remote or automatic control or vice versa, the transferring is to be possible only at the control spaces at engine side. The control transferring between the monitoring room (if the remote control system of the main propulsion installation is provided) and the wheelhouse are to be possible only at the monitoring room.

2.4.4.8 If machinery and the associated equipment can be controlled by several control spaces, the control is to be possible only from one of the control spaces at a time.

2.4.4.9 An indication is to be provided in every control space to indicate which control space is in control.

2.4.4.10 Communication equipment are to be provided among each control space.

2.4.5 Remote control installation for main propulsion

2.4.5.1 The remote control installation for the main propulsion is to be capable of being transferred reliably and flexibly from the remote control to the control at engine side.

2.4.5.2 The remote control installation for the main propulsion is to be operated with a series of simple actions. The design of the remote control systems is to comply with the requirements of the operation procedures of the main propulsion installation. The reversible main diesel engines are to be reversed first and then be started, and the reversing is to be made only when the engine speed is lower than the predetermined

permissible reserving speed. For the main propulsion installation with clutches, only when the engine speed has been down to the predetermined value the clutch is disengaged, and the clutch is engaged only when the engine speed reaches the predetermined corresponding value.

2.4.5.3 The remote control system of the main engine is to be designed to be capable of giving the alarm signals in case of any failure occurs. Under this circumstance, unless otherwise the society reckons that is not workable in fact, the rotating speed and direction of the propeller are to be kept constantly until the local control gets involved, and in particular, are not to cause a greater or abrupt change to the propulsive power and rotating direction when the power source of the control systems (electric, pneumatic and hydraulic power source) is interrupted or the control is converted.

2.4.5.4 The interval from operating at the lowest speed transferred to begin to operate reversely is not to exceed more than 15 seconds when the main engine or reversible clutches are controlled remotely.

2.4.5.5 The speed regulating range is to be not greater than 1.03 times the rated speed when the main engine is controlled remotely, and the lowest steady operating speed is to be maintained.

2.4.5.6 Precautions are to be taken to prevent the main engine from operating within the critical speed range for a long period when the main propulsion installation is controlled remotely.

2.4.5.7 When the control systems of the main machinery is provided with a programming control for the automatic restarting when there is a failure of the starting, the number of consecutive unsuccessful starting times are to be not more than 3, the starting is to be stopped at the third time with abortion, audible and visible alarms are to be immediately given in the wheelhouse and in the engine room.

2.4.5.8 Effective inter-locks are to be provided to prevent the remote starting of the main engine under the conditions which could hazard the machinery such as “turning gear engaged”, “shaft brake engaged” and so on.

2.4.5.9 For electric, pneumatic or hydraulic clutches, alarms are to be given in the wheel-house and in the engine room when there is any insufficiency of the voltage, air pressure or hydraulic pressure. Such alarms are to be given as far as possible when the clutches are still capable of operating.

2.4.5.10 For the main propulsion shafting with clutches, the main engine is to be capable of being shut down automatically when it operates at over-speed (diesel engines rated at 220kW or less may be dispensed with) and alarms are to be given in the wheelhouse and in the engine room.

2.4.5.11 For the man propulsion shafting with controllable pitch propellers, alarms are to be given in the wheelhouse and monitoring room or watch room when there is any insufficiency of the hydraulic control pressure or of electromagnetic control voltage by which the pitch is controlled, and such alarms are to be given as far as possible when the systems are still capable of operating. Moreover, the displays of the pitch and angle of the propeller, pressure of the hydraulic systems and electrical supply of the electromagnetic systems are to be provided in the wheelhouse and in the monitoring room (watch room).

2.4.5.12 The emergency shutting down device for the main engine, which is completely independent of the control systems in the wheelhouse (but the execution unit, the shutting solenoid valve is not necessarily to be independent), are to be provided in the wheelhouse. The devices are to be supplied automatically by storage battery sets in the event of a failure of the main power source.

2.4.5.13 The emergency shutting down device is to be provided with means to prevent it from mal-operations.

2.4.5.14 When the emergency shutting down device is actuated, audible and visible alarms are to be given in all control spaces.

2.4.5.15 The display instruments and alarm items in wheelhouse control stations are to be arranged according to Table 2.4.5.15. The diesel engine and shafting of electric propulsion systems are to meet the relevant requirements of Table 2.4.5.15.

Table 2.4.5.15

No.	Items	Displays	Alarms	Remarks
1	Speed and direction of main engine or propeller	Speed/Direction		For the propeller with adjustable pitch, the steering can be replaced by pitch or propeller angle.
2	Starting air pressure for main engine or starting battery voltage	Pressure/Voltage		It may not be set up for the main engine started in the wheel house.
3	Over speed of main engine		When occurs	See 2.4.5.10
4	Direction of main engine or clutch		Wrong	

5	Power supply for control system (electric, pneumatic and hydraulic)		Failure	
6	Power supply for clutch (electric, pneumatic and hydraulic)		Failure	See 2.4.5.9

2.4.5.16 The display instruments and alarm items in the control spaces at engine side are to be arranged according to Table 2.4.5.16. The diesel engine and shafting of electric propulsion system are to meet the relevant requirements of Table 2.4.5.16.

Table 2.4.5.16

No.	Items	Displays	Alarms	Remarks
1	Speed and direction of main engine or propeller	Speed/Direction		For the propeller with adjustable pitch, the steering can be replaced by pitch or propeller angle.
2	Starting air pressure for main engine or starting battery voltage	Pressure/Voltage		
3	The inlet pressure of the main engine lubricating oil		Low	
4	Gearbox lubricating oil inlet pressure		Low	
5	Main engine cooling water outlet temperature		High	
6	Temperature of lubricating oil or cooling water of gearbox		High	
7	Over speed of main engine		When occurs	See 2.4.5.10
8	Direction of main engine or clutch		Wrong	
9	Direction instruction remotely from the wheelhouse for main engine and clutch	Forward Backward		
10	Main engine emergency shutting down		When operates	
11	Power supply for control system (electric, pneumatic and hydraulic)	Electrical indicators, pneumatic/hydraulic pressure meters	Failure	
12	Power supply for clutch (electric, pneumatic and hydraulic)	Electrical indicators, pneumatic/hydraulic pressure meters	Failure	See 2.4.5.9

Note: If Item 2, 3, 4, 5, 6, 7 or others of the table has random indicator and alarm device, it may not require a repeat setting.

2.4.5.17 If the cabin monitoring room (watch room) is set up, its display instruments and alarm items are to be arranged according to Table 2.4.5.17. The diesel engine and shafting of electric propulsion system are to meet the relevant requirements of Table 2.4.5.17.

Table 2.4.5.17

No.	Items	Displays	Alarms	Remarks
1	Speed and direction of main engine or propeller	Speed/Direction		For the propeller with adjustable pitch, the steering can be replaced by pitch or propeller angle.
2	Starting air pressure for main engine or starting battery voltage	Pressure/Voltage		
3	The inlet pressure of the main engine lubricating oil	Pressure	Low	

No.	Items	Displays	Alarms	Remarks
4	Gearbox lubricating oil inlet pressure	Pressure	Low	
5	Turbocharger lubricating oil inlet pressure	Pressure	Low	Refer to the independent lubricating systems
6	Main engine cooling water outlet temperature		High	
7	Cooling water expansion tank level		Low	
8	Temperature of lubricating oil or cooling water of gearbox		High	
9	Exhaust gas temperature	Temperature		Fitted for each cylinder and exhaust gas head pipes; may be dispensed with for cylinders less than 200mm in diameter
10	Main engine over speed		When occurs	See 2.4.5.10
11	Direction of main engine or clutch		Wrong	
12	Direction instruction remotely from the wheelhouse for main engine and clutch	Forward Backward		
13	Main engine emergency shutting down		When operates	
14	Power supply for control system (electric, pneumatic and hydraulic)		Failure	
15	Power supply for control system (electric, pneumatic and hydraulic)		Failure	See 2.4.5.9

2.4.5.18 A sound communication system independent of the main power source is to be provided between the wheelhouse and the monitoring room (watch room).

2.4.5.19 For ships with an engine room watched by one man (main propulsion units remotely controlled in the wheelhouse, and the engine room and monitoring room watched by only one man), a sound-powered communicating system is to be provided between the monitoring room and the office of the Chief Engineer.

2.4.6 Power Stations

2.4.6.1 The automated control systems for power stations are to ensure the continuous supplying of electric power.

2.4.6.2 The control of diesel engine generator set is to be capable of being changed over flexibly and reliably from remote mode or automatic control mode to manual control mode at engine side.

2.4.6.3 If the circuit breaker of the generating sets trips out due to the short circuit of power network, alarms are to be given immediately. While under this case, the standby generating sets are to be automatically started and connected to the power network, and the automatic closing of the circuit breaker is only restricted to one time.

2.4.6.4 For diesel engines driving generator sets, the alarms are to be given in case of low pressure of lubricating oil inlet, high temperature of cooling water outlet, over speed as well as power failure of control system.

2.4.6.5 For diesel engines driving generator sets, the display instruments are to include inlet pressure of lubricating oil and outlet temperature of cooling water.

2.4.6.6 For generator sets, the alarms are to be given in case of failure of automatic starting, failure of automatic connecting to the power network, automatic shedding of non-essential loads as well as failure of power station during operation, etc.

2.4.7 Oil-fired auxiliary boilers

2.4.7.1 The automatic controls of the boiler water level, combustion system and temperature or viscosity of fuel oil (for heavy oil only) are to be provided for the oil-fired auxiliary boilers in order to keep the steady state and safety of the operation of the boilers under all operating conditions.

2.4.7.2 The combustion control system for the boiler is to ensure the safety of boiler under programmed

automatic ignition.

2.4.7.3 Means are to be taken to automatically shutdown the boiler in case of flameout in combustion chamber, failure of ignition, loss air pressure into combustion chamber as well as low limits of water level in boiler.

2.4.7.4 Alarms are to be given in case of low limits of water level in boiler, flameout in combustion chamber, failure of ignition as well as high temperature of pre-heating heavy-oil.

2.4.8 Steering gear systems

2.4.8.1 For steering gear-systems, the alarms are to be given in case of power failure of steering gear, overload, low oil level of lubricating oil tank, as well as electrical or hydraulic power failure for control system.

2.4.9 Bilge water level monitoring

2.4.9.1 For ships in which the engine room is watched by one watch-keeper, the alarms for high levels of bilge water are to be given.

2.4.10 Fire detecting and extinguishing

2.4.10.1 This article applies to the ships in which the engine room is watched by one watch-keeper.

2.4.10.2 Fixed automatic fire-detecting and alarm systems are to be fitted in engine room.

2.4.10.3 The fixed automatic fire-detecting and alarm systems are to comply with the relevant requirements specified in CHAPTER 3 of this Part.

2.4.10.4 The fire-detecting systems are to be supplied automatically by storage battery when there is any failure of the main power source, and audible and visible alarms are to be given in the wheelhouse.

2.4.10.5 The detectors of the fire-detecting systems are to be so arranged in the engine room that all possible fire-outbreak points in the engine room can be covered by the systems. The detectors located in the engine room are to be of the types which will not cause false alarms by dust, air currents, oil vapors, or hot gases normally present in the engine room.

2.4.10.6 A remote starting device for fire pumps is to be fitted at the exits of engine room or in the monitoring room.

2.4.11 Requirements for small ships with the main propulsion installation controlled remotely from the wheelhouse

2.4.11.1 This Chapter applies to the ships having a length of 30m or less and a rated power of single main engine of 370kW or less, and the main propulsion installation remotely controlled by means of mechanical mode or mechanic-pneumatic mode or mechanic-hydraulic mode from the wheelhouse. The wheelhouse of the ship is to be provided with a console of the main propulsion installation, and the engine room is to be provided with on-site control of the main propulsion installation.

2.4.11.2 Handling gears and instruments on the operating console of main propulsion installation in wheelhouse are to be easily identified. Where a centralized control console located in wheelhouse consist of the remote handling gears for main propulsion installation and other control systems, these control (handling) systems are to be independent of each other and not be interfered by other systems.

2.4.11.3 The main propulsion installation is not to be controlled from wheelhouse and engine side simultaneously. The changing-over of control is to be made at engine side.

2.4.11.4 The remote control system of the main propulsion installation may be of mechanical type, mechanic-pneumatic type or mechanic-hydraulic type. The speed-adjusting, revolution direction changeover and clutch engagement/ disengagement of main propulsion installation are to be achieved by means of a single control stick.

2.4.11.5 The main propulsion installation operating system is to ensure that acceleration can be achieved only after the completion of reliable disengagement/ engagement at a low speed.

2.4.11.6 The operating system of main propulsion installation is to ensure that there is no deviation within the whole control range between the wheelhouse operation and the control location of main propulsion installation itself.

2.4.11.7 A separated operating stick or push-button for the main engine starting may be permitted to fit on wheelhouse control console.

Where the main engine starting is operated from wheelhouse, it is to ensure that the main engine can be kept running at the lowest stable revolution speed after being started.

Where the main engine starting is operated from engine room, while the operating stick of main propulsion installation on wheelhouse operating console is at "idle" position, it is to ensure that the main engine can be kept running at the lowest stable revolution speed.

2.4.11.8 The steel wire rope or chain of mechanical operating system for main propulsion installations are

to be arranged as straightly as possible. Direction rollers are to be fitted at corners. The steel wire rope or chain is to be firmly connected. The tying at the connections of wire ropes is not to be dragged by each other.

2.4.11.9 The valves, pipes and hydraulic (pneumatic) cylinders of hydraulic (pneumatic) executive system for main propulsion installation are to comply with relative requirements specified in Section 2 of this Chapter.

2.4.11.10 Where program control is used for hydraulic or pneumatic remote control system of main propulsion installation, its design is to comply with relative requirements of 2.4.5.2 of this Section.

2.4.11.11 Emergency tripping device for the remote control system of main propulsion installation are to be fitted in engine room, which are to be locked-in normally, in order to transfer the control of main propulsion installation from the wheelhouse to the engine side at an emergency.

2.4.11.12 In case the engine room is not being watched by watch-keeper frequently, the wheelhouse is to be provided with display instruments and audible/visual alarms according to Table 2.4.11.12. The engine room is to be fitted with necessary display instruments, and audible/visual alarms which may be only provided with acknowledge-silence and testing button.

Table 2.4.11.12

No.	Items	Displays	Alarms	Remarks
1	Speed and direction of main engine or propeller	Speed Direction		
2	The inlet pressure of the main engine lubricating oil	Pressure	Low	
3	Main engine cooling water outlet temperature	Temperature	High	Display or alarm may be provided. If the main engine is started from the wheelhouse, display is to be provided.
4	Gearbox lubricating oil inlet pressure	Pressure	Low	
5	Power supply for control system (electric, pneumatic and hydraulic)	Pressure		
6	Pressure of starting air or voltage of starting battery	Pressure Voltage		

CHAPTER 3 FIRE

Section 1 GENERAL PROVISIONS

3.1.1 General requirements

3.1.1.1 This Chapter is applicable to the arrangements of the structural fire protection, fire-extinguishing system, fire detection and fire alarm system, firefighting appliances and fire escape devices of inland waterways ships..

3.1.1.2 Requirements for tanks in this Chapter are to apply to tankers carrying oils having a flashpoint not exceeding 60°C (closed-cup test, as determined by an approved flashpoint apparatus, similar hereinafter).

3.1.1.3 Unless otherwise specified, tanks carrying oils having a flashpoint exceeding 60°C in bulk are to meet requirements for cargo ships; but the water fire-extinguishing systems of cargo ships are to meet requirements for tanks in 3.4.3 of this Chapter. For tankers of 2000 tons or over, a fixed deck foam fire-extinguishing system is to be provided complying with the provision of Section 7 of this Chapter to protect cargo tank deck.

3.1.1.4 Ships carrying petroleum asphalt in bulk are to meet requirements for cargo ships; but water fire-extinguishing systems of cargo ships are to meet for tanks in 3.4.3 of this Chapter. For cargo ships of 2000 tons or over, a fixed deck foam fire-extinguishing system is to be provided complying with the provision of Section 7 of this Chapter to protect cargo tank deck.

3.1.2 Approval of marine products

3.1.2.1 Unless otherwise specified, the principal materials, equipment and installation used for fire protection of ships are to be approved complying with the Guidelines of [CCSISC](#) Regulations for Classification of Inland Waterway Ships.

3.1.3 Acceptance of Equivalent

3.1.3.1 The particular equipment, appliances, extinguishing medium or installations regulated in this Chapter may be replaced by other equipment which are proved to be the same effective and are approved by [CCSISC](#).

3.1.4 Fire control plans/firefighting equipment layout

3.1.4.1 Fire control plans are to be permanently exhibited in ro-ro passenger ships Type I, ro-ro passenger ships Type II, passenger ships with a length of 50m or over (including vehicle-passenger ferries and restaurant pontoons), cargo ships of 2000GT or over and oil tankers of 300GT or over.

Other ships are to be provided with fire-fighting plans including the arrangement and number of fire extinguishing equipment, accesses of each compartment and deck and ventilation services and so on. The plan is to be permanently exhibited in the crew spaces.

3.1.4.2 The fire control plans are to show clearly the various fire sections enclosed by “A” or “B” class divisions, the arrangement of firefighting stations, the fire detection and fire alarm systems, the fixed fire-extinguishing systems and appliances, means of access to different compartments and decks etc. and the ventilating system including the fan control positions and the position of dampers and particular of identification numbers of the ventilating fans serving each section.

3.1.4.3 The fire control plans are to be permanently exhibited at crew spaces; in addition a set of fire control plan is to be permanently stored in a weathertight enclosure with prominent mark outside the deckhouse for the assistance of shoreside fire-fighting personnel.

3.1.4.4 The fire control plans/firefighting equipment layout are to adopt Graphical symbols for fire control plans prescribed by the International Maritime Organization by the resolution A.952(23) of IMO.

3.1.5 Definitions

3.1.5.1 “Non-combustible materials” is the materials which neither burn nor give off flammable vapors in sufficient quantity for self-ignition when heated to approximately 750°C, this being determined by an established test procedure, i.e. *Code of Fire Test Procedure*. Any other materials are combustible materials.

3.1.5.2 “Steel or other equivalent materials”. Where the words “steel or other equivalent materials” appear, “equivalent materials” mean any non-combustible materials which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at end of the applicable fire exposure to the standard fire test (e.g. aluminum alloy with appropriate insulation).

3.1.5.3 “Low flame spread” means that the surface, thus determined by an established procedure, i.e. *Code of Fire Test Procedure*, will adequately restrict the spread of flame.

3.1.5.4 A *standard fire test* is a test in which specimens of the relevant bulkheads or decks are exposed in a test furnace to temperatures corresponding approximately to the standard time-temperature curve in accordance with the test method specified in the *Fire Test Procedures Code*.

3.1.5.5 *Code of Fire Test Procedure* refers to the *International Code for Application of Fire Test Procedures* adopted by the Maritime Safety Commission of International Maritime Organization by the Resolution No.MSC.61(67), including the following amendments to FTP Code.

3.1.5.6 “A class divisions” are those divisions formed by bulkheads and decks which comply with the following requirements:

- (1) they are to be constructed of steel or other equivalent materials;
- (2) they are to be suitably stiffened;
- (3) they are to be so constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test;
- (4) they are to be insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature, within the time listed below:

Class “A—60”	60 min
Class “A—30”	30 min
Class “A—15”	15 min
Class “A—0”	0 min

(5) A test of a prototype bulkhead or deck to ensure that it meets the above requirements for integrity and temperature rise may be required. For the steel bulkhead or deck without insulation, the minimum dimensions are to meet the following requirements; if the bulkhead or deck has no opening, it is considered to meet the requirements of Class “A – 0”:

Bulkhead of Class “A – 0”:	steel bulkhead with a thickness of 4mm
Stiffener:	60mm×60mm×5mm
Distance:	600mm
	Or equivalent structures
Deck of Class “A – 0”:	steel deck with a thickness of 4mm
Beam:	95mm×65mm×7mm
Distance:	600mm
	Or equivalent structures

3.1.5.7 “B class divisions” are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following requirements:

- (1) they are to be so constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test;
- (2) they are to have an insulation value such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225 °C above the original temperature, within the time listed below:

Class “B – 15”	15min
Class “B – 0”	0min

- (3) they are to be constructed of approved non-combustible materials and all materials entering into the construction and erection of “B” class divisions are to be non-combustible, with the exception that combustible veneers may be permitted provided they meet other requirements of this Chapter;
- (4) A test of a prototype bulkhead or deck to ensure that it meets the above requirements for integrity and temperature rise may be required.

3.1.5.8 “C class divisions” are divisions constructed of approved non-combustible materials. They need meet neither requirements relative to the passage of smoke and flame nor limitations relative to the temperature rise. Combustible veneers are permitted provided they meet other requirements of this Chapter.

3.1.5.9 “Continuous B class ceilings or linings” are those “B” class ceilings or linings which terminate only at “A” or “B” class divisions

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

3.1.5.11 “Accommodation spaces” are those spaces used for public spaces, cabins, offices, hospitals, corridors, water closets, lavatories and similar spaces.

3.1.5.12 “Public spaces” are those portions of the accommodation spaces which are used as halls, meeting

rooms, reading rooms, lounges, dining rooms and similar permanently enclosed spaces.

3.1.5.13 “Service spaces” are those spaces used for galleys, pantries, lockers, workshops other than those forming part of the machinery spaces, and similar spaces and enclosed trunks to such spaces.

3.1.5.14 “Cargo spaces” are all spaces used for loading cargos and enclosed trunks to such spaces.

3.1.5.15 “Machinery spaces” are all machinery spaces containing main engines, boilers, oil fuel units, pumps, generators, ventilating machines, refrigerators, air-conditioners etc., repairing rooms and similar spaces together with enclosed trunks to such spaces.

3.1.5.16 “Important machinery spaces” are the machinery spaces containing fuel equipment such as internal combustion engines (excluding those used to drive deck machinery and emergency fire pump) and oil boiler etc., and oil fuel units.

3.1.5.17 “Other machinery spaces” are the machinery spaces other than the important machinery spaces.

3.1.5.18 “Oil fuel units” are the equipment supplying fuel oil for internal combustion engines or oil boilers, including the pressure oil pumps, filters and heaters used to disposal of oils and with a pressure higher than 0.18Mpa.

3.1.5.19 “Control stations” are those spaces in which the ship's radio or main navigating equipment or the emergency source of power is located or where the fire indicator or fire control equipment is centralized.

3.1.5.20 “Ro-ro spaces” are spaces not normally subdivided in any way and normally extending to either a substantial length or the entire length of the ship in which motor vehicles with fuel in their tanks for their own propulsion and/or goods (packaged or in bulk, in or rail or road cars, vehicles (including road or rail tankers), trailers, containers, pallets, demountable tanks or in or on similar stowage units or other receptacles) can be loaded and unloaded normally in a horizontal direction.

3.1.5.21 “Open ro-ro spaces” are those ro-ro spaces which are either open at both ends or have an opening at one end, and are provided with adequate natural ventilation effective over their entire length through permanent openings distributed in the side plating or deck head or from above, having a total area of at least 10% of the total area of the space sides.

3.1.5.22 “Closed ro-ro spaces” are ro-ro spaces which are neither open ro-ro spaces nor weather decks.

3.1.5.23 “Weather deck” is a deck which is completely exposed to the weather from above and from at least two sides.

3.1.5.24 “Cargo oil areas” refers to the cargo oil compartments, slop compartments and cargo pump-rooms of oil tankers, including adjacent pump rooms, cofferdams, ballast tanks and void spaces, and the entire width and length of the decks above such areas.

3.1.5.25 “Sauna” is a hot room with temperatures normally varying between 80°C and 120°C where the heat is provided by a hot surface (e.g., by an electrically heated oven). The hot room may also include the space where the oven is located and adjacent bathrooms.

3.1.5.26 The fire-extinguishing concentration of heptafluoropropane fire-extinguishing agent – under the atmosphere of 0.1 MPa and specified temperature, the minimum percentage of the volume of gas extinguishing agent needed for extinguishing a fire in the air.

3.1.5.27 The fire-extinguishing density of aerosol fire-extinguishing agent – under the atmosphere of 0.1MPa and the specified temperature, the quantity of solid pyrotechnics aerosol fire-extinguishing agent needed for extinguishing a fire in an unit volume.

3.1.5.28 Pyrotechnics aerosol – the aerosol form agent combustion in a pyrotechnic gas generator.

Section 2 PREVENTION OF FIRE

3.2.1 General requirements

3.2.1.1 Means are to be provided to control leaks of flammable liquids and limit the accumulation of flammable vapors.

3.2.1.2 The quantity of smoke and toxic products released from combustible materials including surface finishes is to be limited during fire.

3.2.1.3 Ignition sources are to be restricted and separated from combustible materials and flammable liquids

3.2.1.4 Devices are to be provided to control air supply to the space and flammable liquids in the space.

3.2.1.5 The use of combustible materials in passenger ship is to be restricted.

3.2.2 Limitations and arrangements for oil fuel, lubricating oil system and other flammable oils

3.2.2.1 Unless otherwise specified, no oil fuel with a flashpoint of less than 60°C is to be used in the ships.

3.2.2.2 Oil fuel with a flashpoint of not less than 43°C may be used by emergency generator.

3.2.2.3 Oil fuel with a flashpoint of less than 60°C but not less than 43°C may be used in the spaces where special measures can be used to reduce the environmental temperature 10°C lower than the flashpoint of the oil fuel.

3.2.2.4 The use of oil fuel with a flashpoint of less than 60°C but not less than 43°C may be permitted (e.g., For feeding the emergency fire pump's engines and the diesel engines outside main propulsion machinery rooms) subject to the following requirements:

(1) Fuel oil tanks except those arranged in double bottom compartments are to be located outside of machinery spaces;

(2) Oil temperature measuring equipment is provided on the suction pipe of the oil fuel pump;

(3) Stop valves and/or cocks are provided on the inlet side and outlet side of the oil fuel strainers; and

(4) Pipe joints of welded construction or of circular cone type or spherical type union joint are applied as much as possible.

3.2.2.5 Arrangements for oil fuel systems: Except provisions of Section 2 of CHAPTER 2 in this Part, in a ship in which oil fuel is used, the arrangements for the storage and utilization of the oil fuel are to be such as to ensure the safety of the ship and persons on board and are to at least comply with the following provisions:

(1) Fuel oil tanks are to be not situated above the hot surfaces if fuel oil may escape or leak from the tanks, drop onto such surfaces and constitute a hazard. 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.

(2) Any oil tank or any part of fuel oil systems including filling pipes is to be provided with means against over-pressure. Air pipes, overflow pipes or inlet pipes of oil tanks and outlets pipes of relief valves are to discharge to a position where there is no risk of fire or explosion from the emergence of oils and vapor.

(3) Oil fuel pipes and their valves and fittings are to be made of steel or other approved material. For valves fitted to oil fuel tanks and under static pressure, steel or spheroid-graphite cast iron may be accepted. However, ordinary cast iron valves may be used in piping systems where the design pressure is lower than 7 bar and the design temperature is below 60°C.

(4) If daily service tanks (cabinet) or settling tanks (cabinet) are fitted with heaters, high temperature alarms are to be provided to prevent temperature of fuel oil from exceeding the flash point.

(5) As far as practicable, parts of the fuel oil system containing heated oil under pressure exceeding 0.18MPa are not to be placed in a concealed position such that defects and leakage cannot readily be observed.

(6) Fuel oil tanks are to be provided with safe and efficient means of ascertaining the amount of fuel oil contained in any fuel oil tank. The Administration may permit the use of oil-level gauges with flat glasses and cylindrical gauge glasses, but a self-closing valve is to be fitted between the gauge and fuel tank. The oil-level gauges are to be not of plastic pipes. Where sounding pipes are used, they are not to terminate in any space where the risk of ignition of spillage from the sounding pipe might arise. In particular, they are not to terminate in passenger or crew spaces. As a general rule, they are not to terminate in machinery spaces. However, where it is difficult to arrange, it may permit termination of sounding pipes in machinery spaces on condition that all of the following requirements are met:

① The sounding pipes terminate in locations remote from ignition hazards unless precautions are taken to prevent the fuel oil in the case of spillage through the terminations of the sounding pipes from coming into contact with a source of ignition; and

② The termination of sounding pipes are fitted with self-closing blanking devices and with a small-diameter self-closing control cock located below the blanking device for the purpose of ascertaining before the blanking device is opened that fuel oil is not present. Provisions are to be made so as to ensure that any spillage of oil fuel through the control cock involves no ignition hazard.

(7) For passenger ships and cargo ships of 500GT or over, external high-pressure fuel delivery lines between the high-pressure fuel pumps and fuel injectors are to be protected with a jacketed piping system capable of containing fuel from a high-pressure line failure. Such jacketed pipe incorporates an outer pipe into which the high-pressure fuel pipe is placed, forming a permanent assembly. The jacketed piping system is to include a means for collection of leakage. Diesel engines of anchor gear and lifeboat may be free from jacketed piping systems.

3.2.2.6 Arrangements of lubricating oil systems: The arrangements for the storage and utilization of the lubricating oil are to be capable of ensuring the safety of the ship and persons on board, and are to at least comply with provisions stipulated 3.2.2.5 (1), (2), (3), (5) and (6).

3.2.2.7 Arrangements of other flammable oils: The arrangements for the storage and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heating systems are to be such as to ensure the safety of the ship and persons on board. They are at least to

comply with the provisions stipulated in 3.2.2.5 (1), (2) and (3) where they are in the machinery spaces.

3.2.2.8 In spaces where penetration of oil products is possible, the surface of insulation is to be impervious to oil or oil vapors.

3.2.3 Closing Appliances and Stopping Devices of Ventilation

3.2.3.1 The main inlets and outlets of all ventilation systems are to be capable of being closed from outside the spaces being ventilated.

3.2.3.2 All power ventilation systems are to be provided with quickly cut off devices operated outside the ventilating fan rooms in the event of a fire. And the spaces where such devices are installed are to be isolated in the event of a fire.

3.2.4 Special arrangement in machinery spaces

3.2.4.1 The number of skylights, doors, ventilators to permit exhaust ventilation and other openings to machinery spaces is to be reduced to a minimum consistent with the needs of ventilation and the proper and safe working of the ship. Such openings of the important machinery spaces and machinery spaces provided with gas fire-extinguishing systems are to be capable of being closed from outside of such spaces in the event of a fire.

3.2.4.2 The skylights in machinery spaces are to be fitted with steel frames and protected by grille. The glass are to be strengthened by metal wire. They are to be provided with steel covers attached outside and capable of being closed outside the spaces

3.2.4.3 The windows and side scuttles located in the sides of machinery space enclosure on the freeboard deck are to be constructed with frames of steel or other suitable materials. The glass are to be retained by a metal glazing bead. The windows and side scuttles located in the sides of machinery space fitted with a gas fire-fighting system are to be provided with closed steel covers

3.2.4.4 Except the provisions of 3.2.4.2 and 3.2.4.3 in this Section, windows are to be not fitted in machinery space boundaries. However, this does not preclude the use of glass in control rooms within the machinery spaces

3.2.4.5 For ships having a total power output of main engine more than 440kW, the following installations located in the spaces containing main engines, boilers and generators are to be provided with control devices outside such spaces, so that the installations are capable of being shut down or cut off in the event of a fire:

- (1) Oil fuel transfer pumps, oil fuel unit pumps, lubricating oil service pumps, thermal oil circulating pumps and oil separators (purifiers), exclusive of oily water separators.
- (2) Stopping valves or cocks on supplying pipes of fuel oil tanks above double bottom;
- (3) Stopping valves or cocks on supplying pipes of lubricating oil tanks above double bottom for passenger ships

3.2.5 Limitation on use of combustible materials

3.2.5.1 The oil paint, varnish and other facing materials used on the exposed surfaces are to be approved in accordance with *Fire Test Procedures Code* and not give out excessive smog and toxic substance when exposed to high temperature.

3.2.5.2 Passenger ships are to meet the following requirements:

- (1) All bulkheads and their linings, ceilings, grounds, thermal insulation, etc. in accommodation spaces, service spaces and control stations are to be of non-combustible materials. The wainscot of the exposed surfaces are to have low flame-spread characteristics.
- (2) Combustible materials used on the wainscot of accommodation and service spaces specified in (1) are to have a calorific value not exceeding MJ/m² of the area for thickness used and the total volume is not to exceed a volume equivalent to 2,5mm veneer on the combined area of the walls and ceiling linings. In case of ships fitted with an automatic sprinkler system complying with the provisions of Section 7 in this Chapter, the above volume may include some combustible materials used for erection of "C" class divisions.
- (3) Draperies, curtains & other suspended textile materials and floor coverings are to have qualities of resistance to flame spreading.
- (4) Materials with low flame-spread characteristics are to be approved in accordance with Fire Test Procedures Code and not give out excessive smog and toxic substance when exposed to high temperature.

3.2.5.3 Cargo ships with a gross ton of equal to or higher than 2000GT are to meet the requirements of 3.2.5.2 of this section (excluding 3.2.5.2 (3)). The corridors and stairways in such spaces are to be equipped according to the requirements of 3.2.5.2 of this section. Fixed fire detection and fire alarm systems are to be provided in the accommodation & service spaces and control stations in accordance with the requirements of 3.7.6 of this Chapter, excluding void spaces, sanitary spaces, etc. with no fire risk.

3.2.6 Primary deck coverings

3.2.6.1 Primary deck coverings, if applied within accommodation spaces, control stations, stairways and corridors, are to be of approved material which will not be ignition or give rise to toxic or explosive hazards at elevated temperatures, this being determined in accordance with the Fire Test Procedures Code.

3.2.7 Galleys

3.2.7.1 Galley elevator trunk enclosure and removable doors together with their frames in way of each deck are to be of steel. Means are to be provided to prevent the passage of smoke and flame from one deck space to another. The galley elevator trunk enclosures of passenger ships are to be of an isolation of "A – 0" class.

3.2.7.2 If oil-fired ranges are fitted in the galley, the daily service tanks are to be arranged far away from the space above the ranges. They are to be fitted with closed-circuit filling devices and proper ventilating and overflow devices. The fuel supply of the burners is to be capable of being controlled from a readily accessible position in the event of a fire occurring in the galley.

3.2.7.3 The smoke extraction facilities installed in the galley are to be capable of protecting slop from dropping onto the range.

3.2.7.4 If liquefied gas fired ranges are fitted in a galley, the following requirements are to be complied with:

(1) Ranges, gas cylinders, angle valves and pressure reduction valves etc. are to conform to the relevant national standards.

(2) Quantity of liquefied gas stored is to be approximate to the needs and is not allowed to be exceeded. Storage of gas bottles are to be located on the open deck or in a wall ventilated space which opens only to the open deck. The distance between the gas bottles and the ranges are to be not less than 2m, if the gas bottles are stored within the galleys.

(3) Galleys are to be situated above the main deck. No opening and stairway is allowed to be arranged inside the galley to the underlying spaces.

(4) The doors and windows in the boundary of galleys are to open outwards and to the open deck. Natural ventilation or power ventilation are to be provided to ensure the air flowing between upper and lower spaces inside the galley.

(5) Liquefied gas ranges are to be fitted reliably at predetermined positions. Means are to be provided to prevent shifting of ranges.

(6) Liquefied gas cylinders are to be positioned vertically and fixed reliably. Fixing hoops are to be capable of being released easily and quickly. Cylinders are to be provided with wood blocks under the bottoms to avoid impact.

(7) Steel liquefied gas pipe lengths are to be connected by welding. Threaded joints may be adopted in the connections between ranges, valves or instrumentations etc. and pipes or valves. The joints are to be fitted with oil resistant sealing washers or coated with binder to ensure gastight.

The joints between rubber hose and pressure valve, ranges or steel pipes are to be cramped by metal band. The bands are to be connected reliably. They are to be capable of being- easily fitted or removed and to ensure gastight.

(8) For the pressure of strength test and tightness test on liquefied gas piping system, the requirements prescribed in Tab.3.2.7.4 (8) are to be complied with.

Table 3.2.7.4 (8)

Liquefied-gas piping	Test Pressure	
	Strength test (in workshop) MPa	Tightness test (after installed on board) MPa
Piping from cylinders to pressure reduction valve	2.4	2.0
Piping from pressure reduction valve to range	0.2	0.1

3.2.8 Miscellaneous

3.2.8.1 Waste receptacles are to be made of non-combustible materials with no openings in the sides or bottom.

3.2.8.2 Combustible materials or materials which may give off toxic vapors when they are against fire are to be not used for the purpose of insulation.

3.2.8.3 Electric radiators, if used, are to be fixed in position and so constructed as to reduce fire risks to a minimum. No such radiators are to be fitted with an element so exposed that clothing, curtains, or other similar materials can be scorched or set on fire by heat from the element.

3.2.8.4 Electric heating equipment for service are to be fixed in position and provided with insulation

facilities.

3.2.9 Cargo oil spaces

3.2.9.1 Position and isolation of self-propelled oil tankers

(1) Self-propelled oil tankers are to be positioned behind cargo tanks, slop tanks, cargo pump rooms and cofferdams, but not necessarily behind the fuel oil bunker tanks. Besides, self-propelled oil tankers are to be isolated from the oil tanks and slop tanks by cofferdams or cargo pump room.

Machinery spaces other than that of the major propelling machinery are to be located in front of cargo oil tank and slop tank on condition that such machinery space is isolated from the cargo oil tank and slop tank by the cofferdams or cargo pump rooms, and has equivalent safety requirements as the machinery space behind the cargo oil tank and proper fire extinguishing devices.

(2) Accommodation spaces, main cargo control stations, control stations, and service spaces are to be positioned behind cargo tanks, slop tanks, cargo pump rooms and cofferdams. Any common bulkhead isolating cargo tanks and accommodation & service spaces and control stations are to be fabricated in Level "A - 30".

If necessary, navigation bridges are to be positioned in front of cargo tanks and spaces which isolate cargo tanks (including slop tanks) from machinery spaces. Such navigation bridges are to have equivalent safety requirements and measures as the navigation bridges behind the cargo tanks.

(3) The cofferdams are to be fabricated with a kind of waterproof bulkhead and with a length not less than 500mm.

(4) Facilities are to be installed to isolate the accommodation spaces from the service spaces in case of oil spilling in deck. Such facilities may be fixed continuous dam with a height not less than 100mm and capable of extending to both sides of the ship.

(5) If necessary, the navigation bridge of the tanker with a gross ton less than 150GT is to be positioned in the upstream of cargo oil spaces with the consent of [CCSISC](#). However, the navigation bridge is to be isolated from the cargo oil space by an open space with a height of 700mm.

3.2.9.2 Limitations for openings of boundaries of self-propelled tankers

(1) The entrances, air inlets or openings accessing to accommodation & service spaces, control stations and machinery spaces are not to face cargo oil spaces. If such entrances, air inlets or openings are positioned on the superstructures or outside the deckhouses, the distances from the end of the superstructures or deckhouses facing the cargo oil spaces is to be not less than 3m.

Doors accessing to cargo oil control stations and service spaces of store are to be positioned facing boundaries of cargo oil spaces or within the above limitation range of 3m; however, there is to no direct or indirect accesses in the cargo oil control stations and service spaces of store to the accommodation spaces, control stations or service spaces of galleys and workshops or spaces having ignition source such as oil gas. The heat insulation of the boundaries of cargo oil control stations and service spaces of store are to meet the related standards regulated in 3.3.6.3 of this Chapter; the boundaries in the direction of cargo oil spaces are excluded. Plank doors secured with bolts are to be installed with the limitation range of 3m for removing machines.

(2) Doors and windows of navigation bridge may be located with the limits specified in 3.2.9.2 (1) so long as they are designed to ensure that the navigating bridge can be made rapidly and efficiently gastight.

(3) Windows and sidescuttles facing the cargo oil spaces and on the sides of the superstructures and deckhouses within the limits specified in 3.2.9.2 (1) are to be of the fixed (non-opening) type. Such windows and sidescuttles of tankers with a gross ton equal to or more than 2000GT are to be fabricated to "A - 60" class standard; such windows and sidescuttles of tankers with a gross ton equal to or higher than 1000GT but less than 2000GT are to be fabricated to "A - 30" class standard. But the navigation bridge is excluded. Such windows and sidescuttles on the first layer of freeboard deck are to be equipped with inner caps made of steel or other equivalent materials.

The widows and sidescuttles of the tankers with a gross ton less than 1000GT are to be of movable airtight type and with a heat insulation of "A - 0" class.

3.2.9.3 Additional requirements for oil barges

(1) Accommodation spaces, cargo control stations and control stations are to be positioned after of all cargo tanks, cargo pump rooms and cofferdams isolating cargo tanks.

(2) Machinery spaces are to be positioned in accordance with the requirement of 3.2.9.1 (1).

(3) Means of keeping deck spills away from the accommodation and service areas are to comply with the requirement of 3.2.9.1 (4).

(4) Doors and windows in the bulkheads which are within 3m from the ends of superstructures and deckhouses which face the cargo area are to be of a free gas-tight type.

(5) Cabins are to be not located below the freeboard deck.

(6) Air inlets and outlets of superstructures and deckhouses are to be not arranged facing the cargo area so as to minimize the possibility of oil vapors entering accommodation spaces.

3.2.10 Draught stops

3.2.10.1 Air spaces enclosed behind ceilings, paneling or linings are to be divided by close-fitting draught stops spaced not more than 14 m apart. Draught stops are to be made by incombustible materials. In the horizontal direction, draught stops are to be in the same vertical plane with the compartment boundaries; in the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., are to be closed at each deck.

Section 3 SUPPRESSION OF FIRE

3.3.1 General Requirements

3.3.1.1 The equipped manual alarm devices are to be capable of immediate operation in all time.

3.3.1.2 The ship is to be subdivided by thermal and structural boundaries.

3.3.1.3 Fixed fire detection and fire alarm system installations are to be suitable for the nature of the space.

3.3.1.4 Thermal insulation of boundaries are to have due regard to the fire risk of the space and adjacent spaces.

3.3.1.5 The fire integrity of the divisions is to be maintained at openings and penetrations.

3.3.2 Detection and alarm

3.3.2.1 The following ships are to be fitted with manual alarm systems for the purpose of informing the wheel house or the watch room in the event of a fire:

- (1) ro-ro passenger ship type 1, ro-ro passenger ship type 2, ro-ro cargo ships;
- (2) passenger ships and restaurant pontoons with a length of 50m and over;
- (3) vehicle-passenger ferries with a length of 50m and over;
- (4) cargo ships of 2000 gross tonnage and over;
- (5) oil tankers of 1000 gross tonnage and over;
- (6) Self-propelled project ships and pushers (tugs) having a total power of main engine 735kW or more.

3.3.2.2 The following spaces are to be fitted with fixed automatic fire detection and fire alarm systems:

(1) Accommodation spaces, service spaces and control stations, including corridors and stairways, for ro-ro passenger ships type 1 and type 2, passenger ships with a length of 50m or over and restaurant pontoons, and vehicle-passenger ships with a length of 50m and over;

The bathrooms within the guest rooms do not require to be fitted with smoke detectors. The spaces with low fire risk or without fire risk, such as void compartments, public toilets, carbon dioxide rooms and the similar spaces, need not be fitted with fixed fire detection and fire alarm systems.

(2) Machinery spaces containing main engines, if they are not continuously attended by watchkeepers during whole navigation.

3.3.2.3 Arrangement of manually operated call points

(1) Manually operated call points are to be installed throughout the accommodation spaces, service spaces and control stations. One manually operated call point are to be located at each exit. Manually operated call points are to be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 m from a manually operated call point.

3.3.2.4 Arrangement of fire indicating units

(1) Fire indicating units are to be positioned in the wheelhouse or the place where the responsible member of the crew is on duty to ensure that the alarms are heard and observed on the wheelhouse or by the responsible member of the crew on duty. Where such units are located in the place where a responsible member of the crew is on duty, means of communication are to be provided between such place and the wheelhouse.

3.3.3 Structural materials

3.3.3.1 The hull, superstructures, structural bulkheads, decks and deckhouses are to be constructed of steel or other equivalent materials.

3.3.3.2 The bulkheads and decks in the boundary of machinery spaces are to be made of steel or other equivalent materials.

3.3.3.3 Accommodation spaces are to be separated from adjacent machinery spaces, cargo spaces and service spaces by steel bulkheads and decks or other equivalent materials.

3.3.3.4 Service spaces, lamp rooms, paint lockers, fire-fighting stations etc. are to be separated from

adjacent spaces by steel bulkheads and decks or other equivalent materials.

3.3.3.5 All doors in the boundary of machinery spaces, service spaces, lamp rooms, paint lockers and fire-fighting stations are to be of steel construction or other equivalent materials.

3.3.4 Thermal and structural subdivision of passenger ships

3.3.4.1 Main vertical zones

(1) In ro-ro passenger ships type 1 and type 2, passenger ships of category I and II with a length of 50m or over and restaurant pontoons with a length of 50m or over, if the area of passenger spaces on the single deck is more than 800m², the hull, superstructure and deckhouses are to be subdivided into main vertical zones by “A-60” class divisions. The “Step” is to be kept to a minimum, and insulation values are to also be “A-60” class divisions. If spaces on one side of the main vertical zones are open deck spaces, void compartments and public toilets or other similar spaces having little or no fire risk, the insulation values of their bulkheads and decks may be reduced to “A-0”.

(2) As far as practicable, the bulkheads forming the boundaries of the main vertical zones above the bulkhead deck are to be in line with watertight subdivision bulkheads situated immediately below the bulkhead deck. The length of main vertical zones does not generally exceed 40 m in order to bring the ends of main vertical zones to coincide with watertight subdivision bulkheads or in order to accommodate a large public space zone, the length of main vertical zones may be extended to 48 m;

(3) Such bulkheads are to extend from deck to deck and to the shell or other boundaries;

(4) Where a main vertical zone is subdivided by horizontal “A-60” class divisions into horizontal zones, the divisions are to extend between adjacent main vertical zone bulkheads and to the shell or exterior boundaries of the ship.

3.3.4.2 Bulkheads of other boundaries

(1) Bulkheads required to be “A” class and “B” class divisions, are to extend from deck to deck and to the shell or other boundaries. Except corridor bulkheads, bulkheads required to be “B” class divisions, if there a continuous “B” class ceiling or lining is fitted on both sides of a bulkhead which is at least of the same fire resistance as the adjoining bulkhead, the bulkhead may terminate at the continuous ceiling or lining.

3.3.4.3 Fire integrity of bulkheads and decks

(1) Ro-ro passenger ship type 1 and type 2, passenger ships of category I and II with a length of 50m or over and restaurant pontoons with a length of 50m or over, the minimum fire integrity of bulkheads separating adjacent spaces is to comply with the provisions of Table 3.3.4.3 (1) ①, and the minimum fire integrity of decks separating adjacent spaces are to comply with the provisions of Table 3.3.4.3 (1) ②.

In determining the applicable fire integrity standard of a boundary on the basis of Table 3.3.4.3 (1) ① and table 3.3.4.3 (1) ② between two spaces which is not protected by an automatic sprinkler system, the higher of the two values given in the tables is to apply.

In determining the applicable fire integrity standard of a boundary on basis of Table 3.3.4.3 (1) ① and Table 3.3.4.3 (1) ② between two spaces which is protected by an automatic sprinkler system, the lesser of the two values given in the tables are to apply. Where a zone with sprinkler and a zone without sprinklers meet within accommodation and service spaces, the higher of two values given in Table 3.3.4.3 (1) ① and Table 3.3.4.3 (1) ② are to apply to the division between the zones.

Table 3.3.4.3 (1) ①

Spaces	①	②	③	④	⑤	⑥	⑦
Control stations ①	A—0 ^c	A—0	A—15	A—0	A—60	A—30	A—60 A—15n
Corridors ②		C	B—0	A—0 B—0	A—60	A—15 A—0	A—60 A—0n
Accommodation spaces (except sanitary spaces) ③			C	A—0 B—0	A-60	A—15 A—0	A—60 A—0n
Stairways ④				B—0	A—60	A—15 A—0	A—60 A—0n
Machinery spaces ⑤					*	A—30	A—60 A—15n
Service space of fire risk ⑥						*	A—60
Ro-ro spaces ⑦							A—0

Notes: c-- where superscript “c” appears, bulkheads separating the wheelhouse and chartroom from each other may have a “B-0” rating.

n--The ships carrying vehicles with fuel having a flashpoint exceeding 60°C (closed cup test) in their tanks for their own propulsion, such as ro-ro passenger ship type 2, may adopt the lower class.

*- The divisions are to be of steel or other equivalent material, but not required to be “A” class.

Table 3.3.4.3 (1) ②

Spaces above the deck Spaces below the deck	①	②	③	④	⑤	⑥	⑦
Control stations ①	A—0	A—0	A—0	A—0	—	A—0	A—15
Corridors ②	A—0	A—0	A—0	A—0	—	A—0	A—0
Accommodation Spaces (except sanitary spaces) ③	A—0	A—0	A—0	A—0	—	A—0	A—15
Stairways ④	A—0	A—0	A—0	*	—	A—0	A—0
Machinery spaces ⑤	A—60	A—60	A—60	A—60	—	A—60	A—60 A—15 ⁿ
Service spaces of fire risk ⑥	A—30	A—15 A—0	A—15 A—0	A—0	—	*	A—30 A—15 ⁿ
Ro-ro spaces ⑦	A—60	A—60 A—15	A—60 A—15	A—0	—	A—60 A—15 ⁿ	A—0

Notes: n-- the ships carrying vehicles with fuel having a flashpoint exceeding 60 °C (closed cup test) their own propulsion, such as ro-ro passenger ship type 2, may adopt the lower class.

* --The divisions are to be of steel or other equivalent material, but not required to be “A” class.

For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories ① to ⑦. The title of each category is intended to be typical rather than restrictive.

Explanations for table 3.3.4.3 (1) ① and table 3.3.4.3 (1) ②:

① Control stations:

Wheelhouse and chartroom;

Spaces containing emergency sources of power and emergency sources of power of light;

Spaces containing the ship's radio equipment;

Spaces which contain fire alarm equipment or in which the fire control devices and fire-extinguishing equipment are centralized;

Monitor stations or control stations located outside the machinery space.

② Corridors:

Passenger and crew corridors.

③ Accommodation spaces:

Spaces as defined in 3.1.5.11 of this Chapter, except corridors.

④ Stairways:

Interior stairways (except those wholly contained within machinery spaces) and enclosures thereto.

⑤ Machinery spaces:

Machinery spaces as defined in 3.1.5.16 of this Chapter;

⑥ Service spaces of fire risk

Galley, pantries containing cooking appliances;

Paint lockers, lamp rooms and spaces for the storage of combustible liquid.

⑦ Ro-ro spaces

Ro-ro spaces as defined in 1.2.5.8 of this Chapter;

(2) For vehicle-passenger ferries, all kinds of passenger ships with a length of 30m or over (except passenger ships of category I and II with a length of 50m or over) and restaurant pontoons with a length of less than 50m, the minimum fire integrity of bulkheads and decks is to be complied with the following requirements:

① Bulkheads and decks separating machinery spaces and one of such adjacent spaces as control stations,

corridors, accommodation spaces, stairways and service spaces of fire risk etc. are to be of the construction of “A-15” class standard.

② Bulkheads and decks separating service spaces of fire risk and one of such adjacent spaces as control stations, corridors, accommodation spaces, stairways and machinery spaces etc. are to be of the construction of “A-15” class standard.

③ In the case that decks separating adjacent accommodation spaces are fitted with ceilings, the ceilings are to be constructed continuously and throughout with non-combustible material.

④ The bulkheads of accommodation spaces and inner corridors are to be made of non-combustible material.

⑤ For vehicle-passenger ships, the bulkheads and decks separating ro-ro spaces and one of such adjacent spaces as machinery spaces, accommodation spaces, service spaces, control stations and other spaces are to be of the construction of “A-0” class standard.

⑥ The special requirements about the above-mentioned spaces refer to 3.3.4.3 (1) of this Section.

(3) For ro-ro passenger ships type 1 and type 2, passenger ships with a length of 30m or over, restaurant pontoons with a length of 30m or over, and vehicle-passenger ships with a length of 50m or over, the bulkheads and decks separating other machinery spaces and one of such adjacent spaces as accommodation spaces (except sanitary and bathroom), corridors, stairways, service spaces and control stations are to be of the construction of “A-0” class standard.

(4) For ships fitted with evacuation systems, facing embarkation spaces of this system and exterior boundaries of open deck spaces used for escape routes, or boundaries adjacent to the embarkation spaces, and boundaries that their failure during a fire would impede escape to the embarkation space, including doors, windows and sidescuttles, the fire integrity is at least of “A-30” class standard.

The ship’s side to the waterline in the lightest seagoing condition, superstructure and deckhouse outsides situated below the evacuation systems embarkation spaces and adjacent to the evacuation slide are to adopt the construction of “A-0” class. The width of this construction is to be at least of 500mm to that of the evacuation slide extended to the right and the left.

3.3.5 Thermal and structural subdivision of cargo Ships

3.3.5.1 Cargo ships of 2,000 gross tonnage or over

(1) For machinery spaces and one of such adjacent spaces as control stations, corridors, accommodation spaces, stairways, and service spaces of fire risk etc. are to be of the construction of “A-0” class;

(2) Bulkheads and decks separating service spaces of fire risk and one of such adjacent spaces as control station, corridors, accommodation spaces, and stairways etc. are to be a construction of ‘A-0’ class standard.

3.3.5.2 Ro-ro cargo ships

(1) In addition to the relevant requirements of cargo ships, the minimum fire integrity of the ships’ ro-ro spaces and the bulkheads and decks of such adjacent spaces are to comply with the relevant requirements of Table 3.3.4.3(1) ① and ② in this Section.

3.3.5.3 Machinery space boundaries of container ships

(1) If containers are stacked at the side walls of the machinery spaces or upward side adjacent places, such places are to be not fitted with doors, windows, vents or other openings. If containers are stacked at the top deck of the machinery spaces, this deck is to be the construction of “A-0” class standard.

3.3.6 Thermal and structural subdivision of oil tankers

3.3.6.1 For oil tankers of 2,000GT or over, the minimum fire integrity of bulkheads and decks is to comply with the following requirements:

(1) The minimum fire integrity of the bulkheads separating adjacent spaces is to comply with the provisions of Table 3.3.6.1 (1);

(2) The minimum fire integrity of the decks separating adjacent spaces is to comply with the provisions of Table 3.3.6.1 (1);

Table 3.3.6.1(1)

Spaces	①	②	③	④	⑤	⑥	⑦
Control stations①	A—0 ^c	A—0	A—30	A—0	A—30	A—30	A—30
Corridors②		C	B—0	A—0 ^m	A—30 ^e	A—30	A—0
Accommodation spaces③			C	A—0 ^m	A—30	A—30	A—0
Stairways④				A—0 ^m	A—30	A—0	A—0

Spaces	①	②	③	④	⑤	⑥	⑦
Machinery spaces⑤					*	A—0 ^d	A—0
Cargo pump-rooms⑥						*	A—30
Service spaces of fire risk⑦							*

Notes: c-- where superscript “c” appears, bulkheads separating the wheelhouse and chartroom from each other may have a “B-0” rating.

d--Bulkheads and decks between cargo pump and machinery spaces may be penetrated by cargo pump shaft glands and similar gland penetrations, provided that gastight seals with efficient lubrication or other means to ensure the permanence of the gas seal are fitted in way of the bulkheads or deck.

e--Fire-resisting divisions of the engine-room and the corridors are to be of at least one deck height of the freeboard deck. The other explanations are in accordance with the related explanation in 3.3.4.3 (1) of this Section.

m--Stairways which penetrate only a single deck are to be surrounded at least by “B-0” class divisions and be protected by self-closing doors.

* --The divisions are to be of steel or other equivalent material, but not required to be “A” class.

Table 3.3.6.1 (2)

Spaces above the deck Spaces below the deck	①	②	③	④	⑤	⑥	⑦
Control stations ①	A—0	A—0	A—0	A—0	—	—	A—0
Corridors ②	A—0	*	*	A—0	—	—	A—0
Accommodation spaces③	A—30	A—0	*	A—0	—	—	A—0
Stairways④	A—0	A—0	A—0	*	—	—	A—0
Machinery spaces⑤	A—30	A—30	A—30	A—30	*	A—0 ^d	A—0
Cargo pump-rooms⑥	—	—	—	—	A—0 ^d	*	—
Service spaces of fire risk⑦	A—30	A—0	A—0	A—0	—	—	A—0

Notes: d--Bulkheads and decks between cargo pump and machinery spaces may be penetrated by cargo pump shaft glands and similar gland penetrations, provided that gastight seals with efficient lubrication or other means to ensure the permanence of the gas seal are fitted in way of the bulkheads or deck.

*-- The divisions are to be of steel or other equivalent material, but not required to be “A” class.

3.3.6.2 For oil tankers of 1,000 gross tonnage or over but less than 2000GT, the minimum fire integrity of bulkheads and decks is to be complied with the following provisions:

(1) Bulkheads and decks separating machinery spaces and one of such adjacent spaces as control stations, corridors, accommodation spaces, stairways and service spaces of fire risk are to be of the construction of “A-0” class standard;

(2) Bulkheads and decks separating service spaces of fire risk and one of such adjacent spaces as control station, corridors, accommodation spaces, and stairways etc. are to be a construction of ‘A-0’ class standard;

(3) In the case that decks separating adjacent accommodation spaces are fitted with ceilings, the ceilings are to be constructed continuously and throughout with low non-combustible material;

(4) The bulkheads of accommodation spaces and inner corridors are to be made of non-combustible material;

(5) “A” class bulkheads and doors in non-combustible material bulkhead divisions are to comply with the provisions of this Section 3.3.9.1;

3.3.6.3 Exterior boundaries of superstructures and deckhouses of oil tankers of 2,000 gross tonnage or over enclosing accommodation and including any overhanging decks which support such accommodation are to be insulated to “A-60” standard for the whole of the portions which face the cargo area and on the outward sides for a distance of 3 m from the end boundary facing the cargo area; oil tankers of 1,000 gross tonnage or over but less than 2000, such insulation are to be of “A-0” class standard. In the case of the sides of those superstructures and deckhouses, such insulation are to be carried up to the underside of the deck of the navigation bridge.

3.3.6.4 Cargo pump rooms

(1) Cargo pump rooms are to be of a sealed construction. The skylights or hatch covers are to be of steel

and not to contain glass panels. They are to be capable of being closed from the outside of the space;

(2) Approved permanent gas-tight lighting enclosures for illuminating cargo pump rooms may be permitted in bulkheads and decks separating cargo pump rooms and other spaces provided they are of adequate strength and the integrity and gas-tightness of the bulkhead or deck are maintained;

(3) Bulkheads and decks between cargo pump and machinery spaces may be penetrated by cargo pump shaft glands and similar gland penetrations, provided that gastight seals with efficient lubrication or other means to ensure the permanence of the gas seal are fitted in way of the bulkheads or deck.

3.3.6.5 Galley

(1) Boundaries between the galleys of oil tankers of 2,000 gross tonnage or over and its adjacent enclosed spaces are to be of at least “A-0” class divisions.

3.3.7 Penetrating deck spaces

3.3.7.1 In addition to the provision in Paragraph 3.3.7.3, this requirement is only applicable to the public spaces of passenger ships.

3.3.7.2 The fire integrity of ships penetrating deck public spaces required in 3.3.4.3 (1) of this Section and bulkheads of its adjacent accommodation spaces is to be of at least “B-15” class divisions.

3.3.7.3 The construction and arrangements passing through the inside decks of the deckhouses or superstructures of ro-ro passenger ships type 2 are to comply with the followings:

(1) The inside bulkheads of superstructures on each deck are to be constructed of steel, in which doors fitted, are to be constructed of steel, and the windows are to be constructed with frames of steel. The glass are to be fire resistant and be retained by a metal glazing bead or angle.

(2) The inside bulkheads of superstructure are to be faced with linings of non-combustible material and the decks (excluding corridors) are to be fitted with ceilings of non-combustible material.

(3) Public spaces are to be separated from other spaces by steel bulkheads, and the bulkheads are to be faced with linings of non-combustible material.

(4) The doors and windows of galleys are to be opened towards the corridors, and the doors and the window frames are to be constructed of steel.

(5) Entrances and stairways accessing to the open deck are to be fitted at the fore and aft of each deck.

(6) Pressure sprinkler piping are to be provided at the openings in the boat deck, and the nozzles are to be evenly arranged along the opening.

3.3.8 Saunas

3.3.8.1 The perimeter of the sauna is to be of “A” class boundaries and may include changing rooms, showers and toilets. The sauna is to be insulated to “A-60” standard against other spaces except those inside of the perimeter and spaces of categories, open deck spaces, sanitary and other similar spaces or other spaces with low fire risk or without fire risk.

3.3.8.2 Bathrooms with direct access to saunas may be considered as part of them. In such cases, the door between sauna and the bathroom need not comply with fire safety requirements.

3.3.8.3 The traditional wooden lining on the bulkheads and ceiling are permitted in the sauna. The ceiling above the oven is to be lined with a non-combustible plate with an air gap of at least 30mm. The distance from the hot surfaces to combustible materials is to be at least 500mm or the combustible materials are to be protected (e.g., non-combustible plate with an air gap of at least 30 mm).

3.3.8.4 The traditional wooden benches are permitted to be used in the sauna.

3.3.8.5 The sauna door is to open outwards by pushing.

3.3.8.6 Electrically heated ovens are to be provided with a timer.

3.3.9 Protection of openings and penetrations in divisions

3.3.9.1 The doors on the bulkheads of “A”, “B” class divisions and non-combustible material divisions are to be insulated to the rating equivalent to the bulkheads thereof. The doors on the bulkheads of “A” class divisions and their frames are to be of steel or other equivalent materials, and the doors on the bulkheads of “B” class divisions and non-combustible material divisions are to be of non-combustible material. Each door is to be capable of being opened or closed at each side by only one person.

Fire doors of “B” class division may be constructed with other material and with the approval of the Administration, provided that they are complied with the requirements of temperature rising of the unexposed side, of preventing the passage of flame and of fire integrity during a standard fire test for ‘B’ class divisions.

Fire doors on the bulkheads of non-combustible material divisions may use approved fire doors of “B” class.

3.3.9.2 Where “A” class divisions are penetrated for the passage of electrical cables, pipes, enclosed trunks and ducts etc., or for girders, beams or other structural members, arrangements are to be made to ensure that the fire integrity is not impaired.

3.3.9.3 Where “B” class divisions are penetrated for the passage of electrical cables, pipes, enclosed trunks and ducts etc., or for the fitting of ventilation terminals, lighting fixtures and similar devices, arrangements are to be made to ensure that the fire integrity is not impaired.

3.3.9.4 The materials used for the construction of pipes passing through “A” or “B” class divisions are to be capable of withstanding the temperature which the divisions need to withstand and be approved by the **CCSISC**.

3.3.9.5 Windows and sidescuttles

(1) All windows and sidescuttles on the bulkheads are to be constructed with frames of steel or other suitable materials. The glass are to be retained by a metal glazing bead or angle;

(2) All windows in bulkheads within accommodation spaces, service spaces and control stations are to be so constructed as to preserve the fire integrity requirements of the bulkheads in which they are fitted.

3.3.10 Ventilation Systems

3.3.10.1 Ventilation ducts are to be of steel or other equivalent materials.

3.3.10.2 Where ventilation systems penetrate decks, precautions are to be taken, in addition to those relating to the fire integrity of the deck requirements, to reduce the likelihood of smoke and hot gases passing from one between-deck space to another through the system.

3.3.10.3 Where a public space having a penetrated deck or a stairway enclosure etc. is provided with ventilation facilities, the ventilation ducts are to be connected with ventilating fans separately and isolated with other ventilation ducts of the system. They are to be not used for the ventilation of other spaces.

3.3.10.4 Ducts with a clear cross-sectional area exceeding 0.02m² passing through “A” class bulkheads or decks are to be lined with steel sheet sleeves unless the duct is of steel for the part passing through the bulkheads or decks. The steel sheet sleeves have a thickness of at least 3mm and a length of at least 900mm. When passing through the bulkheads, the steel sheet sleeves are to be divided preferably into 450mm on each side of the bulkheads. These ducts, or sleeves lining such ducts, are to be provided with fire insulation. The insulation are to have at least the same fire integrity as the bulkhead or deck through which the duct passes.

3.3.10.5 Ducts with a clear cross-sectional area exceeding 0.075m² are to be fitted with fire dampers in addition to the requirements of 2.2.7.3. The fire damper is to operate automatically, but is to also be capable of being closed manually from both sides of the bulkhead or deck. The damper is to be provided with an indicator which shows whether the damper is open or closed. Fire dampers are not required, however, where ducts pass through spaces surrounded by “A” class divisions without serving those spaces, provided those ducts have the same fire integrity as the divisions which they pierce.

3.3.10.6 Ducts provided for the ventilation of machinery spaces, ro-ro spaces, galleys and cargo spaces are not to pass through accommodation spaces, service spaces or control stations. Ducts provided for the ventilation of accommodation spaces, service spaces or control stations and so on are not to pass through machinery spaces ro-ro spaces, galleys or cargo spaces.

These ducts exclude those meeting with the following requirements:

(1) The ducts are constructed of steel having a thickness of at least 3mm and 5mm for ducts, the widths or diameters of which are up to and including 300mm and 760mm and over respectively and, in the case of such ducts, the width or diameters of which are between 300 mm and 760 mm, having a thickness obtained by interpolation;

(2) The ducts are suitably supported;

(3) The ducts are insulated to “A-60” class standard passing through the accommodation spaces, service spaces or control stations or passing through the machinery spaces or galleys.

3.3.10.7 Where they pass through accommodation spaces or spaces containing combustible materials, the exhaust ducts from galley ranges are to be constructed of “A” class divisions. Each exhaust duct is to be fitted with:

(1) a grease trap readily removable for cleaning;

(2) a fire damper located in the lower end of the duct;

(3) arrangements, operable from within the galley, for shutting off the exhaust fans;

(4) fixed means for extinguishing a fire within the duct.

Section 4 FIRE EXTINCTION

3.4.1 General requirements

3.4.1.1 Any ship is to be provided with fire pumps, fire mains, hydrants, water nozzles and hoses.

3.4.1.2 Control stations or centralized control valve housing of various fixed fire-extinguishing systems are to be located in places which may be easily accessed and may not be isolated by the fire occurred in the spaces protected. Such stations or spaces containing centralized valve housing are to be provided with sufficient lightings and ventilating.

3.4.1.3 Various fire-extinguishing piping valve bodies are to be fixed with nameplates. Rotation directions of opening or closing are to be clearly marked on the valve disks.

3.4.1.4 Diagrams and concise instruction for the operation of fixed fire-extinguishing systems are to be exhibited in ship's fire stations or other suitable places.

3.4.1.5 Fire extinguishing appliances are to be kept in good order and available for immediate use at any time.

3.4.2 Arrangements of fixed fire-extinguishing systems

3.4.2.1 Passenger ships, cargo ships, engineering ships, cargo barges and pushers (tugs) are to be fitted with fixed fire-extinguishing systems and appliances as prescribed in Table 3.4.2.1.

Table 3.4.2.1

Space protected		Dry cargo spaces	Machinery spaces	Accommodation and service spaces
Ship type				
Passenger ship Length of ship L in m	≥50	1. Water 2. Carbon dioxide	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ②Pressure water spraying ③Aerosol ④Heptafluoropropane	Water
	<50	Water	Water	Water
Cargo ship (Gross Tonnage)	≥2000	1. Water 2. Carbon dioxide	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ②Pressure water spraying ③Aerosol ④Heptafluoropropane	Water
	<2000	Water	Water	Water
Cargo barge		Water	Water	Water
Total power output(kW) of auxiliaries for non-self-propelled engineering ships and for self-propelled engineering ships	≥2000		1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ②Pressure water spraying ③Aerosol ④Heptafluoropropane	Water
	<2000		Water	Water

Space protected		Dry cargo spaces	Machinery spaces	Accommodation and service spaces
Ship type				
Pusher(Tug) Total power of main engine in kW	≥2000		1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ②Pressure water spraying ③Aerosol ④Heptafluoropropane	Water
	<2000		Water	Water

Notes: 1. The general cargo holds of open-top cargo ships may be only fitted with water fire-fighting;

2. Pontoons are to be fitted with fixed fire-extinguishing systems in accordance with the provisions for barges, or the fire-fighting piping system on-shore are to be led to the pontoons and are to comply with the provisions for water fire-extinguishing systems.

3.4.2.2 The configuration of oil tankers' fire-extinguishing systems is to comply with the provisions of Table 3.4.2.2.

Table 3.4.2.2

Space protected		Cargo pump-rooms	Machinery spaces	Cargo oil tanks and its decks area	Accommodation and service spaces
Type of the ship					
Oil tanker (Flash point <u>≤60°C</u>)	≥300 gross tonnage	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ②Pressure water spraying ③Heptafluoropropane	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ② Pressure water spraying ③Aerosol ④Heptafluoropropane	1. Water 2. Fixed deck foam system	Water
	<300 gross tonnage	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ②Pressure water spraying ③Heptafluoropropane	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ② Pressure water spraying ③Aerosol ④Heptafluoropropane	1. Water 2. Portable foam applicator (fitted with required power units figuration) 3. Large foam-type extinguisher	Water

Space protected Type of the ship		Cargo pump-rooms	Machinery spaces	Cargo oil tanks and its decks area	Accommodation and service spaces
Oil tanker (Flash point >60°C)	≥2000 gross tonnage	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ② Pressure water spraying ③Heptafluoropropane	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ② Pressure water spraying ③Aerosol ④Heptafluoropropane	1. Water 2. Fixed deck foam system	Water
	<2000 gross tonnage	Water	Water	1. Water 2. Portable foam applicator 3. Large foam-type extinguisher	Water
Oil barge (Flash point ≤60°C)	≥300 gross tonnage	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ②Pressure water spraying ③Heptafluoropropane	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ② Pressure water spraying ③Aerosol ④Heptafluoropropane	1. Water 2. Portable foam applicator 3. Large foam-type extinguisher	Water
	<300 gross tonnage	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ② Pressure water spraying ③Heptafluoropropane	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ② Pressure water spraying ③Aerosol ④Heptafluoropropane	1. Water 2. Large foam-type extinguisher	Water
Oil barge (Flash point >60°C))	≥2000 gross tonnage	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ②Pressure water spraying ③Heptafluoropropane	1. Water 2. One of following fixed fire-extinguishing systems: ①Carbon dioxide ② Pressure water spraying ③Aerosol ④Heptafluoropropane	1. Water 2. Large foam-type extinguisher	Water

Space protected Type of the ship		Cargo pump-rooms	Machinery spaces	Cargo oil tanks and its decks area	Accommodation and service spaces
	< 2000 gross tonnage	Water	Water	1. Water 2. Large foam-type extinguisher	Water

3.4.2.3 Accommodation and service spaces and control stations of ships are to be protected by fixed fire detection and fire alarm systems and/or an automatic sprinkler, fire detection and fire alarm system complying with the requirements of Section 7 of this Chapter. When ships are fitted with this system, the fire integrity of the bulkheads and decks is to be determined in accordance with the provisions of 3.3.4.3 of this Chapter.

3.4.3 Water fire-extinguishing systems

3.4.3.1 Fire pumps

- (1) The number of ship's fire pumps is to be not less than that required in Table 3.4.3.1 (1);
- (2) The driving mode of ships' fire pumps is to comply with the requirement of Table 3.4.3.1 (1);
- (3) Sanitary, ballast, bilge or general service pumps may be employed as fire pump provided that they comply with the requirements for fire pumps and the capacity of drawing bilge water is not affected. General service pumps are to be not used for the transfers of fuel when they are employed for fire pump;
- (4) The capacity and waterhead of fire pumps are to be sufficient to meet the running requirements of following fire-fighting facilities simultaneously:

- ① The output from hydrants on the uppermost deck supplied by one fire pump is to comply with the requirements of Table 3.4.3.1 (1). The ranges of jets are to be not less than 12m;
- ② Passenger ships type 1 and type 2 and ro-ro cargo ships are to be capable of getting three water jets from the hydrants within vehicle spaces or ro-ro spaces, of which the ranges are not less than 12m;
- ③ There is sufficient water supply for fixed deck foam fire-extinguishing system (if any);
- ④ There is sufficient water supply of the oil tanker deck's water sprinkler system (such as, water supply of the fire pumps).

(5) Restaurant pontoons are to be fitted at least one independently driven fire pump. Such fire pumps are to have a capacity not less than 25m³ per hour and ensure that the ranges of water jets from any two hydrants are not less than 12m. If the terminal is provided with fire pumps meeting the requirement of this clause or fire lines supplied from the shore, independently driven fire pump may be dispensed for the restaurant pontoon, however fire piping of the restaurant pontoon are to have reliable connecting to water-supply lines of the terminal;

(6) Passenger ships type 1 and type 2, passenger ships with a length of 100m or over and oil tankers of 1000 gross tonnage or over are to be fitted with a fixed and independently driven emergency fire pump which is positioned outside the machinery space containing independently driven fire pumps as required by (1) above. The capacity is to be not less than 25m³ per hour and ensure that the ranges of water jets from any two hydrants are not less than 12 m;

(7) Any diesel engine driving the fixed and independently driven emergency fire pump are to be capable of being readily started by manual cranking in cold condition down to a ambient temperature of 0 °C. Other means of starting may be permitted provided that these means enable the diesel driven power source to be started at least 6 times in a period of 30 minutes, and at least twice in the first 10 minutes.

The storage of fuel oil is to enable the pump to run under full load condition for at least three hours.

(8) For passenger ships type 1 and type 2, ro-ro cargo ships, passenger ships with a length of 50m or over, cargo ships of 2000 gross tonnage or over and oil tankers of 1000 gross tonnage or over, at least one fire pump are to be capable of being remotely started from the outside of the exits of the wheelhouse, monitoring rooms or engine rooms or from the fire control stations (if any) in order to ensure to timely supply water.

Table 3.4.3.1 (1)

Type of the ship		Fire pump	
		Number of pump	Driven mode
Passenger ship ^① Length of ship L (in m)	≥50	2	By independent power source
	< 50 ≥30	1	By independent power source
	< 30	1	By independent power source or by main engine
Cargo ship (Gross tonnage)	≥1000	2	By independent power source
	< 1000 ≥300	1	By independent power source
	<300	1	By independent power source or by main engine
Cargo barge (Gross tonnage)	≥1000	1	By deck auxiliary machine
	< 1000	1	By deck auxiliary machine or manually
Total power of main engine for self-propelled engineering ships (kW)	≥735	2	By independent power source
	< 735	1	By independent power source
Total power of auxiliaries for non-self-propelled engineering ships (kW)	≥2000	2	By independent power source
	≥735	1	By independent power source
	< 735	1	By independent power source or by deck auxiliary machine
Pusher (Tug) Total power of main engine (in kW)	≥735	2	By independent power source
	< 735 ≥220	1	By independent power source
	≤ 220	1	By independent power source or by main engine
Oil tanker (Gross tonnage)	≥500	2	By independent power source
	< 500 ≥300	1	By independent power source
	< 300	1	By independent power source or by main engine
Oil barge (Gross tonnage)	≥2000	1	By independent power source
	<2000	1	By independent power source or by deck auxiliary machine

Notes: ① For vehicle-passenger ferries, fire pumps are to be driven by independent power source or by main engine. If the ship's length is more than 50m and the time of sailing exceeds half an hour, another fire pump driven by independent power source are to be fitted.

Water Supply

Table 3.4.3.1 (4)

Type of Ship		Nozzle size	19mm	16mm	13mm
Passenger ship Length of ship (in m)	≥50		At least 2 water jets		
	< 50 ≥30			At least 2 water jets	
	< 30				At least 2 water jets
Cargo ship (Gross tonnage)	≥1000		At least 2 water jets		
	< 1000 ≥300				At least 2 water jets
	< 300				At least 2 water jets

Type of Ship		Nozzle size		
		19mm	16mm	13mm
Cargo barge (Gross tonnage)	≥1000			At least 2 water jets
Total power of main engine for self-propelled engineering ships (in kW)	≥735	At least 2 water jets		
	< 735		At least 2 water jets	
non-self-propelled engineering ships				At least 2 water jets
Pusher (Tug) Total power of main engine (in kW)	≥735	At least 2 water jets		
	< 735		At least 2 water jets	
	≥370			
	< 370			At least 2 water jets
	≥220			At least 2 water jets
Oil tanker (Gross tonnage)	< 220			At least 2 water jets
	≥500	At least 2 water jets		
	< 500		At least 2 water jets	
	≥300			
Oil barge (Gross tonnage)	< 300			At least 2 water jets
	≥2000			At least 2 water jets
Oil barge (Gross tonnage)	< 2000			At least 2 water jets

3.4.3.2 Arrangement of fire main

(1) Fire pumps are to get water supply from at least sea chest valves at both sides. For barges, they may get water supply from sea chest valve at one side.

(2) The fire main and water service pipes are to meet the effective contribution of the maximum required discharge from fire pumps operating simultaneously.

(3) The laying of pipes is to avoid passing through the cargo holds, cabins and damp places. Their arrangement are to avoid the damage in loading deck cargoes or vehicles and possible freezing.

(4) To cut off damaged sections on the fire pumps, stop valves are to be fitted between the exists of any pumps, main fire pumps at the poop front and all the fire hydrants on decks within the cargo area, and the intervals between them are to be not more than 40m.

(5) For ships fitted with emergency fire pumps, isolating valves isolating the main fire pumps inside this area and main fire bumps outside the area are to be fitted in easily accessible positions of the main fire pumps' machinery spaces. When the isolating valves are shut off, except those in the space referred to above, other fire hydrants can be supplied with water by an emergency fire pump;

(6) The emergency fire pump, its seawater inlet, and suction and delivery pipes and isolating valves are to be located outside the main fire bumps space. If this arrangement cannot be made, the sea-chest may be fitted in the machinery space if the valve is remotely controlled from a position in the same compartment as the emergency fire pump and the suction pipe is as short as practicable. When the main fire pump space is on fire, it is not to affect the normal operation of valves. Short lengths of suction or discharge piping may penetrate the machinery space, provided they are enclosed in a substantial steel casing or are insulated to "A-60" class standards. The pipes are to have substantial wall thickness, and are to be welded except when it is surely necessary.

The emergency fire pump is to be not adjacent to the fire pump room. If this cannot be made, then the adjacent boundaries are to be of "A-60" class fire-resisting divisions, and there are to be no openings.

3.4.3.3 Hydrants

(1) The number and position of hydrants are to be such that at least two jets of water not emanating from the same hydrant, one of which is to be from a single length of hose, and reach any part of the space protected. For ships only need one jet of water, the number and position of hydrants are to ensure that water can reach any part of the ship normally accessible to the passengers or crew with a single length of hose. Such hydrants are to be positioned at each access to the protected spaces.

(2) At least one hydrant is to be fitted near the access to the engine room at each side. For cargo ships of less than or equal to 500 gross tonnage, if it is difficult for arrangement, only one hydrant may be fitted at one side. At least one hydrant is to be fitted near the entrances of galley of restaurant pontoons.

(3) The positions of hydrants are to be such that fire hoses can be easily connected to them and they can be readily accessed. They are to be so arranged that they can avoid possible freezing or being bumped to damage.

(4) Each hydrant is to consist of an inner-buckling connection fit for fire hoses, a stop valve, and a protecting cover. The inner-buckling connection fit and the stop valve are to be constructed with nonferrous metal or other heat-resisting and corrosion resisting materials.

3.4.3.4 Fire hoses and nozzles

(1) Fire hoses are to be constructed with approved corrosion-resisting materials. Each hose is to be sufficient in length but not necessary to exceed 20m.

(2) Each hose and nozzle is to be exchangeable, otherwise, each hydrant is to be provided with another hose and nozzle.

(3) Each hose is to be provided with a nozzle and necessary couplings, which is to be kept ready for use in conspicuous positions near hydrants.

(4) Provisions of fire hoses are to comply with the following requirements:

① For passenger ships, passenger ships type 1 and type 2, ro-ro cargo ships and restaurant pontoons, there is to be one fire hose for each hydrant;

② For vehicle-passenger ferries with a length of 50m or over, cargo ships of 1000 gross tonnage or over, and pushers (tugs) having a total power of main engine 735 kW or more, there are to be not less than five hoses for the whole ship. For vehicle-passenger ferries with a length of less than 50m, cargo ships of less than 1000 gross tonnage, pushers (tugs) having a total power of main engine less than 735kW, and cargo barges, there are to be not less than three hoses for the whole ship; For cargo ships of less than 250 gross tonnage, there is to be not less than one hose for the whole ship. For oil tankers of 500 gross tonnage or over, there are to be not less than five hoses for the whole ship; For oil tankers of less than 500 gross tonnage, there are to be not less than three hose for the whole ship;

③ Engine and boiler rooms are to be provided with one hose for each hydrant.

(5) For the purposes of this Section, standard nozzle sizes are to be 13mm, 16mm, and 19mm in diameter or near the size as possible. Larger diameter nozzles may be permitted at the discretion of [CCSISC](#).

(6) The size of nozzles of all kinds of ships need not exceed the sizes listed in table 3.4.3.1 (4). For accommodation and service spaces, a nozzle size greater than 13mm need not be used. For machinery spaces and exterior locations, the nozzle size is to be such as to obtain the maximum discharge possible from tow jets at the range mentioned in 3.4.3.1 (4).

(7) All nozzles are to be of approved types. Nozzles used in machinery spaces, ro-ro spaces, and oil tankers are to be of a dual-purpose type (i.e. spray/jet type) with a shut off switch.

A water fog applicator might consist of a metal L-shaped pipe, the long limb being about 2m in length, capable of being fitted to a fire hose, and the short time being about 250mm in length, fitted with fixed water for nozzle or capable of being fitted with a water spray nozzle.

3.4.3.5 Tests

All pipes of fire main systems together with their fittings are to be subjected to a hydraulic test with 1.5 times of the design pressure in workshops, and on completion of installation on board, the fire main system is to be tested under operation condition.

3.4.4 Fixed fire-extinguishing systems

3.4.4.1 Carbon dioxide fire-extinguishing systems, water-spraying fire-extinguishing systems, fixed deck foam fire-extinguishing systems, aerosol fire-extinguishing systems, heptafluoropropane fire-extinguishing systems required by 3.4.2 of this Section, are to comply with the provisions in Section 7 of this Chapter.

3.4.5 Extinguishers and other fire-fighting appliances

3.4.5.1 The types, quantities and the arrangement of fire-fighting appliances are to be at least in accordance with the provision of Table 3.4.5.1. Fire-fighting appliances are to be in accordance with the provisions of Section 7 in this Chapter.

Ship type		Configuration									
		Portable extinguisher	Large foam-type extinguisher	Portable foam applicator unit (set)	Gas extinguisher	Fire bucket	Sand box	Axe	Portable electric-al safety	Iron slender and hook (set)	Fire-fighter's outfit (set)
Passenger ship ro-ro cargo ship Length of ship <i>L</i> (in m)	≥50	Each deck 6 Galley 2 Engine room 4 Ro-ro space ^① 1/50m ²	2(accesses of vehicle spaces or ro-ro spaces), 1(other spaces)	Engine room 1	Radio station 1 Switch-board 1 Transformer station 1 Central control room 1 Propulsion motor rooms 2 Other electric equipment space as needed	6	Each deck 2	4		2	2 (passenger ships with a length of 50m or over)
	<50	Each deck 4 Galley 2 Engine room 4 Ro-ro space ^① 1/50m ²				4	Each deck 2	2		1	
Cargo ship Oil tanker (Gross tonnage)	≥1000	Each deck 4 Galley 2 Engine room 4		Engine room 1	Radio station 1 Switch-board 1 Transformer station 1 Central control room 1 Propulsion motor rooms 2 Other electric equipment space as needed	6	4	4	2	1	2 (oil tanker)
	<1000	Each deck 2 Galley 2 Engine room 4				4	2	2	2	1	
	≤200	Total 5				2	2	1			
Pusher (Tug) Total power of main engine (in kW)	≥735	Each deck 4 Galley 1 Engine room 2		Engine room 1	Radio station 1 Switch-board 1 Transformer station 1 Central control room 1 Propulsion motor rooms 2 Other electric equipment space as needed 1	4	2	2		1	
	<735	Each deck 2 Galley 1 Engine room 2				4	2	2		1	

Name of Appliances		Portable extinguisher	Large foam-type extinguisher	Portable foam applicator unit (set)	Gas extinguisher	Fire bucket	Sand box	Axe	Portable electric-al safety	Iron slender and hook (set)	Fire-fighter's outfit (set)
Ship type											
Cargo barge (Gross tonnage)	≥1000	Total 6			Radio station 1 Switch-board 1 Transformer station 1	4	2	2			
	<1000	Total 4			Central control room 1 Propulsion motor rooms 2 Other electric equipment space as needed	2	2	1			
Oil barge (Gross tonnage)	≥1000	Total 8	1 (Cargo oil area)		Radio station 1 Switch-board 1	6	4	2	1		
	<1000	Total 6			Transformer station 1	4	2	2	1		
	≤200	Total 3			Central control room 1 Propulsion motor rooms 2 Other electric equipment space as needed	2	2	1			
Total power of main engine for self-propelled engineering ships (in kW)	≥735	Each deck 4 Galley 1 Engine room 2		Engine room 1	Radio station 1 Switch-board 1 Transformer station 1	4		2		1	
	<735	Each deck 2 Galley 1 Engine room 2			Central control room 1 Propulsion motor rooms 2 Other electric equipment space as needed	4		2		1	
Total power of	≥735	Pump room 2			Radio station 1 Switch-board 1	2		1			

Name of Appliances		Portable extinguisher	Large foam-type extinguisher	Portable foam applicator unit (set)	Gas extinguisher	Fire bucket	Sand box	Axe	Portable electric-al safety	Iron slender and hook (set)	Fire-fighter's outfit (set)
Ship type											
main engine non-self-propelled engineering ships (in kW)	<735	Pump room 1			Transformer station 1 Central control room 1 Propulsion motor rooms 2 Other electric equipment space as needed	1		1			

- Notes: ① For ro-ro spaces fitted with water-spraying fire-extinguishing systems, such quantity and arrangement of portable foam applicators are to ensure that the distance between extinguishers is to be not more than 20m.
- ② Where the total power output of auxiliaries of pump engine room is more than 2000 kW, the pump engine room is to be fitted with two large foam extinguishers.

3.4.5.2 Machinery spaces of oil tankers of 300 gross tonnage or over are to be fitted with one set of portable foam nozzle.

3.4.5.3 For oil tankers of less than 300 gross tonnage and oil barges of 300 gross tonnage or over, the oil cargo area is to be fitted with at least one large foam-type extinguisher and one portable foam nozzle. For oil tankers of less than 2000 gross tonnage and flash point more than 60°C, the oil cargo area is to be fitted with at least one large foam-type extinguisher and one portable foam nozzle. For oil barges of less than 300 gross tonnage and oil barges of flash point of more than 60°C, the oil cargo area is to be fitted with at least one large foam-type extinguisher.

3.4.5.4 Cargo barges are to be fitted in accordance with the relevant provision.

3.4.5.5 Galleys fitted with liquefied-gas ranges are to be provided with a dry powder extinguisher.

3.4.5.6 Configuration of firefighting appliance of vehicle-passenger ferries.

(1) The types, quantities and arrangements of firefighting appliance of vehicle-passenger ferries are to comply with the provisions in Table 3.4.5.6 (1);

Table 3.4.5.6 (1)

Name of firefighting appliances	Portable Fire Extinguisher (set)	Gas extinguisher(set)	Fire bucket	Axe	Iron slender and hook (set)
Provisions	Each deck 6 Engine room 4 Ro-ro space 1/50m ²	Radio station 1 Switch-board 1 Transformer station 1 Other electric equipment space as needed	4	2	1

(2) For vehicle-passenger ferries with a length of 50m or over and a running time of more than half an hour, the vehicle spaces are to be fitted with one large foam-type extinguisher, in addition to the requirements stipulated in Table 3.4.5.6 (1) ;

(3) Pushers (tugs) with a total output of main engine of more than 735kW and pushing (tugging) vehicle-passenger ferry barges are to be provided with at least 4 portable foam applicator units, in addition to the requirements stipulated in 3.4.5.1 of this Section.

3.4.5.7 Configuration of firefighting appliance of restaurant pontoons

(1) For restaurant pontoons with a length of 50m or over, each deck is to be fitted with at least eight portable foam applicator units, at least six sets are to be provided for the galley and at least four sets for the machinery space. The fire buckets are to be not less than two sets;

(2) For restaurant pontoons with a length of less than 50m, each deck is to be fitted with at least four portable foam applicator units, at least four sets are to be provided for the galley and at least two sets for the machinery space. The fire buckets are to be not less than two sets;

(3) The galley fitted with a gas liquid stove is to be provided with two dry powder fire extinguishers and in addition, the requirements stipulated in (1) and (2) above.

3.4.5.8 Carbon dioxide fire extinguishers are to be not placed in accommodation spaces. In control stations and other spaces containing electrical or electronic equipment or appliances necessary for the safety of the ship, fire extinguishers are to be provided of which extinguishing media are neither electrically conductive nor harmful to the equipment and appliances.

Section 5 ESCAPE

3.5.1 General requirements

3.5.1.1 Stairways and ladders are to be so arranged as to provide ready means of escape to the life-saving appliance embarkation spaces of the freeboard decks from passenger and crew accommodation spaces and from spaces in which the crew is normally employed, other than machinery spaces.

3.5.1.2 All stairways are to be constructed of steel.

3.5.1.3 Escape routes are to be kept clear and are not to pile up obstructions. Their floors are to be so arranged as to prevent persons from slipping during the evacuation.

3.5.1.4 Lifts are to be not considered as forming one of the means of escape as required by this Section.

3.5.1.5 Passenger ships are to be provided with broadcasting systems, which are to meet the relevant requirements of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

3.5.2 Means of escape from control stations, accommodation spaces and service spaces on passenger ships

3.5.2.1 All accommodation spaces are to be provided with doorways easily leading to the open decks. In the case that cabins only have the doors leading to longitudinal inner corridors, such corridors are to be provided with more than two doorways which are to be located far apart and capable of leading from open decks to freeboard decks, or directly leading to freeboard decks.

3.5.2.2 Doors in the access of accommodation spaces to the open deck are to open outwards. However, where there are not more than four persons living in the accommodation compartment, the doors may open into the cabins in order to avoid prevent to the operation or injury to persons in the corridor when the door is opened.

3.5.2.3 All enclosed public spaces are to be provided with two widely separated accesses. For a ship of less than 30m in length, only one access may be provided.

3.5.2.4 Unless expressly provided otherwise, corridor, lobby, or part of a corridor with only one route of escape is to be prohibited.

3.5.2.5 Stairways within accommodation spaces, the net width of which is to be not less than 900mm. Unless expressly provided otherwise, the division with accommodating spaces is to be of B-0 class, except the passenger ships type 5 and vehicle-passenger ferries with a sailing time less than half an hour. The enclosures of stairways are to access to corridor directly.

3.5.2.6 Stairways may be fitted in the open position, provided that they lie wholly within the public space of the penetrating deck.

3.5.2.7 A public space passing through decks is to be provided with two accesses as far apart as practicable on each deck, which are to lead to the freeboard deck.

3.5.2.8 Stairways serving only one space and its balcony are not to be regarded as means of escape required in this Section.

3.5.2.9 Unless expressly provided otherwise, corridors, stairways and accesses are to be in accordance with the relevant provisions in PART NINE of the Guidelines.

3.5.2.10 The fire integrity of escape routes is to comply with the requirements of 3.3.4 of this Chapter.

3.5.2.11 Ro-ro passenger ships type 1 and type 2, passenger ships of category I and II with a length of 50m or over and restaurant pontoons with a length of 50m or over are to comply with the following requirements:

- (1) Two escape routes are to be provided for each space or main vertical zones (if any);
- (2) At least one stairway is to be provided at the both sides of the escape route. At least one stairway are to be provided within each main vertical zone (if any);
- (3) Means of escape are to comply with the requirements in appendix 1 of this Chapter;
- (4) The exit of the escape route stairway of the freeboard deck is to lead to both sides of the ship;

The direction of escape is to be plainly indicated at the escape routes, in the corridors and at the accesses, and it is to be in accordance with the provisions of Section 3 in CHAPTER 2 of this Part;

3.5.3 Means of escape from control stations, accommodation spaces and service spaces on cargo ships

3.5.3.1 All accommodation spaces are to be provided with doorways easily leading to the open decks. In the case that cabins only have the doors leading to longitudinal inner corridors, such corridors are to be provided with more than two accesses which are to be located far apart and capable of leading from open decks to freeboard decks, or directly leading to freeboard decks.

3.5.3.2 Doors in the access of accommodation spaces to the open deck are to open outwards. However, where there are not more than 4 persons living in the accommodation compartment or the length of the cargo ship is less than 40m, the doors may open into the cabins in order to avoid prevent to the operation or injury to persons in the corridor when the door is opened.

3.5.3.3 All enclosed public spaces are to be provided with two widely separated accesses. For a ship of less than 30 m in length or the enclosed public space of less than 7 m in length, only one access may be provided.

3.5.3.4 No dead-end corridors with a length of more than 7m are to be accepted.

3.5.3.5 The width of the doors of the access to open decks and escape routes is to be greater than or equal to 700mm, the above width for ships of less than 2000 gross tonnage may be reduced to 600mm. The angle of inclination of the stairway for escape routes is not to exceed 50°.

3.5.4 Means of escape from control stations, accommodation spaces and service spaces on oil tankers

3.5.4.1 In addition to the provisions of 3.5.3 in this Section, stairways or ladders are to be fitted in all crew spaces. For ships equipped with lifeboats, they are to be so arranged as to provide ready means of escaping to the lifeboat embarkation deck. Other stairways are to lead to the freeboard deck.

3.5.5 Means of escape from machinery spaces

3.5.5.1 At least two accessed are to be provided for an important machinery space to the freeboard deck and are to be located on both sides of the ship and as widely separated as possible.

A Metal ladder with handrails is to be provided in way of an access from the floor of the important machinery space and is to be inclined to the floor at an angle of not more than 65° .

For the ships with a length of 30 m or less, a vertical ladder may be permitted as one of the ladders of the important machinery space. For the ships with a length of less than 40 m, only one inclined ladder with handrails may be provided for the important machinery space, provided that its two accessed are connected by gratings.

3.5.5.2 At least one means of escape to the open deck is to be provided to other machinery spaces.

3.5.5.3 The net width of the doors and the ladders used as means of escape of the machinery space is to be at least 600 mm.

3.5.5.4 For the important machinery spaces of each demihull of catamarans, it is permitted that one ladder is inclined and the other is vertical.

3.5.6 Emergency Escape Breathing Devices

3.5.6.1 For ro-ro passenger ships type 1 and type 2, passenger ships of category I and II with a length of 50m or over and restaurant pontoons with a length of 50m or over, the accommodation spaces are to be equipped with at least two sets of emergency escape breathing devices. Passenger ships fitted with main vertical zones are to be equipped with at least two sets of emergency escape breathing devices in each vertical zone.

3.5.6.2 Emergency escape breathing devices are to be situated ready for use at easily visible places.

Section 6 PROTECTION OF RO-RO SPACES

3.6.1 General Requirements

3.6.1.1 In addition to comply with the requirements of other sections in this Chapter, ro-ro spaces are to comply with the requirements of this Section.

3.6.2 Ventilation systems

3.6.2.1 Closed ro-ro spaces are to be provided with an effective power ventilation system and comply with the following requirements:

(1) There are to be at least 10 times per hour.

(2) The power ventilation system is to be separate from other ventilation systems, and is to be in operation at all times when vehicles are in such spaces.

(3) Control means for closing the power ventilation system from outside are to be provided.

The ventilation system is to be such as to prevent air stratification and the formation of air pockets.

3.6.3 Permanent Openings

3.6.3.1 Permanent openings in the side plating, the ends or deckhands of the ro-ro space are to be so situated that a fire in this space does not endanger stowage areas for survival craft and accommodation spaces, service spaces and control stations in superstructures and deck-houses above the ro-ro spaces.

3.6.4 Passageway

3.6.4.1 The accesses with a width of at least 850mm are to be provided at both sides of the vehicle space along the ship's length. The longitudinal accesses are to be provided between the vehicles, of which the width is to be not less than 500mm. A transversal access with a width of not less than 700mm is to be provided every not more than four rows of vehicles for patrolling and fire-fighting, and it can access to both sides of the ship. In addition, the space between the vehicles is not to be less than 300mm along the ship's length.

For ro-ro cargo ships only carrying commercial vehicles, the vehicle spaces may be provided only an emergency longitudinal access with a width of not less than 600mm.

3.6.4.2 The door of the machinery space leading to ro-ro spaces is to adopt self-closing and comply with the requirements of fire-resisting divisions of the spaces. The door is to be not fitted with hold-back hooks.

3.6.4.3 For ro-ro passenger ships type 1, if there are doors leading to vehicle spaces fitted for means of escape, they are to be self-closed, and the fire integrity is to comply with the requirements for corresponding subdivisions.

3.6.5 Other ignition sources

3.6.5.1 Other equipment which may constitute a source of ignition of flammable vapors are not to be permitted.

3.6.6 Detection and Alarm

3.6.6.1 Ro-ro spaces of passenger ships type 1 and type 2 and ro-ro cargo ships, other than those on the exposed weather deck, are to be fitted with a fixed automatic fire detection and fire alarm system.

3.6.6.2 For ships fitted with manual alarm system in accordance with the provision of 3.3.2 in this Chapter, manually operated call points in such ro-ro spaces are to be so arranged that no part of the space is more than 20m from a manually operated call point and are to be located at the ends of the both sides of the space.

3.6.6.3 The open ro-ro spaces on ro-ro passenger ships type 1 and type 2 are to be fitted with video monitoring system, which are to cover the whole area of the open ro-ro spaces. The system is to be of good monitoring image effects at night and the display screen is to be fitted in the wheelhouse or manned stations.

3.6.7 Firefighting

3.6.7.1 Ro-ro passenger ships type 1 and type 2, ro-ro cargo ships and vehicle-passenger ferries with a length of more than or equal to 50m and a sailing time over half an hour are to be fitted with fixed

fire-extinguishing systems and devices in accordance with the provisions in Table 3.6.7.1.

Ro-ro spaces		
Open deck	Open ro-ro Spaces	Closed ro-ro spaces
Water	1. Water 2. Pressure water spraying	1. Water 2. One of following fixed fire-extinguishing systems: ① Carbon dioxide ② Pressure water spraying

3.6.8 Drainage systems

3.6.8.1 Passenger ships:

(1) In the spaces above the freeboard deck, sufficient scuppers are to be fitted; and in the spaces below the freeboard deck, there are to be provided power drainage facilities.

(2) The outlets of drainage pipes are to be not access to machinery spaces or other spaces where the risk of ignition might arise.

(3) Drainage systems above the deck are to be so arranged as to ensure avoidance of harmful interaction of the water between both sides or of the water at one side, and are to be fitted for rapidly clearing the water within this space. The scuppers (or suction ports) are to be arranged so as to prevent from being fouled by materials and to be convenient for dredging.

The overboard scuppers of drainage pipes are to be in general located at appropriate level above the full-loading waterline. Drainage pipes are to be not fitted with closed valves.

(4) The drainage for ro-ro spaces fitted with fixed pressure sprinkler systems is to comply with the following requirements, besides the provisions stipulated in above (1) to (3):

- ① In addition to the bilge system fitted in accordance with the relevant provision of this Part in Section 2.2.7 of CHAPTER 2, spaces below the freeboard deck are to be fitted with bilge pumps and piping, and they are to be sized to remove not less than 125% of the combined capacity of both the water-spraying system pumps and the required number of fire hose nozzles. The bilge system valves are to be operable from outside the protected space at a position in the vicinity of the sprinkler system controls. Bilge wells are to be of a holding capacity of not less than 0.15m³ and are to be arranged at the side shell of the ship at a distance from each other of not more than 40m in each watertight compartment.
- ② For the spaces above the freeboard deck, the scuppers and suction ports at each side are to be of a capacity of 1.25 times the maximum capacity of water mist systems (including pressure water mist systems and sprinkler systems), and the scuppers with a space of about 9m and a diameter of not less than 150mm is to be fitted at both sides of this space in general.

3.6.8.2 Cargo ships

(1) The drainage of ro-ro spaces is to comply with the relevant requirements of 3.6.8.1 (1), (2), (3) and (4) ②;

For the spaces fitted with fixed pressure water sprinkler systems and below the freeboard deck, the bilge drainage systems are to be sized to remove no less than 125% of the combined capacity of both the water spraying system pumps and the required number of fire hose nozzles. The bilge system valves are to be operable from outside the protected space at a position in the vicinity of the sprinkler system controls. Bilge wells are to be of a capacity of not less than 0.15m³ and are to be arranged at the side shell of the ship at a distance from each other of not more than 40m in each watertight compartment. If this is not possible, the adverse effect upon stability of the added weight and free surface of water is to be taken into account to the extent deemed necessary in the approval of the stability information. These documents are to be included in the stability information required to be submitted to the Captain.

Section 7 REQUIREMENTS FOR FIRE SAFETY SYSTEMS AND FIREFIGHTING APPLIANCES

3.7.1 Application

3.7.1.1 Fire safety systems and firefighting appliances fitted on ships are to comply with the provisions of this Section.

3.7.2 Pressure water-spraying fire-extinguishing systems

3.7.2.1 General requirements

(1) Any fixed pressure water spraying system are to be capable of extinguishing oil fire efficiently in the spaces protected.

(2) The system is to be provided with an independent water pump which is not the fire pump as required by Section 4 of this Chapter. The ship's fire pump may be as the spare pump of this system, the connection from the ship's fire main by way of a lockable screw-down non-return valve should prevent a backflow from the system into the fire main.

(3) The pump is to be capable of simultaneously supplying at the necessary pressure to all sections of the system in any one compartment to be protected. The pump and its control device are to be installed outside the space protected. It is to be not permitted that the pump and its control device are out of action due to a fire in the space protected by the water-spraying system.

(4) The pump may be driven by independent internal combustion machinery. But, if it is dependent upon power being supplied from the emergency generator, that generator is to be so arranged as to start automatically in case of main power failure so that power for the pump is immediately available. When the pump is driven by independent internal combustion engine it is to be so situated that a fire in the protected spaces is not to affect the air supply to the engine.

(5) The fixed pressure water-spraying fire-extinguishing system required by the protected spaces is to be provided with spraying nozzles of an approved type.

(6) The number and arrangement of the nozzles are to ensure an effective average distribution of water of at least $5\text{L}/(\text{min} \cdot \text{m}^2)$ per minute in the spaces to be protected. Where increased application rates are considered necessary, these are to be with the satisfaction of [ECSSIS](#).

(7) The system may be divided into sections, the distribution valves of which are to be operated from easily accessible positions outside the spaces to be protected and are to be not readily cut off by a fire in the protected space.

(8) The piping of the water spraying systems are to be subjected to a hydraulic test with 1.5 times of the design pressure. On completion of installation on board, the system are to be subjected to an operational test.

(9) Pressure water-spraying manifolds are to be fitted with a pressure gauge.

(10) Pressure water-spraying valves are to be clearly marked with the space it services.

(11) Precautions are to be taken to prevent the nozzles from becoming clogged by impurities in the water or corrosion of piping, nozzles, valves and the pump. The pipes for water-spraying systems are to be of steel galvanized both internally and externally.

3.7.2.2 Fixed pressure water-spraying system in machinery spaces

(1) The system is to be kept charged at the necessary pressure and the pump supplying the water for the system are to be automatically put into action by a pressure drop in the system.

(2) Nozzles are to be fitted above bilges, tank tops and other areas over which fuel oil is liable to spread and also above other area with specific fire hazard in machinery spaces.

3.7.2.3 Fixed pressure water-spraying system in ro-ro spaces

(1) Spraying nozzles are to be totally porous. The nozzles are to be not less than 0.5m away from the vehicle's top, but for ro-ro cargo ships carrying commercial vehicles, the nozzles are to be not less than 0.5m away from the vehicle's top or the distance required by the pressure water-spraying system. The nozzles are to be arranged so that the water is efficiently and evenly sprayed to vehicle spaces in ro-ro spaces.

(2) For the spaces with a floor-height of less than 2.5m, the system is to supply water of at least $3.5\text{L}/\text{min} \cdot \text{m}^2$ per square meter water. However, where the floor-height is 2.5m or over, the system is to supply water of at least $5\text{L}/\text{min} \cdot \text{m}^2$ per square meter water. The water pressure is to be so sufficient as to ensure the water-spraying evenly distributed.

(3) Each zone is to be capable of covering all the vehicle deck along the whole width, and be not less than 20m amongst, excluding the zones of which staircase is separated by longitudinal "A" class division so that the width of which need to be reduced.

(4) Water service pumps are to be capable of continuously supplying water to at least two zones meanwhile at the required pressure and sufficient capacity.

(5) Water service pumps are to be capable of being started at the control station of distributing valves.

3.7.3 Carbon dioxide fire-extinguishing systems

3.7.3.1 General requirements

(1) The quantity of medium filled in the carbon dioxide system is to be not less than the maximum requirement of each protected spaces.

(2) Where carbon dioxide extinguishing systems are adopted in machinery spaces, cargo oil pump rooms or closed ro-ro spaces, audible and visual alarm devices are to be fitted so that audible alarms can be given prior to and during the discharge of medium. Such devices are to alarm for at least 20s before the discharge of

carbon dioxide medium so that the staff are able to evacuate immediately. Before and during the discharge of medium, they are to give different alarm signals separately.

(3) Proper means are to be adopted so as to shut down all ventilation fans and to close all dampers in the ventilation system serving the protected spaces before the discharge of medium.

3.7.3.2 Fire-extinguishing stations

(1) Fire-extinguishing stations are those spaces in which the discharge of the medium of carbon dioxide systems is controlled. They are to be employed only for the storage of medium vessels and parts or devices of the systems.

(2) Diagrams are to be clearly and permanently exhibited in the stations, showing the arrangement of the vessels, manifold, piping and fittings relating to the distribution and discharge of extinguishing medium, together with the concise instructions for the operation of the system.

(3) Fire-extinguishing stations are to be positioned above the freeboard deck and are to preferably be entered from the open deck. The stations are to be provided with mechanical or natural ventilating. Such stations are to be separated from adjacent accommodation spaces by steel gastight divisions. Bulkheads or doors thereof are to be fitted with observation windows. Doors are to be open outwards.

(4) One of the keys for the station is to be stowed in a box with glass covering near the door of the station.

(5) There are to be sufficient spaces in the station for the operation, measuring, repairing and maintaining.

(6) Control valves are to be fitted on medium pipes to the spaces protected. The names of the spaces protected are to be marked on pipes leading to such spaces.

(7) Stations are to be provided with direct communications to the wheelhouse.

(8) Stations are to be sufficiently illuminated. In addition to the main lighting, the emergency lighting are to be provided.

3.7.3.3 Quantity of carbon dioxide medium

(1) The volume of free carbon dioxide for each protected space is to be determined in accordance with following requirements:

① Engine room—35% of the gross volume of engine room including the casing;

② Cargo oil pump room—45% of the gross volume of cargo pump room including the casing;

③ Cargos hold—30% of the gross volumes of the largest cargo hold under freeboard deck;

③ Closed ro-ro space—45% of the volume of this space.

The volume of free carbon dioxide is to be calculated at 0.56 m³ /kg.

(2) Where the release of compressed air contained in air vessels in engine room seriously affect the efficiency of fire-extinguishing system in the event of a fire, the quantity of fire-extinguishing medium is to be increased properly.

3.7.3.4 Carbon dioxide bottles

(1) Carbon dioxide bottles are to be of seamless steel bottles. Each bottle is to be furnished with a certificate and have on its body the permanent identifications of weight of bottle, capacity, hydraulic test pressure, date of tests, serial number of the factory and also inspection stamp. The bottle is to be wholly painted in red but white in way of the markings, and with yellow letters of carbon dioxide.

(2) The charging ratio for carbon dioxide bottles is to be not more than 0.67 kg per liter.

(3) Bottle head valves are to be associated with steel or copper tubes having a diameter of 10-12mm snipped off at their lower end and terminated near the bottom of the bottles.

(4) Bottle head valves are to be provided with safety diaphragms or other approved safety devices. The bursting pressure of the safety diaphragms is to be 18.6±1 MPa.

(5) The gas escaped through the safety devices are to be led to the open atmosphere through suitable piping.

(6) Bottle head valves are to be made of forged bronze or other suitable materials. Each valve is to be provided with a protecting cover.

(7) The carbon dioxide bottles are to be secured to prevent moving. They are to be placed at a height of at least 50mm from the deck. If releasing is hand-operated, the number of bottles in each group is not to exceed 12.

3.7.3.5 Carbon dioxide piping and operation system

(1) The piping for distribution of carbon dioxide and discharge nozzles are to be so arranged that a uniform distribution of medium is obtained.

(2) For engine rooms, cargo oil pump rooms and closed ro-ro spaces, the piping are to be of adequate size and be provided with sufficient number of nozzles so that 85% of carbon dioxide can be discharged into engine rooms and cargo oil pump rooms within 2 minutes, and 70% of carbon dioxide can be discharged into closed ro-ro spaces within 10 minutes.

(3) Distribution branch pipes from the distribution valve chest are to be provided for each protected space. Each branch distribution pipe is to be fitted with a control valve at valve chest. These valves are to be marked

with the names of the spaces protected.

(4) The control valves used for discharging extinguishing medium are to be capable of being manually operated aside no matter they are capable of being power-operated, automatically or remotely operated.

(5) Each connecting pipe led from each bottle head valve to the collecting pipe is to be provided with a non-return valve. A pressure gauge having a range of 0-24.5MPa is to be provided on the manifold between connecting pipes and control valves chest.

(6) The diameter of carbon dioxide piping leading to the spaces stated in (2) above, is to be determined in accordance with the proposed quantity conveyed by the piping. The maximum quantity of carbon dioxide conveyed by the corresponding pipe diameters is given in Table 3.7.3.5 (6).

Table 3.7.3.5 (6)

Inner diameter of pipes(mm)	Maximum quantity of carbon dioxide conveyed by the pipe (kg)	Inner diameter of pipes(mm)	Maximum quantity of carbon dioxide conveyed by the pipe (kg)
15	60	80	2400
20	100	90	3300
25	175	100	4750
32	275	114	6800
40	500	127	9500
50	1100	152	15250
65	1600		

(7) The minimum wall thickness of carbon dioxide system pipes is given in Table 3.7.3.5(7). Slight difference from the thickness listed in the table will be accepted for the purpose of selecting standard pipes.

(8) The bore diameter of the distribution piping leading to cargo spaces is not to be less than 20 mm, and the bore diameter of those leading to the nozzles is not to be less than 15mm.

(9) At its manifold or distribution valve chest, it is to be provided with compressed air cleaning joint.

(10) Carbon dioxide piping are to be of seamless steel pipes.

Table 3.7.3.5 (7)

Outer diameter (mm)	Wall thickness of pipes (mm)	
	Manifold before distribution valve chest	Branch pipes connecting between distribution valve chest and space protected
21.3 ~ 26.9	3.2	2.6
30.0 ~ 48.3	4.0	3.2
51.0 ~ 60.3	4.5	3.6
63.5 ~ 6.1	5.0	3.6
82.5 ~ 88.9	5.6	4.0
101.6	6.3	4.0
108.0 ~ 114.3	7.1	4.5
127.0	8.0	4.5
133.0 ~ 139.7	8.0	5.0
152.4 ~ 168.3	8.8	5.6

(11) The carbon dioxide piping are to be not led through the accommodation spaces and it is also to avoid passing through the service spaces. If it is impracticable to avoid carbon dioxide piping passing through service spaces, the piping in the service spaces are to be not fitted with detachable joints.

3.7.3.6 Tests

(1) Carbon dioxide bottles and bottle head valves are to be subjected to a hydraulic test with pressure of 24.5MPa. Safety diaphragms are to be burst-tested in accordance with the requirement of 3.7.3.4 (4) by selecting 10% at random.

(2) On completion of fitting the bottle head valves, carbon dioxide bottles are to be subjected to an air tightness test in the workshop with pressure equal to the design pressure of the bottle.

(3) The pipes and valves of carbon dioxide systems' piping are to be subjected to a hydraulic test. The pressure for distribution valve chest and control valves are to be of not less than 11.8MPa. Pipes between bottle head valves and distribution valve chest, the pressure is not to be of less than 1MPa. All above tests may be carried out in workshops. On completion of the hydraulic test, carbon dioxide piping are to be subjected to an on-board air-tightness test of at least 0.69 MPa with the ends closed, to check the tightness of joints.

(4) On completion of installation on board, the carbon dioxide system is to be functionally tested with a pneumatically pressure not less than 2.47 MPa to check the free-passage of piping, nozzles and the operation of releasing mechanism and alarm device.

3.7.4 Aerosol fire-extinguishing systems

3.7.4.1 General requirements

(1) Unless otherwise specified, the aerosol fire-extinguishing system is to be entitled to ship product type approval certificate and the test is to refer to MSC/Circ.1270.

(2) The machinery spaces are to be fitted with mechanical exhaust devices. Before starting the fire extinguishing system, ventilation and air changes facilities are to close automatically and operations having effects on the efficiency of fire suppression are to stop.

(3) All openings in the protected spaces are to be provided with efficient devices for expeditiously closing them from outside. The open or close is to be clear; the openings can be closed effectively before the extinguishing medium is discharged.

(4) The thermal decomposition product from the extinguishing medium is not to spread to accommodation spaces and densely populated areas.

3.7.4.2 Quantity of aerosol fire-extinguishing agent

(1) The design quantity of aerosol fire-extinguishing medium is to be calculated as follows:

$$W = V \times q \quad \text{g}$$

where: W ---the design quantity of aerosol fire-extinguishing medium, g;

q ---the design density of fire-extinguishing aerosols, g/m³, the design density of engine-room fire-extinguishing aerosols is not to be less than 140g/m³;

V -- Clear volume of the protected space, m³.

(2) In protected spaces, the release of compressed air contained in air vessels seriously affect the efficiency of fire-extinguishing system in the event of a fire, the quantity of aerosols is to be increased properly.

(3) Aerosol fire-extinguishing mediums are to be sealed in plastic bag, outside of which are to be protected by protecting cladding; the storage area is to ensure ventilation, cool, dry, away from fire and against breakage.

3.7.4.3 Control system and piping

(1) The control system is to be equipped with manual startup mode and emergency startup button. The emergency startup button is to be fitted easily to operate from outside.

(2) This control system is to ensure that all the fire-extinguishing devices start simultaneously, and the action response time differences is not to be more than 2s.

(3) Within 1.0m from the nozzle of the pyrotechnics aerosol fire-extinguishing system and within 0.2m from the back, sides and ends of the system, no equipment or appliance etc. is to be provided or stored; when the number of nozzles of the generator is more than one, they may be arranged symmetrically, and the arrangement of nozzles is to taken full consideration of the avoidance of possible ignition materials and are to avoid being opened towards the outside of the door or passageway as much as possible.

(4) The protected volume of a single pyrotechnics aerosol prefabricated fire-extinguishing system is to be not more than 160m³; when the volume of the engine room is more than 160m³, multi-points discharge are to be adopted, the generator and the discharge point are to be arranged symmetrically, and their intervals are to be not more than 10m.

(5) The fire-distinguishing device is to discharge 85% medium of the design volume into the protected space in no more than 120s.

(6) All control cables of the fire-extinguishing system are to be fire-retardant.

(7) The generator is to prevent from starting up automatically when below 250°C. In the process of releasing and after, the temperature of the generator or the exit of the nozzle and its shell are to be not more than 200°C, or appropriate protective measures are to be taken.

(8) In the process of medium discharge, the generator or nozzle itself does not make sparks or have residue spillover. After the discharge, there is to be no burning-through, deformation on the shell or ignition phenomenon on the surface of the shell.

(9) When discharging the medium, effective measures are to be taken to ensure the positive pressure of the protected space not more than 0.02 bars and the negative pressure not more than -0.05 bar.

(10) The steering gear power circuit and piping, required for the fire-extinguishing system discharge, are to be arranged to still be able to ensure the fire-extinguishing medium discharged to the whole protected space, when it is damaged due to the fire occurred in the protected space or blast.

(11) The power of the control system is to be fitted with power-losing and other fault detection devices and audible and visual alarm devices are to be fitted at generally manned spaces.

3.7.4.4 Alarm devices

(1) Audible and visual alarm devices are to be fitted at easily visible positions in the protected space. The devices are to give alarm signals to its corresponding protected space and work for at least 20s before the

discharge of medium, and its alarm signal is to be different from other signals.

(2) The exit of the protected space is to be fitted with the fire-extinguishing system protection sign and aerosol discharge light.

(3) Warning boards with white background and red letters are to be posted clearly at the exit of any space that may be affected by the medium.

3.7.5 Heptafluoropropane fire-extinguishing systems

3.7.5.1 General requirements

(1) Unless provided otherwise, heptafluoropropane fire-extinguishing systems are to be entitled to the ship products type approval certificate, and the test is to be carried out with the reference to MSC/Circ.848.

(2) The quantity of medium filled in the heptafluoropropane system is to be not less than the maximum requirement of each protected spaces. If factors that affect the extinguishing effect exist, the quantity of heptafluoropropane is to be increased properly.

(3) When the heptafluoropropane fire-extinguishing system is in action, it is to be fitted with audible and visual alarm devices and work for at least 20s before the discharge of medium and its alarm signal is to be different from other signals.

3.7.5.2 Heptafluoropropane room

(1) Heptafluoropropane room is the operation space for releasing heptafluoropropane fire-extinguishing system agent, and is to be only used for the storage of extinguishing medium vessel and related components and equipment.

(2) Diagrams are to be clearly and permanently exhibited in the heptafluoropropane room, showing the arrangement of the vessels, manifold, piping and fittings relating to the distribution and discharge of medium, together with the concise instructions for the operation of the system.

(3) Heptafluoropropane rooms are to be positioned above the freeboard deck and outside the engine room, to be preferably entered from the open deck and to be provided with mechanical or natural ventilating. Such stations are to be separated from adjacent accommodation spaces by steel gastight divisions. Bulkheads or doors thereof are to be fitted with observation windows. Doors are to open outwards.

(4) One of the keys for the room is to be stowed in a box with glass covering near the door of the room.

(5) There are to be sufficient spaces in the room for the operation, measuring, repairing and maintaining.

(6) Control valves are to be fitted on medium pipes to the spaces protected. The names of the spaces protected are to be marked on pipes leading to such spaces.

(7) The room is to be provided with direct communications to the wheelhouse.

(8) The room is to be sufficiently illuminated. In addition to the main lighting, the emergency lighting are to be provided.

3.7.5.3 Quantity of heptafluoropropane agent

(1) The design quantity of the agent for each protected space is to be calculated as follows:

$$W = k \times \frac{V}{s} \times \frac{c}{100 - c} \quad \text{kg}$$

where: W ---The design quantity for protected spaces, kg

c ---The design concentrations for heptafluoropropane extinguishment (%), the design concentrations c value for the engine room is to be “9”;

V ---The free volume of the protected space, m³;

s ---The specific volume of excessively hot vapor of heptafluoropropane under 101kPa and the lowest environment temperature of the protected spaces; under the room temperature =0.137;

k ---The altitude revision factors are to be determined in Table 3.7.5.3.

Table 3.7.5.3

Altitude (m)	0	1000	1500	2000
Revision factors	1	0.885	0.830	0.785

(2) Where the release of compressed air contained in air vessels in protected spaces seriously affect the efficiency of fire-extinguishing system in the event of a fire, the quantity of heptafluoropropane is to be increased properly.

(3) The designed time for heptafluoropropane discharge is to be not more than 10s.

3.7.5.4 Heptafluoropropane gas cylinders

(1) The supercharge pressure of the storage vessel is divided into three levels, and is to comply with the

following requirements:

Class 1	2.5+0.1 MPa(gauge pressure);
Class 2	4.2+0.1 MPa(gauge pressure);
Class 3	5.6+0.1 MPa(gauge pressure)

(2) For Class 3, supercharge pressure storage vessels are to be seamless steel cylinders. For Class 1 and Class 2, supercharge pressure storage vessel may be welded steel cylinders. Each cylinder is to be furnished with a certificate and have on its body the permanent identifications of weight of cylinders, capacity, hydraulic test pressure, date of tests, serial number of the factory and also inspection stamp. The bottle is to be wholly painted in red but white in way of the markings, and with yellow letters of “heptafluoropropane”.

(3) The charging ratio for heptafluoropropane gas cylinders is to be not more than 1.12 kg per liter.

(4) Each gas cylinder is to be fitted with one barostatic control and crowbar protection. This appliance is to ensure that the inside extinguishing agent can be dispersed safely.

(5) The discharge pressure set value of the safety relief device is to be not less than the 1.25 times cylinder group’s maximum working pressure, but not more than 95% of the 1.5 times cylinder group’s maximum working pressure.

(6) Cylinders are to be fitted with pressure monitoring device. When starting up the air causes abnormal losses, visual and audible fire signals are to be given from the generally manned spaces and the alarm is to be triggered from outside.

3.7.5.5 Piping and control systems of heptafluoropropane

(1) The piping extinguishing system is to be provided with two operation modes “manual operation and emergency operation”; at the same time, the extinguishing system is to be operated from outside.

(2) Nozzles are to be appropriately fitted in accordance with the grouting displacement and the monitoring radius, as well as comply with the requirements of uniform distribution of heptafluoropropane in protected spaces. Nozzles are to have permanent marks of its mode and specification. For closed nozzles, they are to be fitted with dust cover that releases automatically in discharge.

(3) Pipelines transferring heptafluoropropane are to adopt seamless steel pipes, and steel pipelines together with its accessories are to be galvanized inside and out; for corrosive places, stainless pipes are to be adopted; pipelines transferring start gas are to adopt copper pipes. When the nominal diameter of the pipelines is not more than 80mm, they may be connected by screw-threads; when the nominal diameter is more than 80mm, they may be connected by blank flanges. The fire-extinguishing system is not to include aluminum components.

(4) Distribution branch pipes from the distribution valve chest are to be provided for each protected space. Each branch distribution pipe is to be fitted with a control valve at valve chest. These valves are to be marked with the names of the spaces protected.

(5) The density of available heptafluoropropane is to be not more than 10.5%.

3.7.6 Fixed deck foam fire-extinguishing systems

3.7.6.1 General requirements

(1) The arrangement for supplying foam is to be capable of delivering foam to the entire deck area of cargo tanks as well as into any cargo tank above which the deck has been ruptured.

(2) The deck foam system is to be capable of simple and rapid operation. The main control station of the system is to be suitably located outside the cargo area, adjacent to the accommodation spaces, readily accessible and operable in the event of a fire in the areas protected.

3.7.6.2 Foam solution

(1) The supplying rate of foam solution is to be not less than the following maximum value:

- ① 0.6 L/ min·m² of cargo tank deck area, where deck area of cargo tanks means the product of the maximum breadth of the ship multiplied by the total longitudinal extent of the cargo tank spaces; or
- ② 6 L/ min·m² of the horizontal sectional area of the single tank having the largest area; or
- ③ 3 L/ min·m² of the area protected by the largest monitor, and such area being entirely forward of the monitor, but not less than 1250 L/min. Oil tankers of less than 2000 gross tonnage are to be no less than the biggest value from in ① and ②.

(2) Sufficient foam concentrate is to be supplied to ensure at least 30 minutes of foam generation.

(3) The foam expansion ratio (i.e. the ratio of foam produced to the volume of the mixture of water and foam-making concentrate supplied) is not to generally exceed 12 to 1. Where medium expansion ratio foam (between 50 to 1 and 150 to 1 expansion ratio) is employed, the supplying rate of foam solution and the capacity of a monitor installation are to be subjected to the agreement of [CCSISC](#).

3.7.6.3 Monitors and foam applicators

(1) Oil tankers of 2000 deadweight tons or over are to be fitted with foam monitors. Oil tankers less than 2000 dead weight tons and oil barges may be fitted with foam applicators only.

(2) The number and position of monitors are to comply with the requirements of 3.7.6.1. The capacity of any monitor is to be at least 3 L/min·m² of foam solution per square meter of deck area protected by that monitor, the area being entirely forward of the monitor. Such capacity is to be not less than 1250 L/minute.

(3) The distance from the monitor to the farthest extremity of the protected area forward of that monitor is to be not more than 75% of the monitor throw in still air condition.

(4) Applicators are to be so provided as to ensure flexibility of action during fire-fighting operations and to cover the areas which may not be covered by the monitors. The capacity of any applicator is to be not less than 400 L/minute and the applicator throw in still air conditions are to be not less than 15m. The number of foam applicators provided is to be not less than four. The number and disposition of foam main outlets are to be such that foam from at least two applicators can be directed onto any part of deck area of the cargo tanks.

(5) A hose connection for a foam applicator is to be situated in both port and starboard at the front of the poop or in way of accommodation spaces facing the deck of cargo tanks.

(6) Valves are to be provided in the foam main and in the fire main when it is part of the deck foam system, and the valves are to be located at forward of any monitors (applicators) position to isolate damaged sections of those mains. The intervals between these valves are to be not more than 40m.

(7) Operation of a deck foam system at its required output is to permit the simultaneous use of the minimum number required of jets of water at the required pressure from the fire main.

3.7.6.4 Tests

(1) The piping of the deck foam system are to be subjected to a hydraulic test in workshops with 1.5 times of design pressure. On completion of installation on board, the foam piping are to be subjected to a tightness test with 1.25 times of design pressure.

(2) On completion of installation of the system, it is to be subjected to an operation test by discharging foam.

3.7.7 Automatic sprinkler, fire detection and fire alarm systems

3.7.7.1 General requirements

(1) Automatic sprinkler, fire detection and fire alarm systems are to be ready for immediate working without the manual operation. This system is to be wet pipe type. If the preventive measures are necessary, the small exposed sections may adopt dry pipe. Any part of the system, which may be freezing in using, is to have appreciated preventive measures. The system is to maintain necessary pressure and be fitted with facilities to continuously supply water in accordance with the above requirements.

(2) Each zone for a sprinkler is to be fitted with an audible and visual alarm. When any sprinkler acts, one or more index unit can automatically outgo signals. The alarm system is to be capable of displaying any fire-breeding and its position within any space, and is to be grouped in the wheelhouse or fire control station where certain persons and equipment are to be provided so that any alarm given by the system can be immediately received by the subject crew.

(3) Sprinkler systems are to be connected to fire main on board. One locking stop check valve is to be fitted at the connection in order to prevent the water of the system from blowing back to the fire main.

(4) A pressure tank is to be fitted of which the capacity is to be at least equivalent to two times water reserve below. The freshwater reserved in the pressure tank are to be same to the pump capacity in one minute mentioned in 3.7.7.3 of this Section. Where the unallocated freshwater being in use, the pressure in the tank is to be not less than the working pressure of the sprinkler plus head at the extreme higher position in the system measured from the tank bottom. An appreciate facility is to be provided to add air and freshwater to the tank. The pressure tank is to be fitted with a glass water gauge to display the actual water level in the tank.

3.7.7.2 Sprinklers and their arrangement

(1) Sprinklers are to be grouped into a certain number of zones. The sprinklers in each zone are to be not more than 200. The spaces served by any zone are to be not more than two tiers of deck and are to be only arranged in the range of one main vertical zone;

(2) Each zone is to be separated by only one stop valve, which is to be readily accessible and be clearly and permanently marked, and measures are to be taken to prevent any unauthorized person from operating the valve;

(3) Instruments are to be fitted at each valve and within the main fire control station (if any) to display the

pressure in the system;

(4) The acting temperature of sprinklers is to be 68-79°C in accommodation and service spaces, excluding those may occur greater ambient temperature, such as drying room. In these spaces, the acting temperature of sprinklers is to be added to the temperature of the room's top plus 30°C;

(5) A drawing or chart is to be displayed at each index unit mentioned in 3.7.7.1 (2) of this Section, to show the relevant spaces and the position of each zone, and there is to be a caption about tests and maintenance;

(6) Sprinklers are to be fitted at the top of the protected space and have an adequate interval so that the nominal area protected by a sprinkler is to maintain even water production of not less than 5L/min·m². However, other sprinklers may be permitted to be used providing they have the same performance and are suitably arranged.

3.7.7.3 Water service pumps and their arrangement

(1) An independent power pump is to be fitted for the purpose of ensuring the sprinklers to automatically and continuously spray. The pump is to be capable of acting automatically when the pressure of the system fall off before the unallocated freshwater in the pressure tank is fully used up;

(2) The pump and piping are to be capable of maintaining the necessary pressure for the sprinklers at the extreme higher position in order to ensure the sprinklers can spray in a capacity stipulated in 3.7.7.2 (6) of this Section and are to be capable of covering an area of 280 m²;

(3) One testing valve connecting an open drain stub is to be fitted at the output end. The clear sectional area of the valve and stub is to be sufficient to drain in the capacity required by the pump at the pressure stipulated in 3.7.7.1 (4) of this Section;

(4) The input of the pump is to be located at the position where the pump is located as far as possible. It is to be so arranged that the freshwater supply may be cut off for no any purpose, excluding examination or repairing the pump, when the ship is floating;

(5) Water service pumps and pressure tanks are to be located at the appreciate positions far away from main propulsion machinery space, and are not to located in any space required to be protected by the sprinkler system.

3.7.7.4 Power supplies

(1) Water service pumps and automatic fire detection and fire alarm systems are to be provided with two power supplies.

(2) If the water service pump is electrically driven, it is to be supplied by main source of electric power and another power source located in a watertight compartment other than that the former is located in. The circuits are to be mutually independent, a clear mark is to be set at the switch of two circuits, and an auto switch is to be fitted at the water service pump so that this pump is to have an automatic change-over to another independent power source at the failure of main source of electric power. The independent power sources are to be provided and arranged in accordance with the requirements for emergency electric power source, and power supply is to be not less than 3h. The circuits are to avoid passing through galley, machinery spaces and other enclosed spaces with high fire risk unless it is necessary to be connected to the distributing switchboard.

(3) Automatic fire detection and fire alarm systems are to be supply by main source of electric power (or emergency electric power source).

(4) Where one of power supplies of the pump is an internal combustion engine, this engine is to be arranged in such a position that air supply is to be not affected if there is a fire in any protected space and in addition, the provisions stipulated in 3.7.7.3 (5) of this Section.

3.7.7.5 Tests

(1) Each zone for sprinklers is to be fitted with a testing valve. The valve is to be tested for automatic alarm at the discharge of one sprinkler. Testing valves of each zone are to be located at the stop valve;

(2) A facility is to be provided to reduce the pressure in the system to test the auto working of the pump;

(3) A switch is to be fitted at one of the index unit mentioned in 3.7.7.1 (2) of this Section to test the alarm and indicator of each zone.

3.7.8 Fixed automatic fire detection and fire alarm systems

3.7.8.1 General requirements

(1) Any required fire detection and fire alarm system are to be capable of immediate operation in all service time;

(2) The design performance of the alarm systems, the environmental and working conditions of the equipment are to comply with the relevant requirements stipulated in Section 4, CHAPTER 2 of this Part;

(3) The action of any detector or manually operated call points is to initiate a visual and audible fire signal

at the fire indicating units. Such units are to denote the space in which a detector or manually operated call point has operated;

(4) Fire detecting systems are to be not used for any other purpose except that the operation of closing the fire doors or similar operations from the control panel are allowed;

(5) The function of the detection and fire alarm systems is to be periodically tested. All detectors are to be of a type such that they can be tested for correct operation and restored to normal surveillance without the renewal of any component;

(6) Suitable instructions and component spares for testing and maintenance are to be provided on board ships.

3.7.8.2 Arrangement of detectors

(1) Smoke detectors are to be installed in all stairways, corridors and escape routes within accommodation spaces. Cabins may be fitted with smoke or thermal detectors;

(2) In engine machinery spaces where are not continuously manned in terms of voyage, the detectors are to be so positioned as to detect rapidly the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures. Except in spaces of restricted height and where their use is especially appropriate, detection systems using only thermal detectors are to be not permitted;

(3) Detectors are to be located for optimum performance. Positions near beams and ventilation ducts or other positions where patterns of air flow could adversely affect performance and positions where impact or physical damage takes place likely are to be avoided. In general, detectors which are located on the overhead are to be a minimum distance of 0.5m away from bulkhead;

(4) The protecting area and the maximum spacing of detectors are to be in accordance with Table 3.7.8.2

(4). Other spacing based upon test data which demonstrate the characteristics of the detectors may be permitted.

Table 3.7.8.2 (4)

Type of detector	Maximum floor area per detector (m ²)	Maximum distance between centers of two detectors (m)	Maximum distance away from bulkheads (m)
Thermal	37	9	4.5
Smoke	74	11	5.5

3.7.8.3 Types and sensitivities of detectors

(1) Detectors are to be operated by heat, smoke or other products of combustion, flame, or any combination of these factors. Detectors operated by other factors indicative of incipient fires may be considered provided that they are not less sensitive than such detectors. Flame detectors are to only be used in addition to smoke or heat detectors;

(2) Smoke detectors installed in stairways, corridors and escape routes within accommodation spaces are to be verified not to operate before the smoke density exceeds 2% obscuration per meter, but to operate not until the smoke density exceeds 12.5% obscuration per meter. Smoke detectors installed in other spaces are to operate within satisfactory sensitivity limits having regard to the avoidance of detector insensitivity or oversensitivity;

(3) Thermal detectors are to be verified not to operate before the temperature exceeds 54°C but to operate not until the temperature exceeds 78°C, when the temperature is raised to those limits at a rate less than 1°C per minutes. At higher rates of temperature rise, the heat detector is to be operated within satisfactory temperature limits having regard to avoidance of detector insensitivity or oversensitivity;

(4) The permissible temperature of operation of thermal detectors may be increased the maximum deckhead temperature to 30°C in drying rooms and similar spaces of normal high ambient temperature.

3.7.8.4 Power supply of fire detection and fire alarm systems

Power supply of fire detection and fire alarm systems is to comply with the relevant requirements in Section 4 of CHAPTER 2 of the Guidelines.

3.7.9 Firefighting appliances

3.7.9.1 General requirements

All kinds of extinguishers are to be of approved type and designing.

3.7.9.2 Extinguishing mediums

Mediums in extinguishers are to be suitable for putting out the fire which occurs in the spaces protected. Gases given off are to be not harmful to persons either by itself or under expected conditions of use.

3.7.9.3 Extinguishers

(1) The capacity of portable fluid extinguishers is to be not more than 13.5L and less than 9L. The medium quality of portable extinguishers is to be not less than 5kg, and the capacity of portable extinguishers is to be at least equivalent to that of fluid extinguishers. The capacity and quality of portable extinguishers in passenger ships accommodation spaces and service spaces may be suitably reduced, but the corresponding quantity is to be increased.

(2) Portable extinguishers are to be located in readily accessible positions within the protected spaces, one of which is to be stowed near the entrance of that space.

(3) Carbon dioxide extinguishers stowed in radio stations and spaces containing switchboards are to be of a capacity of at least 2kg. Each gas extinguisher may be substituted with dry-chemical extinguisher of suitable capacity.

3.7.9.4 Large foam-type extinguisher

The large foam-type extinguishers are those foam-type extinguishers of at least 45L capacity. Such extinguishers are to be provided with hose on reel, which is suitable for reaching any part of the spaces protected. Other equivalent large foam-type extinguishers may be adopted.

3.7.9.5 Portable foam applicator

(1) A portable foam applicator unit is to consist of an air foam nozzle of an inductor type capable of being connected to the fire main by a fire hose, a portable tank containing at least 20L of foam and one spare tank. The nozzle is to be capable of producing effective foam suitable for extinguishing an oil fire at the rate of at least 1.5m³ per minute. The expansion ratio of the foam is not to exceed 12 to 1.

3.7.9.6 Fire-fighter's equipment

(1) The fire-fighter's equipment are to consist of personal equipment, an approved breathing apparatus and a fireproof lifeline. The personal equipment comprises protective clothing, boots and gloves, a rigid helmet, an approved electrical safety lamp, an axe, etc.

(2) The fire-fighter's equipment or sets of personal equipment are to be so stored as to be easily accessible and ready for use and, where more than one fire-fighter's equipment or more than one set of personal equipment are carried, they are to be stored in widely separated positions.

3.7.9.7 Emergency escape breathing apparatus

(1) Emergency escape breathing apparatus, devices supplying air or oxygen, are to be only used for the purpose of escaping from rooms having dangerous gas and are to be of approved type.

(2) Emergency escape breathing apparatus are to be not used for fire-fighting, entering into void space where is lack of oxygen or cargo tank, neither is to be used for fire-fighter's outfit. Under these circumstances, self-contained air-breathing apparatus especially suitable for this purpose are to be adopted.

(3) Emergency escape breathing apparatus are to provide a continuous running time of at least 10min.

(4) Emergency escape breathing apparatus are to include one hood or mask to protect eyes, nose and mouth during the escape. The hood and mask are to be made of fire-resistant materials, and are to have a clean and bright observation window.

(5) Emergency escape breathing apparatus that are not in use temporarily are to be worn on the body and able to keep hands free.

(6) When emergency escape breathing apparatus are in storage, they are to be protected properly from environmental impact.

(7) Diagrams and concise instruction for the operation are to be clearly printed on the emergency escape breathing apparatus. Wear procedures are to be fast and simple so as to obtain safety protection in a dangerous gases environment in the shortest time.

(8) Each apparatus is to have on its body the maintenance, trademark and serial number of the factory, shelf life and production date, and the name of authorized institution. And all the apparatus used for training are to be marked clearly.

(9) Mask refers to a cover which is designed to be placed on the face by appropriated means to wholly cover the eyes, nose and mouth.

(10) Hood refers to a headgear which is able to wholly cover the head, neck and shoulders.

(11) Dangerous air refers to any air that can directly cause harm to human lives or health.

3.7.9.8 Miscellaneous

(1) The capacity of sand boxes is to be not less than 0.03m³. It may be substituted with a portable extinguisher.

(2) Each fire bucket is to be made of iron or wood, and a rope with suitable length is to be provided.

3.7.9.9 Tests

Extinguishers are to be inspected periodically and tested as required.

Section 8 ADDITIONAL REQUIREMENTS FOR PUSHERS (TUGS) PUSHING (TOWING) OIL BARGES AND OTHER SHIPS

3.8.1 General requirements

3.8.1.1 Pusher (Tug) pushing (towing) oil barge with a flash point of not more than 60°C, oil pontoons, and chemicals pontoons required by the provision of this Chapter.

3.8.1.2 Unless expressly specified in this Section, pusher (Tug) pushing (towing) oil barge with a flash point of more than 60°C, oil pontoons, and chemicals pontoons are to separately comply with the relevant provisions on towing ships or cargo barge.

3.8.1.3 Unless expressly specified in this Section, pusher (Tug) pushing (towing) oil barge, oil pontoons, and chemicals pontoons are to comply with other relevant requirements in this Chapter.

3.8.1.4 Unless expressly specified in this Section, chemicals pontoons are to comply with other relevant provision of CHAPTER 3 of PART EIGHT of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

3.8.2 Definitions

3.8.2.1 The definitions in this Section are as follows:

- (1) Pusher (Tug) — Pusher (Tug) pushing (towing) ship pushing (towing) oil barge;
- (2) Oil pontoon — pontoon transferring and/or carrying oils;
- (3) Chemicals pontoon — pontoon transferring products required in CHAPTER 3 of PART EIGHT of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

3.8.3 Additional requirements for pushes (tugs) pushing (towing) oil barges

3.8.3.1 Superstructures and deckhouses on pushers (tugs) are to be of fully enclosed constructions of steel or other equivalent materials. Doors and windows thereof are to be of a free gastight type.

3.8.3.2 For pushers (tugs) not complying with the requirements of 3.8.3.1, the doors and windows on the bulkheads facing fore of the ship or of rooms on freeboard deck are to be of a free gastight type. Segregated smoking rooms or other rooms employed as smoking rooms concurrently are to be arranged on pushers (tugs), and their doors and windows facing outboard are to be of a free gastight type.

3.8.3.3 Cabins are to be not positioned below the freeboard deck normally. Where any cabins are so positioned, they are to be provided with efficient ventilation.

3.8.3.4 Air inlets of cabin ventilating systems on pushers (tugs) are to be rationally arranged to reduce the drawing of oil vapor.

3.8.3.5 Exhaust ducts of main and auxiliary engines and boilers are to be fitted with effective spark arresters.

3.8.3.6 The exhaust ducts from galley ranges are to be fitted with effective spark arresters.

3.8.3.7 Pushers (tugs) are to be fitted with fixed fire pumps and fire water pipes, and are to comply with the relative requirements of Section 4 in this Chapter.

3.8.3.8 The capacity and water head of fire pumps are to be sufficient to meet the requirements of following fire-fighting facilities running simultaneously:

- (1) The output from hydrants on the uppermost deck supplied by one fire pump is to comply with the table 3.4.3.1 (4) in this Chapter. The range of jets is not to be less than 12m;
- (2) There is sufficient water output of deck water spray system for oil tankers (if any);
- (3) There is sufficient water supply for fixed deck foam system, if fitted for oil tankers (if any);
- (4) Sufficient water supply for drencher systems stipulated in 3.8.3.9 of this Section, if fitted for oil

tankers (if any) Fire main and water service pipes of pushers (tugs) pushing (towing) oil barges are to be fitted with common connections connecting the barges pushed (towed) by hoses at both sides. For the pushers (tugs) having a total power of main engine 1470 kW or more, separately controlled drencher systems are to be fitted on both sides of freeboard deck.

3.8.3.10 Nozzles are to be a dual-purpose type (i.e. spray/jet type) with a shut off switch.

3.8.3.11 For the pushers (tugs) having a total power of main engine 1470kW or more, one of the following fire-extinguishing systems is to be fitted in the machinery spaces where the main and auxiliary machinery, and boilers are:

- (1) Carbon dioxide fire-extinguishing system;
- (2) Pressure water-spraying fire-extinguishing system;

3.8.3.12 There is to be at least one large foam-type extinguisher in the machinery space of the pushers (tugs) having a total power of main engine less than 1470kW.

3.8.3.13 Pushers (tugs) having a total power of main engine 1470kW or more are to be fitted with a deck foam fire-extinguishing system and a foam monitor complying with the requirements of Section 7 in this Chapter.

3.8.3.14 Firefighting appliances of pushers (tugs) are to be provided in accordance with the relevant provision of 3.4.5 in Section 4 of this Chapter and are to have at least two sets of portable foam applicators.

3.8.3.15 Pushers (tugs) used for oil barges having a flash point of more than 60°C are to comply with the provisions of 3.8.3.7 to 3.8.3.14 above.

3.8.4 Additional requirements for oil pontoons

3.8.4.1 Entrances, air inlets or openings to machinery spaces, accommodation spaces, service spaces, and control stations are not to face the cargo area. Where they are located on the outboard sides of the deckhouse, the distance to such bulkheads facing the cargo area is to be not less than 3 m. The distance such bulkheads of the deckhouses facing docked ships and the outboard sides of the oil pontoon are to be not less than 5m.

For oil pontoons, cargo oil area is the part of the ship that contains cargo tanks, slop tanks and cargo pump-rooms including pump-rooms throughout the entire length and breadth of the part of the ship and cargo area of the port oil tankers, etc.

3.8.4.2 Windows facing the cargo oil area and on the outboard sides of the deckhouses within the limits specified in paragraph 3.8.4.1 are to be of the fixed (non-opening) type. Such windows are to be insulated to 'A-60' class standard.

3.8.4.3 Bulkheads and decks separating the machinery spaces and its adjacent accommodation spaces, service spaces and the control stations are to be constructed to "A-15" class standard.

3.8.4.4 The bulkheads and decks of service spaces of fire risk and its adjacent control stations, and the accommodation spaces etc., are to be constructed to "A-15" class standard.

3.8.4.5 The bulkheads and decks of control stations, accommodation spaces, service spaces and the inner corridors are to be constructed with non-combustible materials.

3.8.4.6 For exterior boundaries of deckhouses enclosing accommodation and the whole of the portions which face the cargo area and within 3 m from the end boundary, the insulation are to be "A-60" class division.

3.8.4.7 If fitted with cargo pump rooms, they are to be of a sealed construction. The skylights or hatch covers are to be of steel and not to contain glass panels and capable of being closed from the outside of the space. Such rooms are to be protected by the fixed carbon dioxide fire extinguishing system complying with the requirements in Section 7 of this Chapter.

3.8.4.8 Oil pontoons are to be fitted with fixed sprinkler systems and deck foam fire distinguishing systems to protect the cargo oil area of this ship and the docked ships. The fire water and foam solution may be provided by onshore.

3.8.4.9 Oil pontoons are to be fitted with at least two fire monitors, such ranges are to be able to cover any part of the cargo oil tank designed for the dock of the largest ships. Every monitor is to provide with two fire-fighting media of water and foam, and the foam should adopt low-expansion foam. The capacity of foam solution supply is not to be less than 8.0 L/min·m² of the designed largest single cargo oil room of docked oil

tankers and its continuous supplying time is to be not less than 40min.

Under the working condition of fire water, two fire monitors are to be ensured working simultaneously so as that when one fire monitor is used for the deck foam system, the other can supply water at the same time.

3.8.4.10 Water curtains are to be fitted in front of the cargo gear and the set range should be extended to 5m outwards to the two ends of loading area.

3.8.4.11 The control devices for firefighting and drencher systems are to be collocated at proper sites outside of the cargo oil area so as to be accessible safely by persons in the event of fire of the cargo oil area.

3.8.4.12 Oil pontoons are to be equipped with at least two portable foam applicators and six portable fire extinguishers.

3.8.4.13 Oil pontoons are to be equipped with at least two suits of fire-fighter's equipment.

3.8.4.14 Oil pontoons are to be equipped with at least two approved portable combustible gas detecting instruments so as to detect potential leakage of the cargo oil loading area on the ship.

3.8.4.15 Ships are to be not fitted with cargo oil tank, but the flop tank is excluded.

3.8.4.16 Oil pontoons carrying oils with a flashpoint exceeding 60°C (closed cup test), if fitted with cargo oil tanks, are to be equipped with at least two large foam fire extinguishers and two portable foam applicators, to protect cargo oil areas of this ship. The accommodation spaces on this ship are to be equipped with at least six portable fire extinguishers.

3.8.4.17 Oil pontoons are to be fitted with fixed independent power driving emergency fire pumps, but excluding oil pontoons where fire water is provided from onshore.

3.8.5 Chemical pontoons

3.8.5.1 This requirement is applicable to chemical pontoons with a flashpoint not exceeding 60°C (closed cup test).

3.8.5.2 Chemical pontoons are to comply with the provisions of 3.8.4.1 to 3.8.4.14 and 3.8.4.17 in this Section.

3.8.5.3 Foam solution from the deck foam fire-extinguishing system are to be effective to goods transferred in the greatest possible quantity. For other goods that are non-effective or insoluble to the foam are to be fitted with additional approved fire-extinguishing system.

3.8.5.4 If goods are not suitable for using carbon dioxide fire extinguishing system to fight fire, cargo pump-rooms are to be fitted with fixed pressure water-spraying fire-extinguishing systems or other approved fixed fire extinguishing system for protection.

3.8.5.5 Ships are to be not fitted with chemical cargo tanks, but excluding tanks for storing foul solution of the goods.

Appendix 1 MEANS OF ESCAPE

1 Width of Stairway

1.1 Basic requirements for stairway width

Stairways are to be not less than 900mm in net width. The minimum net width of stairways is to be increased by 10mm for every one person provided in excess of 90 persons. The total number of persons to be evacuated by such stairways are to be assumed to be two thirds of the crew and the total number of passengers in the areas served by such stairways. The width of the stairways is to be not inferior to those determined by Paragraph 1.2.

1.2 Calculation method of stairway width

1.2.1 Basic principles of the calculation

1.2.1.1 This calculation method determines the minimum stairway width at each deck level, taking into account the consecutive stairways leading into the stairway under consideration.

1.2.1.2 It is the intention that the calculation method is to consider evacuation from enclosed spaces within each main vertical zone individually and take into account all of the persons using the stairway enclosures in each zone, even if they enter that stairway from another vertical zone.

1.2.1.3 For each main vertical zone the calculation is to be completed for the night time (case 1) and day time (case 2) and the largest dimension from either case used for determining the stairway width for each deck under consideration.

1.2.1.4 The calculation of stairway widths is to be based upon the crew and passenger load on each deck. Occupant loads are to be rated by the designer for passenger and crew accommodation spaces, service spaces, control spaces and machinery spaces. For the purpose of the calculation the maximum capacity of a public space is to be defined by either of the following two values: the number of seats or similar arrangements, or the number obtained by assigning 2m² of gross deck surface area to each person.

1.2.2 Calculation method for minimum value

1.2.2.1 Basic formulae

In considering the design of stairway widths for each individual case which allow for the timely flow of persons evacuating to the freeboard deck from adjacent decks above and below, the following calculation methods are to be used (see figures 1 and 2):

When joining two decks: $W = (N_1 + N_2) 10\text{mm}$;

When joining three decks: $W = (N_1 + N_2 + 0.5N_3) 10\text{mm}$;

When joining four decks: $W = (N_1 + N_2 + 0.5N_3 + 0.25N_4) 10\text{mm}$;

When joining five decks or more decks, the width of the stairways is to be determined by applying the above formula for four decks to the deck under consideration and to the consecutive deck, Where:

W = the required tread width between handrails of the stairway.

The calculated value of W may be reduced where available landing area S is provided in stairways at the Deck level defined by subtracting P from Z, such that:

$$P = S \times 3.0$$

$$P_{\max} = 0.25 Z$$

Z = the total number of persons expected to be evacuated on the deck being considered;

P = the number of persons taking temporary refuge on the stairway landing, which may be subtracted from Z to a maximum value of $P = 0.25Z$ (to be rounded down to the nearest whole number);

S = the surface area (m²) of the landing, minus the surface area necessary for the opening of doors and minus the surface area necessary for accessing the flow on stairs (see figure 1);

N = the total number of persons expected to use the stairway from each consecutive deck under consideration; N₁ is for the deck with the largest number of persons using that stairway; N₂ is

taken for the deck with the next highest number of persons directly entering the stairway flow such that, when sizing the stairway width as each deck level, $N_1 > N_2 > N_3 > N_4$ (see Figure 2). These decks are assumed to be on or upstream (i.e. away from the freeboard deck) of the deck being considered.

1.2.2.2 Distribution of persons

(1) The dimension of the means of escape is to be calculated on the basis of the total number of persons expected to escape by the stairway and through doorways, corridors and landings (see figure 3). Calculations are to be made separately for the two cases of occupancy of the spaces specified below. For each component part of the escape route, the dimension taken is to be not less than the largest dimension determined for each case:

Case 1: Passengers in cabins with maximum berthing capacity fully occupied; members of the crew in cabins occupied to 2/3 of maximum berthing capacity; and service spaces occupied by 1/3 of the crew.

Case 2: Passengers in public spaces occupied to 3/4 of maximum capacity; members of the crew in public spaces occupied to 1/3 of the maximum capacity; service spaces occupied by 1/3 of the crew; and crew accommodation occupied by 1/3 of the crew.

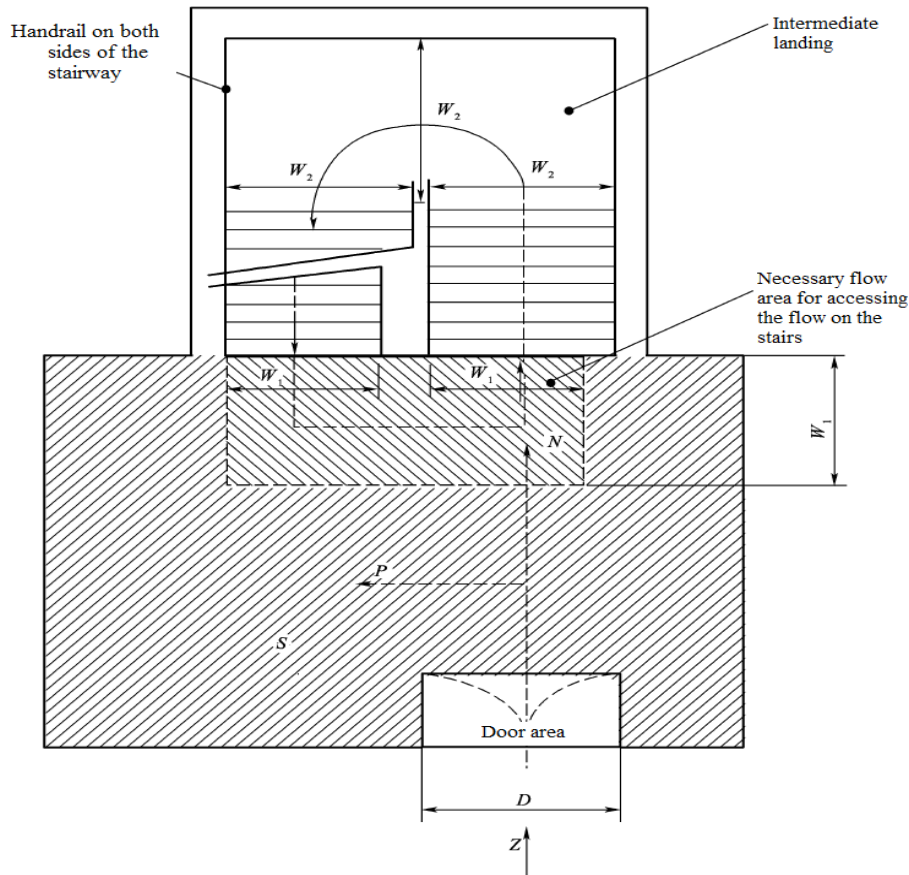
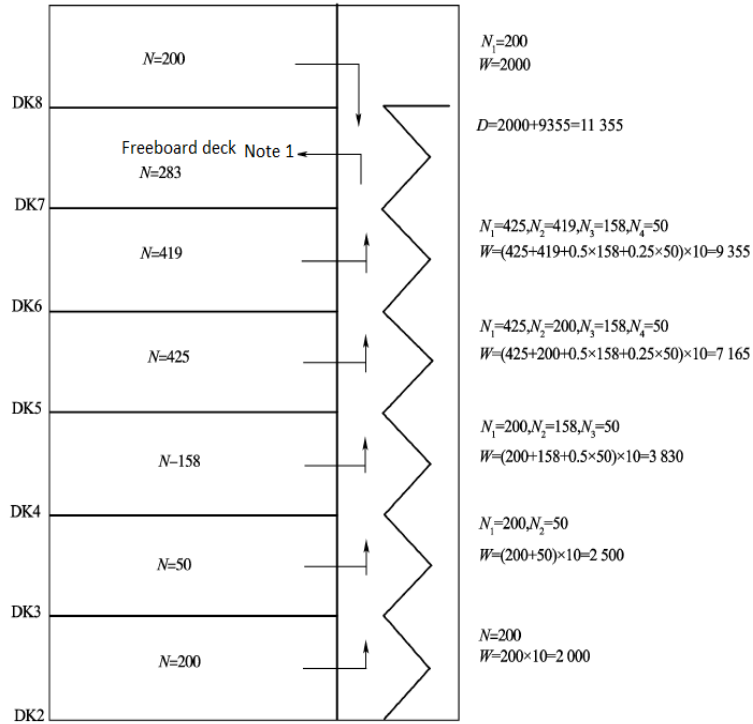


Figure 1 Landing Calculation for Stairway Width Evacuation



N (pers) = number of persons directly entering the stairway flow from a given deck
 $W \text{ (mm)} = (N_1 + N_2 + 0.5 \times N_3 + 0.25 \times N_4) \times 10 = \text{calculated width of stairway}$
 D (mm) = width of exit doors
 $N_1 > N_2 > N_3 > N_4$ where:
 N₁ (pers) = the deck with the largest number of persons N entering directly the stairway
 N₂ (pers) = the deck with the next largest number of persons N entering directly the stairway, etc.
 Note 1: The doors to the assembly station should have aggregate width of 10,255 mm.

Figure 2 Minimum Stairway Width (W) Calculation Examples

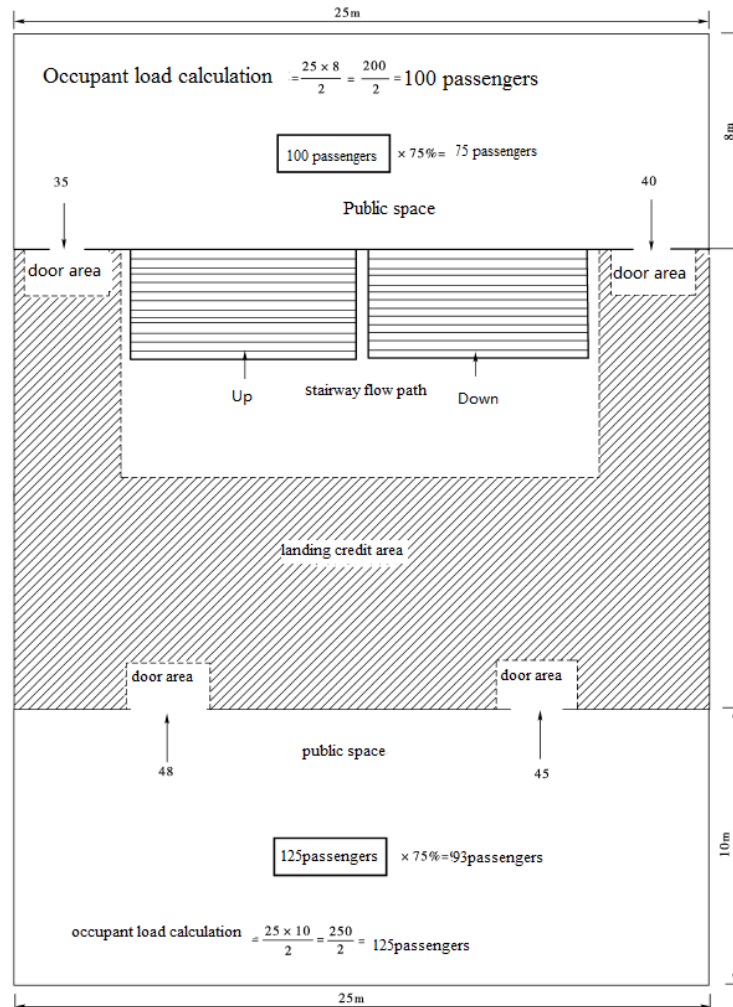


Figure 3 Occupant Loading Calculation Example

(2) The maximum number of persons contained in a vertical zone, including persons entering stairways from another main vertical zone, is not to be assumed to be higher than the maximum number of persons authorized to be carried on board for the calculation of stairway width only.

2 Details of Stairways

2.1 Handrails

2.1.1 Stairways are to be fitted with handrails on each side. The maximum clear width between handrails are to be 1,800mm.

2.2 Vertical rise and inclination

2.2.1 Stairways are not to exceed 3.5 m in vertical rise without the provision of a landing and are not to have an angle of inclination greater than 45°.

2.3 Landings

2.3.1 Landings at each deck level are to be not less than 2m² in area, except for those landings servicing public spaces having direct access onto the stairway enclosure.

3 Doorways and Corridors

3.1 Doorways and corridors and intermediate landings included in means of escape are to be sized in the same manner as stairways.

3.2 The aggregate width of stairway exit doors to the assembly station is not to be less than the aggregate width of stairways serving this deck.

4 Means of Escape Plans

4.1 Means of escape plans are to be provided indicating the following:

(1) The number of the crew and passengers in all normally occupied spaces;

(2) The number of crew and passengers expected to escape by stairway and through doorways, corridors and landings;

(3) Primary and secondary means of escape; and

(4) Width of stairways, doors, corridors and landing areas.

4.2 Means of escape plans are to be accompanied by detailed calculation for determining the width of escape stairways, doors, corridors and landing areas.

CHAPTER 4 LIFE-SAVING APPLIANCES

Section 1 GENERAL PROVISIONS

4.1.1 General Requirements

4.4.1.1 Unless expressly provided otherwise, the technical requirement of life-saving appliances and devices equipped on inland waterway ships are to comply with the provision of Section 4 of this Chapter.

4.1.1.2 It may be allowed to substitute the life-saving appliance specified in this Part with other type of life-saving appliances, but are to undergo certain test and approval procedure first.

4.1.1.3 Passenger ships are to be categorized in accordance with the provisions of Section 1, CHAPTER 1 of this Part.

4.1.1.4 Appendix 2 INSECTION REQUIREMENTS FOR LIFEJACKETS OF INLAND WATERWAY SHIPS of this Chapter is recommended by [CCSISC](#). Where the Administration accepts it, the lifejackets produced according to it may be substituted for the adult lifejackets required in 4.4.6.1 of Section 4 of this Chapter.

4.1.2 Definitions

4.1.2.1 Lifeboat is life-saving appliance in compliance with requirements of 4.4.2 of this Chapter.

4.1.2.2 Lifesaving sampan is the cockboat in compliance with requirements of 4.4.3 of this Chapter.

4.1.2.3 Buoyant apparatus is life-saving appliances which may help persons float in water for rescue, and be in compliance with the provisions of 4.4.5 of this Chapter.

4.1.2.4 Inflatable life-saving appliance is an appliance which depends upon non-rigid, gas filled chambers for buoyancy and which is normally kept uninflected and ready for use at all times.

4.1.2.5 Float-free launching is that method of launching a survival craft whereby the craft is automatically released from a sinking ship and is ready for use.

4.1.2.6 Marks of inland waterway ships life-saving appliance are the marks comprising of safety colors, picture and words , showing the storage position and direction of special life-saving appliances in inland waterways ships.

4.1.2.7 Lightest seagoing condition is the loading condition with the ship on even keel, without cargo, with 10% stores and fuel remaining and in the case of a passenger ship with the full number of passengers and crew and their luggage.

4.1.2.8 Mass lifesaving appliance is the lifesaving appliance provided for more people use, including lifeboat, lifesaving sampan, open type reversible inflatable liferaft and mass lifesaving apparatus complying with the provision of this Chapter.

4.1.2.9 Urgent evacuation system is an appliance for the rapid transfer of persons from the embarkation deck of a ship to a floating survival craft.

Section 2 QUOTAS OF LIFE-SAVING APPLIANCES

4.2.1 General Requirements

4.2.1.1 Unless expressly provided in this Section, ro-ro passenger ships type 1 and type 2, vehicle-passenger ferries and restaurant pontoons are to be provided with life-saving appliances in accordance with the requirements for passenger ships.

4.2.2 Lifejackets and buoyant apparatus

4.2.2.1 Passenger ships

(1) The lifejackets cruise ship and excursion steamer are to be equipped according to 100% number of

passengers. For other passenger ships, the lifejackets and personal buoyant apparatus are to be equipped as per the table 4.2.2.1.

Table 4.2.2.1

Service Area (section)	The ratio of the quota of lifejackets and buoyant apparatus to the number of passengers on board (%)							
	Category 1 Passenger ship	Category 2 Passenger ship	Category 3 Passenger ship		Category 4 Passenger ship		Category 5 Passenger ship	
	Lifejacket	Lifejacket	Buoyant apparatus	Buoyant apparatus	Lifejacket	Buoyant apparatus	Lifejacket	Buoyant apparatus
Grade A、J ₁	100	100	70	30	60	40	30	70
Grade B、J ₂	100	100	70	30	60	40		
C	100	100	60	40	50	50		

Notes: ①For restaurant pontoons, the lifejackets and personal buoyant apparatus are to be half provided according to the requirement of passenger ship of category V.

②The lifejacket may be replaced with personal buoyant apparatus, and vice versa.

(2) Lifejackets suitable for children equal to 10% of the number of passengers on every passenger ship are to be provided, of which cruise ships are to be equipped (allocated) one piece of lifejacket for every child according to the possible number of children on board.

(3) Lifejackets for the ship with a length of 60m or over are to be equipped according to at least 5 percent of the total number of passengers. For the passenger ship of category I navigating in the Grade A area and J₁ section, lifejackets for at least 10% of total number of passengers are to be provided therein.

(4) Every crew is to be provided with one lifejacket; lifejackets are to be provided according to 20% of the crew members for their shift or work use.

(5) The lifejacket provided on passenger ship of category I sailing in Service Area A, J₁ section and J₂ section are to be fitted with lifejacket light according to at least 20% of total number of lifejackets.

4.2.2.2 Cargo ships

(1) Every crew is to be provided with one lifejacket.

(2) For self-propelled cargo ships, the number of lifejackets is to be provided according to 20% of the total number of crews for their shift or work use. The engineering ship may be equipped with proper number of inflatable lifejackets based on actual needs.

(3) For non-self-propelled cargo ships, the number of lifejackets is to be provided according to 10% of the total number of crews for their work use.

4.2.3 Equipment of lifebuoys and inflatable life-saving rings

4.2.3.1 Passenger ships

(1) The lifebuoys and inflatable life-saving rings on passenger ships are to be fitted according to the following table 4.2.3.1

Table 4.2.3.1

Service area (section)	Ship's length L(m)	Lifebuoy number + inflatable lifesaving ring number			
		For every deck			
		Total number	Lifebuoys with a buoyant lifeline therein	Lifebuoys with a self-igniting light therein ②	The maximum number of inflatable lifesaving ring therein ③
A、B、J ₁ 、J ₂	20≤L<30	2	1	1	1
	30≤L<60	4	2	2	2
	L≥60	6 ^②	2	2	4
C	20≤L<30	2	1	1	1
	L≥30	4	2	2	2

Notes: ①The top deck may not be equipped with lifebuoy if it is not for sightseeing use.

② Each deck with a short superstructure having a length of less than 40% of this ship's length may be fitted with four lifebuoys (including two with a buoyant lifeline)

③ Lifebuoys for non-night vessels may not be fitted with self-igniting lights.

④ The inflatable lifesaving ring may be substituted with lifebuoy.

4.2.3.2 Cargo ships

(1) The self-propelled cargo ships are to be equipped with lifebuoy and inflatable life-saving rings according to the requirement of 4.2.3.1

(2) For non self-propelled cargo ships, the lifebuoys and inflatable life-saving rings are to be equipped according to the requirement of 4.2.3.2.

Table 4.2.3.2

Length of ship	Lifebuoy + inflatable lifesaving ring	Lifebuoys with a buoyant lifeline therein
$L < 30$	2	1
$30 \leq L < 60$	2	2
$L \geq 60$	4	2

Note: ①The inflatable life-saving ring may be replaced with lifebuoy.

4.2.4 Equipment of mass life-saving appliances

4.2.4.1 Passenger ships

(1) Mass life-saving appliances for the ship with a length of 60m and over of category I (excluding catering pontoon) are to be equipped according to 60% percent of the total number of passengers, of which at least one motor lifeboat and two open reversible inflatable liferafts are to be equipped (arranged along ship's rail evenly as much as possible)

(2) In addition to the requirement of above (1), the mass life-saving appliances for the ship with a length of 60m and over of other categories are to be equipped according to 30% of the total number of passengers.

(3) Mass life-saving appliances for vehicle-passenger ferries with a length of 60m or over are to be equipped according to 20% of the total number of passengers.

4.2.4.2 Cargo ships

(1) For self-propelled oil tanker s(not including oil supply tankers in port) carrying cargo having a flash point not more than 60°C(closed cup test), liquefied gas carriers and chemical tankers of which the length is equal or greater than 60m, the lifeboats made of non-combustible materials or fire resistant materials are to be equipped depending on 100% of person on board, and at least one of them is to be motor lifeboat. One non-powered life swampan is to be required for the non-self-propelled oil tanks carrying cargo having a flash point not more than 60°C(closed cup test).

(2)For the liquefied gas carriers and chemical tankers carrying liquid cargo vapor toxic gas, also their length is equal or greater than 60m, the lifeboats are to be equipped depending on above (1), and also gas masks are to be equipped depending on 100% of the number of persons on board.

(3) In addition to the ships mentioned in above (1) and (2), the open reversible inflatable liferafts or mass buoyant apparatus are to be equipped according to 100% of the total number of persons on board.

(4) One powered life sampan is to be required for the tug(pushers) servicing non-self-propelled oil tanker carrying cargo having a flash point not more than 60°C (closed cup test), of which the total rated power of main engine is equal to 735kW or above.

Section 3 STOWAGE, LAUNCHING, EMBARKATION, RECOVERY AND MAINTENANCE OF LIFE-SAVING APPLIANCES

4.3.1 Stowage

4.3.1.1 Mass Life-saving Appliances

(1) Lifeboats and life sampans

① The lifeboats and life sampans are to be stowed as far forward of the propeller and dangerous areas or spaces as practicable. The lifeboats and life sampans of passenger ships are to be so installed that the distance between the after end of the lifeboats or life sampans and the propeller is not less than the length of

the lifeboat or life sampans.

② The juts of ship sides are not to interfere with launching of lifeboats, and the lifeboats are to be not stowed outside of ship.

③ The lifeboats are to be installed on its bed and launched easy. The bed's shape is to be same as the lines of lifeboat

(2) The inflatable open reversible liferafts and mass buoyant apparatus

①The position where inflatable open reversible liferafts is launched is to be away from propeller for people embarkation. Its launching and storage place are not to interfere with the operation of lifeboat and life sampan.

② The inflatable open reversible liferafts are to be stored on special raft with bow fast tightly tied on ship, and are to also be equipped with approved free-floating device to ensure liferafts free floating when the ship sunk, and are to possess manual release function.

③ The lifebuoys are to be installed on both side of ship reasonably where people can reach readily. The lifebuoys are to be so hung that the lifebuoys can float off when the ship sunk.

(3) Emergency evacuation systems

①The ship's side is not to have any openings between the embarkation station of the marine evacuation system and the waterline in the lightest seagoing condition and means are to be provided to protect the system from any projections.

②Marine evacuation systems are to be in such positions as to ensure safe launching having particular regard to clearance from the propeller and steeply overhanging positions of the hull and so that, as far as practicable, the system can be launched down the straight side of the ship.

③Each marine evacuation system is to be stowed so that its stowage or operational arrangements will never interfere with the operation of any other life-saving appliance at any other launching station.

④Where appropriate, the ship is to be so arranged that the marine evacuation systems in their stowed positions are protected from damage by heavy seas.

⑤Emergency evacuation systems are not to stowed on the vehicle deck.

4.3.1.2 Personal Life-saving Appliance

(1) The lifejackets and personal lifebuoys are to be placed as to be readily accessible. The lifejackets for crews are to be respectively placed in steering room and passenger compartment. The place where lifejackets and personal lifebuoys are stored are to be indicated with visible marks. The storage of passenger ship, lifejackets and personal lifebuoys are to also meet following requirements:

①The number of lifejacket stowed in passenger compartment is to satisfy the needs of every passenger on board.

②The lifejacket equipped as indicated in 4.2.2.1(3) are to be stowed in public area, embarkation station or the danger escape passageway in between.

③ The kid's lifejackets are to be separately placed from adult's lifejackets when lifejackets are collectively stored.

(2) The lifebuoys are to be installed on both sides of ship reasonably where the people can reach readily. The lifebuoys are to be so hung that the lifebuoys can float off when the ship sunk. The lifebuoys with a buoyant lifeline are to be hung on both sides outside the wheelhouse, and can be used rapidly.

(3) the inflatable life-saving rings are to be hung inside the wheelhouse or nearby, and can be used immediately.

4.3.1.3 Marks

(1) In all passages, stairway entrances and exits leading to the storage (or embarkation) spaces of life-saving appliances, "marks for life-saving appliances of inland waterways ships" is to be posted, showing the storage (or embarkation) position and direction of life-saving appliances.

(2) “Marks for life-saving appliances of inland waterways ships” is to comply with the relevant provision of competent authority.

4.3.2 Launching, embarkation and recovery

4.3.2.1 The ship is to be equipped with embarkation station for person embarkation of mass life-saving appliances. Each embarkation station is to have sufficient clear deck space (including upper and lower deck area closer and directly linking to the embarkation) to accommodate the persons for their embarking on mass life-saving appliances. The path linking to embarkation stations is to be marked with luminous signs; the embarkation station is to be pasted with special marks.

4.3.2.2 The embarkation station is to be arranged somewhere person can easily reach from living and working areas.

4.3.2.3 An embarkation ladder approved by the Administration is to be provided at each embarkation station or at every two adjacent embarkation stations so that persons on board can be embarked on mass life-saving appliances on water.

4.3.2.4 The passenger ship is to be equipped with embarkation appliances according to following requirements:

(1) Where the embarkation station has a height of less than 4.5m from waterline in the lightest seagoing condition, the embarkation ladder, emergency evacuation systems or the equivalent facilities of both are to be equipped accordingly so that persons on board can be embarked on mass life-saving appliances on water.

(2) Where the embarkation station has a height of more than 4.5m from waterline in the lightest seagoing condition, the emergency evacuation system is to be equipped so that persons on board can be embarked on mass life-saving appliances on water.

4.3.2.5 The length of embarkation ladder and evacuation passageway of emergency evacuation system is to be capable of being intended from deck to the waterline in the lightest seagoing condition under unfavorable condition of trim of up to 5° and a list of up to 10° either way.

4.3.2.6 All passageway, ladder way and exit linking to the place stowed with mass life-saving appliances including lifeboats and liferafts, along with embarkation station, the place where mass life-saving appliances are stowed and its launching water, are to be provided with emergency lighting

4.3.2.7 The embarkation station for mass life-saving appliance on passenger ship is to be fitted with a billboard with characters “ Priority use for the aged, weak, sick, disabled and the pregnant” written on it.

4.3.2.8 Every lifeboat(sampan) is to be fitted with boat davit which can be used for launching and collection of such lifeboat(sampan).

4.3.3 Servicing

4.3.3.1 Every inflatable liferaft, inflatable buoyant and hydrostatic release unit and emergency evacuation system are to be periodically serviced at intervals not exceeding 12 months. Provided where the apparent has no anomaly, the Administration may permit to extend this period to 17 months.

4.3.3.2 The boat fall used for launching is to be regularly checked, with special attention paid to the areas where pulley is passed through. The boat fall is to be replaced when it is worn out or on the basis of the interval of 6 years (refer to the earlier arrival time of for replacement date).

4.3.3.3 In addition to the requirements of 4.3.3.1, each emergency evacuation system is to be mapped out at least one time every 6 years alternately.

4.3.3.4 Servicing is to be carried out at a servicing station approved by competent authority.

4.3.3.5 It is suggested that the service life of a lifejacket is not to exceed 6 years on the basis of the date of manufacture, and the lifejacket is to be timely renewed where any damage happens to it.

Section 4 REQUIREMENTS FOR LIFE-SAVING APPLIANCES

4.4.1 General Requirements

4.4.1.1 All life-saving appliances are to be able to be put into use immediately in case of emergency. They are to be kept readily available before departure and during the whole period of navigation.

4.4.1.2 The life-saving appliances are to be made out of recognized material with favorable technology.

4.4.1.3 Unless otherwise specified, the life-saving appliances are to be not shattered under atmospheric temperature of -30°C to 65°C , and are to be used normally in water temperature of -1°C to 30°C . The personal life-saving appliances are to be capable of being used under the atmospheric temperature of -15°C to 40°C .

4.4.1.4 All life-saving appliances are to feature rotting and corrosion resistance and are to be used normally against damage from river, crude oil and mould. It are to be anti-aging being exposed to sunshine.

4.4.1.5 The surface of all life-saving appliances is to be colored with international orange or bright orange or other visible colors for better detection above water, and is to be pasted with retro-reflective material poss.

4.4.2 Lifeboats

4.4.2.1 General requirements for lifeboats

(1) All lifeboats are to be properly designed and constructed so that they have ample stability and sufficient freeboard when loaded with their full complement of persons and equipment, and also they are to be capable of maintaining positive stability when hull holed in any one location below the waterline.

(2) The initial metacentric height (GM) is to be not less than the value determined by the following formula when the lifeboat is with full complement of persons and equipment:

$$GM = 0.05 (B^2 - B + 4) \quad \text{m}$$

where: B ---Breadth of the boat, the distance between outside surfaces of the shell plates on both sides at top of the middle section

(3) The freeboard of the lifeboat with full complement of persons and equipment are to be not less than 40% of the moulded depth.

(4) The length of lifeboat is to be not less than 3.5m, and not exceed 6.0m.

(5) The lifeboats are to be of sufficient strength to enable them to be safely launched into the water when loaded with their full complement of persons and equipment.

(6) The lifeboats are to have rigid hulls, and sufficient inherent buoyancy. The hull are to be watertight.

(7) The average sheer height of the lifeboats is to be not less than 4% of the length.

(8) The transverse seat pan is to be arranged as low as possible, and the vertical distance between the upper surface of the seat pan and the lower side of the side top plate is to be not less than 230mm

(9) The lifeboats are to have suitable handholds to enable persons to hold the capsized lifeboat, this handholds may be installed on keel or bilge of the lifeboat, of which the length is not to be less than 1/2 the length of the lifeboat.

(10) A buoyant lifeline is to be bucketed below the outside fender of the lifeboat. A buoyant handhold are to be fitted on every bucket. The distance of two adjacent handholds is not to be more than 600mm. The height to water surface is not to exceed 300mm when the lifeboat is on light condition.

(11) All liftboats are to be provided with one or two drain holes fitted in the bottom, each drain hole are to be provided with 2 stainless steel plugs which are to be attached to the lifeboat by a stainless steel chain.

4.4.2.2 The cubage and carrying capacity of lifeboats

(1) the cubic capacity of a motor lifeboat is to be calculated according to lines plan along with ships statics.

(2)The cubic capacity of a motor lifeboat is to be the value calculated according to (1) minus the cubage of engine and its accessories and operating space.

(3) The carrying capacity of of a lifeboat is to be the cubic capacity divided by $0.225 \text{ (m}^3\text{)}$, taking the

integer, but not to exceed the seat number determined by testing.

4.4.2.3 Lifeboat buoyancy

(1) Lifeboats are to have sufficient inherent buoyancy. The buoyancy may be provided by watertight air boxes, watertight air tanks or foamed rigid plastic of closed-cell type material, the total buoyancy is to be sufficient to float the capsized lifeboat and 7.5kg buoyancy force to every person.

(2) Watertight tank and foamed rigid plastic of closed-cell type buoyancy of lifeboat are to be manufactured not more than 1.2m in length. If the boat hull is one side of the buoyancy tank, foamed rigid plastic of closed-cell type are to be filled in each buoyancy tank, or the pressure test connection are to be fitted, and be in compliance with the requirement of 4.4.2.5 for a watertightness test.

(3) In board the lifeboat, the spare buoyancy is to be arranged on both sides. Arrangement in fore and aft may be also be accept, but arrangement in the amidships bottom is not allowed. Watertight tank, foamed rigid plastic of closed-cell type buoyancy is to be moveable for inspection, but not to be moved by water, and can keep the lifeboat upright floating. The protection is to be provided against damage.

(4) The shell of the watertight box is to be made of copper, aluminum; fiber reinforced plastic or other stainless material approved by the Administration. The foamed rigid plastic of closed-cell type used for inherent buoyancy is to be approved by the Administration.

(5) One of the following tightness tests is to be carried out after the air box is finished.

①Put the air box 0.6m under the water, the weight of the box is not to vary after 1 hour.

②Filling in 6kPa compressed air from pressure test connection, the pressure is not to decrease in 5 min.

(6) One of the following methods is to be taken to measure the cubage of the inherent buoyancy material:

①Displacement method.

②Accurate measurement and calculation.

③Water filing method for air tank, the rate of filling is to be measured for foamed rigid plastic of closed-cell type.

(7) Every watertight box or foamed rigid plastic of closed-cell type buoyancy is to be obviously marked with No. and cubage value, facing to inside of the lifeboat.

(8) The cubage V_1 of the inherent buoyancy is to be not less than the value determined by following formula:

$$V_1 = \frac{0.5G_1 + 0.95G_2}{1000} + 0.0075n \quad \text{m}^3$$

where: G_1 ---the weight of fiber reinforced plastic or other material for the hull of lifeboat and belongings

G_2 ---the weight of steel for the hull of lifeboat and equipment.

n ---the number of permitted person

The inherent buoyancy is to increase 0.1 m³ by per 100kg of formed rigid plastic of closed-cell type.

4.4.2.4 Additional requirement for motor lifeboats

(1) The engine is to be diesel engine, and the flash point of the fuel oil is to exceed 43°C (closed cup test)

(2) The lifeboat engine, stern shaft and its running components are to be protected by a casing. The exhaust pipe are to be appropriately bound up.

(3) The lifeboat engine is to be provided with a clutch and astern device.

(4) The oil tank is to have enough strength and is to be fixed inside the lifeboat. The oil tank is to have appropriate refueling and draining devices with an oil tray under the tank. The hydraulic test at 2m water height pressure is to be done to the oil tank and connecting devices.

(5) The speed of lifeboat in still water is to be at least 10km/h, when loaded with its full complement of persons and equipment.

(6) Watertight floors are to be installed in front of engine.

(7) The start and running tests for the lifeboat engine are to comply with following requirements.

①The engine running test is to be carried out t the condition that the lifeboat have a list of 10° and trim of 7° .

②The engine start and running tests are to be done when the ambient temperature is -5°C .

4.4.2.5 Lifeboat equipment

(1) The lifeboat equipment are to be supplied according to Table 4.4.2.5

(2) All the lifeboat equipment are to be appropriately secured in lifeboat and are to be easy to take out except the boat-hooks.

Table 4.4.2.5

Item	Unit	Motor Lifeboat	Non-motor Lifeboat	Life Sampan
Fuel oil		For 4 hour running		
Lub oil		For 4 hour running		
Repairing tool box	Case			
Oar	PC	1		
Boat-hooks	PC	2	6	3
Thule pin	PC	1	1	1
Rudder and tiller	PC	2	6	3
Bow painter	Pair	1	1	
White all-round light	Pair	1	1	1
Bailer	PC	1	1	1
Canvas cover	PC	1	1	1
Lifebuoy	Pair	1	1	1
Stern Painter	PC	1		
Whistle	PC	1	1	1
Fire-extinguisher for oil fires	PC	1	1	1
First aid kit ^②	Set	1	1	1

Note: ①White all-around lights are to be provided with enough oil for four hours and 2 packages of wind-prevention matches.

②The first aid kit is to be placed in the waterproof box which can be tightly closed after use. It is to be equipped according to appendix 1.

4.4.2.6 Lifeboat tests

(1) Type tests for lifeboats are to include stability, strength, watertightness, operation, immersion and freeboard measurement.

(2) Except the water test and operation test, the items specified in (1) may be dispensed with provided that the lifeboat meets both of the following requirements.

① The lifeboat working plans are approved by the Administration.

② The test, which is for the sister boat with same material and procedure, has been done and found to meet all relative requirements under the supervision of the Administration.

(3) Stability test. One lifeboat selected from a batch of same type lifeboats is to have stability test according to the following requirements:

① The test is to be done in still water to avoid the affect of tide and current.

② The lifeboat ais to be upright floating before the test.

③ The object with the same weight of all persons and equipment is to be put in the lifeboat, the weight of each person for calculation is taken as 75 kg, the center of gravity is supposed to be 0.3m above the actual seat plate.

④ The movable weight for an inclining test is to be 4 percent of displacement at full loading, divided into groups, put at both side in the middle of the lifeboat. The persons on the seats can be used for movable object.

⑤ Heeling angle may be measured by pendulum. The measurement line is to be 2m in length.

⑥ Substitution of fittings equipment and persons is to be fixed during the tests, except movable weight.

⑦ After tests, the initial metacenteric height (GM) is to be not less than the results calculated according to 4.4.2.1(2)

⑧ If the stability is not passed, it is permitted to reduce the permitted number of accommodated person or make alternation for further test till the relevant requirement are satisfied.

(4) Freeboard measurement is to be carried out during stability tests. The measurement is to be not less than the results according to 4.4.2.1(3). If the freeboard is not up to the requirement, it is allowed to reduce the permitted number of accommodated person and to test till the relevant requirement are met.

(5) One lifeboat from a bath of same type lifeboats is to be subject to the static load strength test under the specified loading condition according to the following procedure:

① With the unloaded lifeboat being suspended, make the alignment of the keel, and measure the breadth of the boat.

② The lifeboat is to then be loaded with tests weight (W) according to following formulas:

$$W = K_1 G_1 + K_2 (G_2 + G_3) \quad \text{kg}$$

where, G_1 —unloaded lifeboat mass, in kg

G_2 ... equipment mass (if motor lifeboat including engine mass), in kg;

G_3 ... launching person mass (65kg/person), kg;

K_1 ... factor, 0.25 for metal lifeboat, 1 for others;

K_2 ... factor, 0.25 for metal lifeboat, 2 for others.

③ Lift the lifeboat with lifting hood, after 5 min the breadth and keel sag are to be measured and coopered with that of the unloaded condition, the distortion is to be not greater than 1/400.

④ The lifeboat is not to have permanent distortion after removing the test weight. If the static test is not passed, repair the lifeboat or reduce the permitted number of accommodated persona and test again till the test result is satisfactory.

(6) Drop tests and impact tests are to be carried out as dynamic load test to lifeboat made of fiber reinforced plastic under stability test condition, and the tests result is satisfactory.

① The lifeboat is to be released from 3m in high(from keel to water) and falls freely into the water.

② Drop test: the lifeboat is to be still-suspended on the sling hooks, the vertical distance between a fixed suspension point and the sling hook is to be 6m, and whilst the horizontal distance between the rubber and a rigid wall is to be 0.05m. The lifeboat is to be pulled away to 2.5m off the rigid wall, rubber to the rigid wall, and then let go, the lifeboat impact freely against the rigid wall.

③ No serviceable damage is to be sustained after the drop test and impact test.

(7) Watertight test: All lifeboats are to be subject to the watertight test, and kept clean before test and are to be not painted over. The lifeboat fully loaded with substitution of person (75kg/person) and equipment are not to leak after 2h of floating in water.

(8) Seating tests and maneuverability tests

① The lifeboat is to be loaded with its full complement of persons and equipment, each person being an adult person and wearing a lifejacket over warm clothing can be seated in a normal position in order to verify the convenience of rowing and steering.

② The motor lifeboat is to be subject to starting and maneuverability tests of propulsion installation.

③ If the seating and maneuverability tests are found to be unsatisfactory, the number of persons on the lifeboat is to be permitted to accommodate may be reduced and then the boat is to be retested till a satisfactory result is finally obtained.

(9) Flooding test. During testing, lifeboats are to be loaded with the weights representing its full complement of persons, at 30kg per person, and metallic items of equipment and installations.

(10) The motor lifeboat is to be operated and undergone trial test as per following requirements:

① The lifeboat is to undergo trial test for 2 hours under loaded condition to ensure good motor performance and normal maneuverability of lifeboat.

② The speed of lifeboat riding in still water is to be measured. Its value is to be greater than relevant provision specified in 4.4.2.4(5) of this Chapter.

4.4.2.7 Lifeboat marks

(1) The name of the ship to which the lifeboat belongs, the main dimensions of the lifeboat and the number of persons which the lifeboat is permitted to accommodate are to be marked with black paint on each side of the bow above the rubbers. The name of the port of registry of the ship is to be marked on each side of the stern. Under the English letters, the English Phonetic Spelling of the name and post of registry of the ship is to aslo be marked.

(2) Every lifeboat is to be affixed with a nameplate at a conspicuous place on the forward thwart on which there is to be remarked the main dimensions of the lifeboat, the number of persons which the lifeboat is permitted to accommodate, capacity and total mass of the boat, aggregate volume of the air box, the name of manufacturer, serial number, date of manufacturer(year, month) and the inspection mark of the Administration.

4.4.3 Life sampans

4.4.3.1 The main dimension of the life sampan (hereinafter referred to as sampan) is to comply with the following requirements:

$$L = 5.0 \sim 8.5 \quad \text{m}$$

$$B \geq \frac{L+8.0}{10} \quad \text{m}$$

$$D \leq 0.38B \quad \text{m}$$

where: *L*-maximum length of sampan, in meter, the horizontal distance measured from the forward end to after end;

B- maximum width of sampan, in meter, the maximum width measured between both outside of hull of sampan.

D-depth of sampan, in meter the vertical distance measured from the top of bottom plating to lower edge of top plating at maximum width of sampan.

4.4.3.2 Basic requirements

(1) The sampan may be made of fiber reinforced plastics. The material used and the workmanship are to be approved by the Administration.

(2) The store buoyancy is to be required for sampan made of fiber reinforced plastics, the total volume V_1 of sampan's air-box is to be in compliance with the requirements of 4.4.2.3(8).

(3) The strength of a sampan is to comply with the requirements of 4.4.2.1(5)

(4) The sampan is to have sufficient stability. When the sampan floats upright in still water, which is to be loaded with complement of its equipment and the number of person which sampan is permitted to accommodate at mass of 65kg for each person, of which the center of gravity is to be placed 0.3m above the seat pan according to the practical distribution of the number of persons, its initial metacentric height *GM* is to be not less than that specified in the following formula:

$$GM = 0.165B \quad \text{m}$$

(5)The volume *V* of sampan may be determined approximately by the following formula:

$$V = 0.83L_bBD \quad \text{m}^3$$

where: *L_b*—the horizontal distance measured from the top edge of forward shell plating to the outside of after transverse plates.

B, D—same as the requirements of 4.4.3.1

(6) The person quota is to be the volume *V* being determined by above(5) divided by 0.225, from which the round number is obtained. But the person quota is to be not more than the number of actual seats verified by the Administration.

(7) The height of freeboard is to be not less than 35% of the depth of sampan when the sampan is loaded with complement of its equipment and the number of persons which the sampan is permitted to accommodate.

(8) The average sheer height is to be not less than 4% of length of sampan.

(9) The hull watertightness of a sampan is to comply with the requirements of 4.4.2.1 (6).

(10) The speed of a powered sampan in still water is to be not less than 7km/h, when it is loaded with complement of its equipment and persons which the sampan is permitted to accommodate.

(11) The sampan is to be not driven by petroleum engine.

4.4.3.3 Sampan tests

(1) The stability test is to comply with the requirements of 4.4.2.6(3).

(2) The strength test of sampan made of fiber reinforced plastic is to comply with the requirements of 4.4.2.6(5) .

(3) The watertightness test is to comply with the requirements of 4.4.2.6(7).

(4) The freeboard measure is to be carried out under the condition of stability test for one of same type of sampans; the measured value is to be not less than calculated value of 4.4.3.2(7). In case of freeboard measured value not being satisfactory, it is permitted to reduce the number of persons and then the further test is to be conducted till the result of test is satisfactory.

(5) The loading and maneuvering tests are to comply with the requirements of 4.4.2.6(8).

4.4.3.4 The relevant test may be exempted provided all the following requirements are met:

- (1) The construction plans of sampan is an approved plan;
- (2) Stability test, strength test, freeboard measurement and maneuvering test when persons are seating in have been carried out, and the complete information's relating to tests have kept on board;
- (3) Having same manufacturing procedures as that being carried out.

4.4.3.5 The equipment and marking of a sampan are to comply with the requirements of 4.4.2.5 and 4.4.2.7.

4.4.4 Inflatable open reversible liferafts

4.4.4.1 General requirements

- (1) Not be damaged in stowage throughout the air temperature range of -18°C to $+65^{\circ}\text{C}$;
- (2) Be capable of operating throughout an air temperature range of -18°C to $+65^{\circ}\text{C}$ and a water temperature range of -1°C to $+30^{\circ}\text{C}$.
- (3) Its shape is to remain unreformed after being inflated or fully loaded.

4.4.4.2 Construction

(1) The open reversible inflatable liferaft is to be so constructed that when it is dropped into the water in its container from a height of 10m, liferaft and its equipment will operate satisfactorily.

(2) The open reversible floating inflatable liferafts to be capable of withstanding repeated jumps onto it from a height of at least 4.5m.

(3) The open reversible inflatable liferaft when fully inflated isto be capable of being boarded from the water whichever way up it inflates.

(4) The main buoyancy chamber is to be divided into:

① not less than two separate compartments, each inflated through a nonreturnable inflation valve on each compartment; and

② the buoyancy chambers are to be so arranged that in the event of one of the compartments being damaged or failing to inflate, the intact compartment is to be able to support, with positive freeboard over the open reversible inflatable liferaft's entire periphery, the number of persons which the liferaft is permitted to accommodate, each having a mass of 75kgs and seated in their required positions.

(5) The floor of the open reversible inflatable liferaft is to be waterproof.

(6) The open reversible inflatable liferaft is to be inflated with a non-toxic gas. Inflation is to be completed within the period of one minute at an ambient temperature of between 18°C and 20°C and within a period of three minutes at an ambient temperature of -18°C . After inflation the inflation open reversible liferaft is to maintain its form when loaded with its full complement of persons and equipment.

(7) Each inflatable compartment is to be capable of withstanding a pressure equal to at least three times the working pressure and is to be prevented from reaching a pressure exceeding twice the working pressure either by means of relief valves or by a limited gas supply. Means are to be provided for fitting the topping-up pump or bellows.

(8) The surface of the buoyancy tube is e to be non-slip material. At least 25% of these tubes are to be of a highly visible color.

(9) The number of person which an inflatable open reversible liferaft permitted to accommodate is to equal to the lesser of:

① the greatest whole number obtained by dividing by 0.096 the volume, measured in cubic meters, of the main buoyancy tube (which for this purpose is not to include the thwarts, if equipped)when inflated; or

② the greatest whole number obtained by dividing by 0.372 the inner horizontal cross-sectional area of the inflatable open reversible liferaft measured in square meters (which for the purpose may include the thwart or thwarts, if equipped)measure to innermost edge of the buoyancy tubes, or

③ the number of persons having an average mass of 75kg, all wearing lifejackets, that can be seated inboard of the buoyancy tubes without interfering with the operation of any of the liferaft's equipment.

4.4.4.3 Open reversible inflatable liferaft fittings

(1) Lifelines are to be securely bucketed around the inside and outside of the open reversible inflatable

liferaft.

(2) The open reversible inflatable liferaft is to be equipped with efficient painter of a length suitable for automatic inflation on reaching the water. For open reversible inflatable liferaft accommodating more than 30 persons an additional browsing in line is to be equipped.

(3) The breaking strength of the painter system, including its means of attachment to the inflatable open reversible liferaft, except the weak line, is to be:

- ① 7.5kN for open reversible inflatable liferaft accommodating up to 8 person;
- ② 10.0kN for open reversible inflatable liferaft accommodating up to from 9 person to 30 persons; and
- ③ 15.0kN for open reversible inflatable liferaft accommodating more than 30 persons.

(4) The open reversible inflatable liferaft is to be equipped with at least the following number of inflated ramps to assist boarding from the sera which way up the raft inflates:

- ① one boarding ramp for open reversible inflatable liferafts accommodating up to 30 persons. or
- ② two boarding ramps for open reversible inflatable liferafts accommodating more than 30 persons.

(5) The open reversible inflatable liferaft is to be equipped with water pockets complying with the following requirements:

- ① The cross-sectional area of the pockets is to be in the shape of an isosceles triangle with the base of the triangle attached to the buoyancy tubes of the inflatable open reversible liferaft;
- ② The design is to be such that the pockets fill to approximately 60% of capacity within 15s to 25s of deployment;
- ③ The pockets attached to each buoyancy tube are to normally have aggregate capacity of between 125L and 150L for open reversible inflatable liferafts up to and including the 10-person size;
- ④ The pockets to be equipped to each buoyancy tube on liferafts certified to carry more than 10 persons are to have, as far as practicable, an aggregate capacity of 12N litres, where N is the number of person carried.
- ⑤ Each pocket on a buoyancy tube is to be attached so that when the pocket is in the deployed position it is attached along the full length of its upper edges to, or closed to, the lowest part of the lower buoyancy tube; and
- ⑥ The pockets are to be distributed symmetrically round the circumference of the liferaft with sufficient separation between each pocket to enable air to escape readily.

(6) The equipment of every open reversible inflatable liferaft are to comply with the requirements in Table 4.4.4.3

Table 4.4.4.3

Name of equipment	Unit	Qty
Buoyant rescue quoit, attached not to less than 30m of buoyancy line with a breaking strength of at least 1kN	PC	1
Safety knives of the non-folding type, having a buoyant handle, are to be fitted attached to open reversible inflatable liferaft by light lines. They are to be stowed in pockets so that, irrespective of the way in which the open reversible inflatable liferaft inflates, one will be readily available on the topsurface of the upper buoyancy tube in a suitable position to enable the painter to be readily cut.	PC	2
Buoyant bailer	PC	1
Sponge	BAR	2
Buoyant paddle	PC	2
Whistle	PC	1
Waterproof electric torch with one spare set of batteries and two bulbs in a waterproof container.	PC	1
First aid kit	SET	1

Note: ① The first aid kit is to be placed in the waterproof box which can be tightly closed after use. It is to be equipped according to appendix 1

(7) Where appropriate, the equipment is to be stowed in a container which, if it is not an integral part of, or permanently attached to, the open reversible inflatable liferaft is to be stowed and secured to the open reversible inflatable liferaft and be capable of floating in water for at least 30min without damaging its contents. No matter if the equipment container is an integral part of, or is permanently attached to, the open reversible inflatable liferaft, the equipment is to be readily accessible irrespective of which way up the open reversible inflatable liferaft inflates.

4.4.4.4 Containers for open reversible inflatable liferafts

(1) The open reversible inflatable liferaft is to be packed in a container that is:

- ① so constructed as to withstand conditions encountered at sea:
 - ② of sufficient inherent buoyancy, when packed with the liferaft and its equipment, to pull the painter from within and to operate the inflation mechanism should ship sink; and
 - ③ As far as practicable, watertight, except for drain holes in the container bottom.
- (2) The container is to be marked with:
- ① maker's name or trademark;
 - ② serial number
 - ③ the number of persons it is permitted to carry
 - ④ date when last serviced
 - ⑤ length of painter
 - ⑥ maximum permitted height of stowage above waterline; and
 - ⑦ launching instructions

4.4.4.5 The open reversible inflatable liferafts are to be marked with

- (1) maker's name or trademark;
- (2) serial number;
- (3) manufacture data
- (4) name and place of service station where it was last serviced; and
- (5) number of persons it is permitted to accommodate on the top of each buoyancy tube, in characters not less than 100mm in height and of a color contrasting with that of the tube.

4.4.4.6 Instruction and information are to be in a clear and concise form and are to include, as appropriate, the following:

- (1) general description of the inflatable open reversible liferaft and its equipment
- (2) installation arrangements;
- (3) operational instructions;
- (4) servicing requirements

4.4.5 Buoyant apparatus

4.4.5.1 General requirements

(1) The buoyant apparatus are to be made of obdurate polyfoam or other material approved by the Administration.

(2) The floating arrangement are to ensure efficiency and sufficient stability on in case of any one of both side upwards.

(3) The buoyant apparatus are to be provided with a grabline made of synthetic fiber, having a diameter of not less than 9.5mm, secured at equidistant points depending on its quota around the circumference of buoyant apparatus. The grabline is to float on the surface of water, when the buoyant apparatus are dropped into the water.

(4) The buoyant apparatus are to be dropped into the water from 10m height without damaging or deformation.

(5) the buoyant apparatus are not to sustain burning or continue melting after being totally enveloped in a fire for a period of 2s.

4.4.5.2 Buoyant apparatus for more than one person

(1) The stability and buoyancy of buoyant apparatus for more than one person are to meet following requirements;:

① be capable of supporting the weight calculated as 7kg per 0.3m of its grabline of any one side, of which the top edge is to be not under the water.

② The buoyant apparatus loaded with not less than the mass equal to its person quota are to be remaining floating normally in fresh water for a period of 24h.

(2) The equipment for buoyant apparatus for more than one person are to include:

① one piece of the self-igniting light of lifebuoy which complies with relevant provision

② two buoyant paddles

③ one piece of painter which its perimeter is no less than 50mm and length no less than 14m.

4.4.5.3 Personal buoyant apparatus

(1) The personal buoyant apparatus are to be capable of supporting not less than 9kg of iron in fresh water.

(2) In calm water, the personal buoyant apparatus are to support the subject's chin out of water, the body not being inclined backwards.

(3) The personal buoyant apparatus are to have buoyancy which is not reduced by more than 5% after 24h submersion in fresh water.

4.4.5.4 Additional requirements for inflatable buoyant apparatus

(1) The buoyant apparatus are to be provided with at least two separate compartments, each of which are to be provided with a relief valve and non-return valve. In the event of any one of compartments being damaged or failing to inflate, the intact compartment is to be able to support, with positive freeboard over the entire periphery of the apparatus, the equipment and the number of persons which the apparatus is permitted to accommodate. The floor of the apparatus is to be waterproof.

(2) The apparatus are to be inflated with a nontoxic gas. Inflation is to be effected automatically by a pulling line or other simple and equivalent methods.

4.4.5.5 Carrying capacity of buoyant apparatus

(1) The quotas of persons of buoyant apparatus for more than one person permitted to accommodate is to be equal to the lesser of the following:

① The mass of iron in kg which it is capable of supporting in fresh water divided by 14.5, to obtain the integer ;

② The outer perimeter in mm divided by 305, to obtain the integer;

(2) The quotas of person which a buoyant apparatus for more than one person is permitted to accommodate is to be equal or greater than 2.

(3) Personal buoyant apparatus are to be used only for one person.

4.4.5.6 The buoyant apparatus are to be marked in clear, permanent character with the model, main dimensions, number of persons permitted to accommodate, total mass, name of manufacturer, serial number year and month of manufacturer as well as the inspection stamp of the Administration.

4.4.6 Lifejackets

4.4.6.1 The adult lifejackets and inflatable lifejackets are to comply with the requirements of 2.2.1 or 2.2.1 of CHAPTER II of the International Life-saving Appliance (LSA) Code.

4.4.6.2 The lifejacket lights are to comply with the requirements of 2.2.3 of CHAPTER II of the International Life-saving Appliance (LSA) Code for those lifejackets requiring lifejacket light.

4.4.6.3 The children's lifejackets are to comply with the requirements of 2.2.1 or 2.2.2 of CHAPTER II of the International Life-saving Appliance (LSA) Code for those lifejackets requiring lifejacket light.

4.4.6.4 The lifejackets are to be marked in clear, permanent character with the model, the type, the name of manufacturer, serial number, year and month of manufacture as well as the inspection stamp of the Administration. For the children's lifejackets worn inside-out, the 'children use' and the range of sizes and mass for children are to be clearly marked on lifejackets.

4.4.6.5 The instructions for wearing lifejacket and personal buoyant apparatus are to be pasted in passenger compartment and public areas on ship.

4.4.7 Lifebuoys

4.4.7.1 Lifebuoys (including lifebuoy self-igniting light and buoyant lifelines) are to comply with the applicable requirement of 2.1.1, 2.1.2 and 2.1.4 of Chapter II of the International Life-saving Appliance (LSA) Code.

4.4.7.2 Each side of lifebuoys is to be marked with clear, permanent with the ship's name, port of registry, type in Chinese and English respectively and is to also be marked with the type, the name of manufacturer, serial number, year and month of manufacture as well as the inspection stamp of the Administration.

4.4.8 Inflatable Life-saving Rings

4.4.8.1 Construction and performance of inflatable life-saving rings

(1) The shell of inflatable life-saving rings is made of plastic which is nontoxic and impact-resistant. Double air bags, double gas starters, double electrical sources and accessories are equipped in the ring. Each air bag is to be inflated automatically in water as semi-ring, a ring is to be formed by two semi-rings. The inside diameter of the ring is not less than 400mm. The outer ring is to be equipped with a no less than 9.5mm hand rope which is to be secured at 4 equidistant points around the circumference of the ring. The hand rope is to float on the surface of the water.

(2) The inflatable life-saving rings are to be dropped into the water from 10m height without damaging or deformation

(3) The inflatable life-saving rings are not to sustain burning or continue melting after being totally enveloped in a fire for a period of 2s.

(4) The inflatable life-saving rings are to be provided at least two separate compartments, of which each should support not less than 9kg of iron. In the event of any one of compartments being damaged or failing to inflate, the intact compartment is to be able to support one person. The compartments are to be waterproof.

(5) The inflatable life-saving rings are to be inflated with a nontoxic gas and automatically in water. The inflated time is not more than 8s commonly and not more than 15s in cold.

4.4.8.2 The inflatable life-saving rings are to be marked in clear, permanent character with the model, name of manufacturer, serial number, year and month of manufacturer, next maintenance date, total mass and the inspection stamp of the Administration.

4.4.9 Boat davits

4.4.9.1 The boat davit is to be arranged in accordance with following requirement:

(1) Type of davit: the lifeboat(sampan) is to be provided with a gravity-type boat davit in the case that the mass is greater than 2300kg when the boat is maneuvering outward. For the lifeboat with mass less or equal to 1200kg, it is to be provided with a rotary davit and for the lifeboat with mass greater than 1200kg but not exceeding 1200kg, it is to be provided with gravity-type boat davit or luffing-type davit.

(2) Arrangement and strength of davit: each launching davit is to be so arranged that the lifeboat with complement of attachments and its operating person can be safety launched against a list of up to 10° either way.

(3) The span distance when the davit is maneuvering out of ship: the distance between side of the middle of lifeboat(sampan) and the ship's side plate is to be not less than 300mm; if the ship is provided with fender, the distance between the side of middle of lifeboat(sampan) and ship's fender side is to be not less than 100mm.

(4) The launching winch is to comply with the following requirements

① The drum of a winch is to be so designed that it can wind the 2 falls separately and at the same rate, the falls on the drum are to be no more than 2 layers. The diameter of a drum is to be at least 16 times of that of falls.

② Each launching winch is to be fitted with 2 sets of brakes, one is manual brake, the other is brake with compensatory device which can automatically adjust the launching speed and keep the speed at a safe range.

③ An efficient manual device is to be provided for recovery of each lifeboat (sampan). Hand gear handles or wheels are to be not rotated when the lifeboat is being launched or when it is being hoisted by power.

④ Where davit arms are recovered by power, safety devices, which will automatically cut off the power before the davit arms reach the original position are to be fitted.

(5) The falls are to comply with the following requirements.

① Steel falls are to be soft and flexible. The steel rope is to be made of steel wire which tensile stress is between 1373.4 N/mm² and 1667.7N/mm². Steel ropes are to be galvanized and combined by more than 6

wires with a fiber centre.

② The falls are to be so long that the lifeboat(sampan) can be launched safely to the water against a list of up to 10° either way in the ship's light condition.

③ The device for fastening the falls can be fixed on davit or deck, the type and strength are to ensure to launch safely the lifeboat to the water.

(6) The lifeboat hooks for lift can be fixed type. The openings of the hooks are to face to the middle of lifeboat(sampan). The hooks and falls are to be in a same perpendicular when lifting lifeboat(sampan).

(7) Two lifelines are to be installed to davit span, and lifelines are to be fiber rope. The lifelines are to be so long that it can reach the lightest waterline against a list up to 10° either way.

(8) The diameter of the davit pulley is to be at least 12 times diameter of the falls (measured from the pulley groove).

(9) The davit and its attachments are to have sufficient strength. The testing loading and safety factors are to comply with the requirement of the table 4.4.9.1.

Table 4.4.9.1

Item	Workload	Test load	Safety Coefficient	
			$\sigma_s / [\sigma]$	$\sigma_b / [\sigma]$
Boat davit	P	$2P$	2.5	
Davit hook and pulley etc.	P	$2P$		5
Steel boat fall	Boat fall tension			5

Where: p equals weight of lifeboat(sampan) plus weight of its fittings plus weight of person launching lifeboat

σ_s —material yield limit, MPa

σ_b - material ultimate strength, MPa.

$[\sigma]$ -allowable stress, MPa

(10)The strength test of boat davit, davit hook and boat pulley is not to last over 5mins. There are not to emerge any deformations after the test.

(11)The material of stressed components including boat davit, davit hook and boat pulley are to comply with relevant provision of 2.1.3.1 of CHAPTER 2 of this Part. Its rotating parts are to be made from stainless material.

(12) Launching test. The test is to be conducted on the launching of lifeboat (sampan) after each davit is provided on ship.

①the boat davit is to be capable of being moved to outside board when it is tested with weight of person launching the boat and then conduct the launching and recovery of lifeboat(sampan) for several times to safety and reliability of boat davit appliances.

②when testing boat davit, boat fall, boat hoist and any relevant devices, the boat davit of a lifeboat(sampan) is to be capable of being restored after the recovery of lifeboat (sampan).

③to check appliance strength and brake performance of boat hoist.

④Where the davit brake is not provided with shield, water is to be sprayed on the brake before conducting above test to ensure if it is safe and reliable.

4.4.10 Embarkation Ladders

4.4.10.1 Embarkation ladders are to comply with the provision of 6.1.6 of CHAPTER VI of the International Life-saving Appliance (LSA) Code.

4.4.11 Retroreflective Materials

4.4.11.1 Retroreflective material are to comply with the provision of 1.2.2(7) of CHAPTER I of the International Life-saving Appliance (LSA) Code.

4.4.12 Marine Emergency Evacuation System

4.4.12.1 Emergency evacuation systems are to comply with the provision of 6.2 of CHAPTER VI of the International Life-saving Appliance (LSA) Code or are to be the type approved by [CCSISC](#).

Appendix 1 MEDICINE FOR FIRST-AID OUTFITS OF LIFEBOATS AND LIFRAFTS

The medicine for the first-aid outfit of lifeboat and liferaft are to comply with the requirement of following table:

No.	Name	Spec.	Unit	Qty for lifeboat and liferaft	Remarks
1	bandage	4.8×600cm	roll	5	
2	gauze	34×40cm	bar	10	plastic sealed package
3	triangular bandage	Bottom 130×90cm	bar	3	
4	medical proof fabric	1.2×100cm	roll	1	Adhesive plaster cloth
5	absorbent cotton	10g	package	2	②
6	tourniquet	55cm	piece	2	Latex Φ0.7~1.0cm
7	tweezers	12cm	piece	1	①
8	bandage scissors	10cm	piece	1	round headed
9	pin	3cm	piece	10	①
10	ethanol	75%	ml	20	①
11	adhesive bandage	2.5×2cm	piece	20	
12	scald ointment	20g	piece	2	②
13	chlortetracycline eye ointment	2.5g	piece	2	①
14	pain-killer		piece	50	aspirin②
15	sulfamethoxazole tablets	0.5g	piece	80	②

Notes: ① Liferaft may not be necessarily equipped.

② The liferaft can be half equipped.

Appendix 2 INSPECTION REQUIREMENTS FOR LIFEJACKETS OF INLAND WATERWAY SHIPS

1. Application

1.1 This appendix specifies the categories, marking, technical requirements, test methods, inspection rules, symbols, packaging, transportation and storage for the adult lifejackets (hereinafter referred to as lifejackets) used in inland waterway ships.

1.2 This appendix is applicable to the design, manufacture and acceptance for the lifejackets of inherent buoyancy.

2. Definitions

2.1 Turn-over time refers to the time that the testee's mouth keeps out of the water when the testee imitates a state of extreme exhaustion with face down and whole body relaxed.

2.2 Clear height refers to the vertical distance between the mouth bottom of the testee and water level, as shown in Fig.2.2.

2.3 Facial plane angle refers to the included angle between the connecting line of forehead and chin and water level, as shown in Fig.1.

2.4 Trunk angle refers to the angle between the connecting line of shoulder and hip bone and vertical line, as shown in Fig.1.

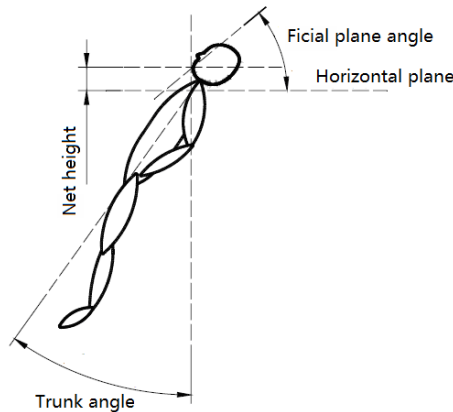


Figure 2.2 Static Balance Position

3. Classification and Marking

3.1 Lifejacket structures generally take the following two types:

- (1) Pullover lifejacket, as shown in Figure 3.1 (1);
- (2) Vest-like lifejacket, as shown in Figure 3.1 (2);



Figure 3.1 (1)



Figure 3.1 (2)

3.2 Other types of lifejackets may be used for inland waterway ships if they meet the relevant provisions of this Appendix.

3.3 Lifejackets are to be obviously marked with “Inland Waterway” on the front side. The marking way is just shown as Figure 3.1 (1) and (2); “Inland Waterway” are to be 60mm in height (approximately 172 pounds).

4. Technical Requirements

4.1 Appearance

4.1.1 The surface of lifejackets is to be salmon pink or orange;

4.1.2 Lifejackets are to be clearly marked with “Put the front on”;

4.1.3 Lifejackets are to be secured by fastener;

4.1.4 Each lifejacket is to be provided with a whistle;

4.1.5 When tested keeps a static balance state, the total area of retro reflective tapes on the outer surface of the lifejacket out of the water is to be not less than 100cm².

4.2 Sewing requirements

4.2.1 The inward tuck of wrapper side is to be not less than 10mm;

4.2.2 The edge of the lifejacket stitch spacing is to be not less than 1mm, and the stitches are to have no skipping stitches;

4.2.3 The machinery stitching density is to be not less than 16 stitches per 50mm lengths and the end of the thread is to be back knotted;

4.2.4 The length of ligature end into wrapping cloth is to be not less than 30mm. The ligature is to be stitched at least 3 times for reinforcement.

4.3 Strength

4.3.1 Strength of lifejackets: the lifejacket body is to stand 2000N forces for 30min without any damage;

4.3.2 Strength of lifejacket shoulder: the lifejacket shoulder is to stand 750N forces for 30min without any damage.

4.4 Buoyancy and buoyancy loss

4.4.1 The buoyancy of a lifejacket is to be not less than 100N, and is to be measured after immersing in fresh water for 24 hours, and the buoyancy loss is not to exceed 5%.

4.5 Temperature cycling

4.5.1 A lifejacket is to stand the ambient temperature of $-30\pm 2^{\circ}\text{C}$ and $+65\pm 2^{\circ}\text{C}$ for ten cycling test, after then, it is to occur with no damages, such as shrinking, cracking, swelling, decomposition or mechanical property changes.

4.6 Flame resistance

4.6.1 Lifejackets are not to continue to burn or melt for 6 seconds after 2 seconds flamed.

4.7 Wear

4.7.1 Two thirds of testers are to properly wear lifejackets within 1 minute without guidance.

4.7.2 After guidance, all testers are to properly wear lifejackets within 1 minute.

4.8 Flooding performance

4.8.1 The turn-over time of testers wearing lifejackets is to be less than 5 seconds;

4.8.2 Testers wearing lifejackets are to remain a backward state with heads above water, and are to be not tended to immerse their heads into the water;

4.8.3 Testers are to meet the following requirements after wearing lifejackets and keeping static balance state in the water (as shown in Fig.1):

(1) The clear heights of all testers are to be not less than 80mm;

(2) The average trunk angles for all testers are to be not less than 30°, and the trunk angle of each tested are to be not less than 20°;

(3) The average facial plane angle of all testers is to be not less than 40°, and the facial plane angle of each tested is to be not less than 30°;

4.9 Diving

4.9.1 Testers who wear lifejackets are to meet the following requirements after diving:

(1) Testers are to keep faces above the water after being surfaced, and the clear heights of all testers are to be not less than what specified in 4.8.3 (1);

(2) Lifejackets are not to take place any displacement or cause any injury to testers;

(3) Lifejacket sand their attachments are to be not damaged.

4.10 Material

4.10.1 The strengths of Wrapping cloth, ligature, buckle and stitching threads are to comply with Table 4.10.1.

Tab.4.10.1

No.	Material Name	Test Item	Property Requirement
1	wrapping cloth	tensile strength	≥784 N / 50 mm
		tensile strength after aging	not less than 60% of the original
		yarn slippage	≥220 N
2	ligature	tensile strength	≥1600 N
		tensile strength after aging	not less than 60% of the original
3	buckle	tensile strength	≥1600 N
		tensile strength after aging	not less than 60% of the original
4	stitching thread	tensile strength	≥20 N

4.10.2 Retro-reflective material are to meet the requirements of “Reflective Films for Life-Saving Equipment” (GB / T26086-2010).

4.10.3 The buoyancy core material are to be closed-cell foam, while it can’t use loose granular material. The buoyancy core material are to meet the following requirements:

(1) After 10 times cycling under the requirements of 5.5, check samples of each type, which are to have no signs of changes in structure or mechanical quality;

(2) The core material are not to occur with shrinking, cracking, swelling, decomposition and other damages after being immersed in the diesel of 100mm head pressure for 24 hours;

(3) Buoyancy measures are to be performed after the core material being immersed in 1.25m water for 1 day and 7 days, and the buoyancy loss are not to exceed 5%, while for the core material after diesel oil resistant test, its buoyancy loss is not to exceed 10%;

(4) The tensile strength against fracture of the core material is to be not less than 140kPa, the loss of which is not to exceed 25% after experiencing 10 temperature cycling and diesel oil resistance tests.

5. Test methods

5.1 Appearance

5.1.1 Visually check the quality of lifejacket appearance, where the results are to be consistent with the requirements of 4.1.

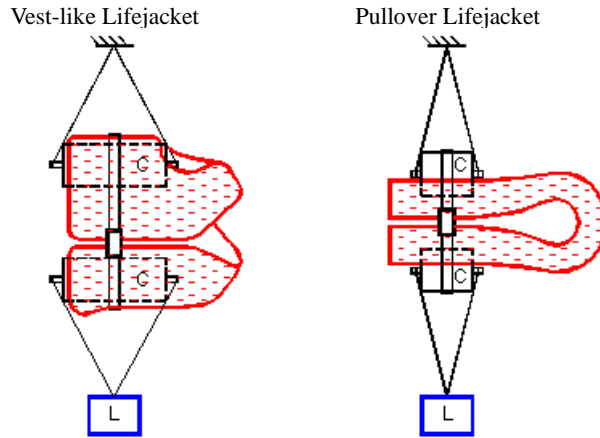
5.1.2 Check the lifejacket reflective material size by universal measuring tools, where the results are to meet the requirements of 4.1.5.

5.2 Sewing requirements

5.2.1 Check the processing quality of lifejacket by means of visual inspection and universal measuring tools, where the results are to be consistent with the requirements of 4.2.

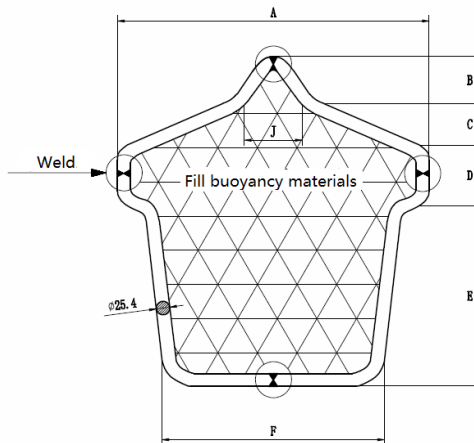
5.3 Strength

5.3.1 Immerse lifejacket into water for 2 minutes, then buckle it up as the real wearing way does and suspend it; put pressure of more than 2000N on the lifejacket, as shown in Figure 5.3.1, and maintain 30 minutes. The results are to meet the requirements of 4.3.1.



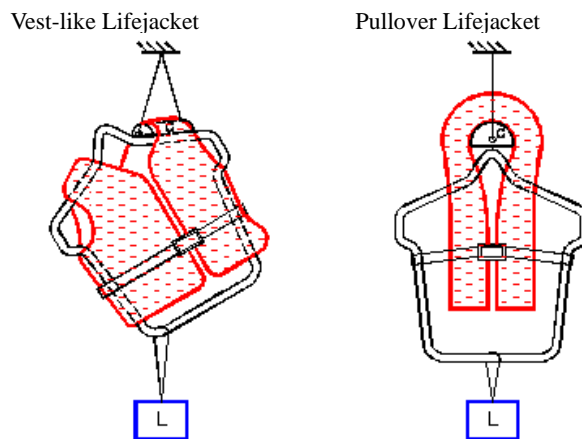
In the figure, C is cylindrical (diameter size of 125 mm); L is test load (N)
Figure 5.3.1

5.3.2 Immerse lifejacket into water for 2 minutes, then take it out of water and buckle it up in a shelf shown in Figure 5.3.2 (1) as the real wearing way does. Go through the shelf and put pressure of more than 750N on the lifejacket shoulder (test load plus test shelf), just as shown in Figure 5.3.2 (2), and maintain 30 minutes. The results are to meet the requirements of 4.3.2



Mark in Fig.	A	B	C	D	E	F	G	Ø	J
Size (mm)	610	114	76.2	127	381	432	508	25.4	178

Figure 5.3.2 (1)



In the figure, C is cylindrical (diameter size of 125 mm); L is test load (N)
Figure 5.3.2 (2)

5.4 Buoyancy and buoyancy loss

5.4.1 Immerse lifejacket to the point just below the surface of fresh water, then respectively test and record the buoyancy at the time of immersion and the immersion of 24 hours. The buoyancy loss ratio WS is calculated as follows:

$$W_s = \frac{W_1 - W_2}{W_1} \times 100$$

Where: W1- lifejacket buoyancy at the time of immersing, N;
W2-lifejacket buoyancy after 24 hours immersing, N;

5.4.2 The buoyancy loss ratio WS is to be rounded to the second place after decimal point, the result of which is to meet the requirements of 4.4.

5.5 Temperature cycling

5.5.1 Alternately place the lifejacket into a high temperature environment of $+65 \pm 2^\circ\text{C}$ and a low temperature environment of $-30 \pm 2^\circ\text{C}$ and remain for 8 hours. The alternating cycling is not needed to be carried out one by one and it may be repeated as the following procedures:

- (1) Put the lifejacket into a heating chamber at the temperature of $+65 \pm 2^\circ\text{C}$ for 8 hours;
- (2) 8 hours later, take the sample out of the heating chamber and keep it unfolded in normal temperature for 2 days;
- (3) Put the lifejacket into a cold chamber at the temperature of $-30 \pm 2^\circ\text{C}$ for 8 hours;
- (2) 8 hours later, take the sample out of the cold chamber and keep it unfolded in normal temperature for 2 days;

Repeat 10 temperature cycling tests and check the lifejacket's appearance. The results are to meet the requirements of 4.5.

5.6 Flame Resistance

5.6.1 Place a test plate of 300 mm x 350 mm x 60 mm in a place with no wind, and then pour 10 mm deep fresh water into the test plate. Next, pour gasoline with its depth not less than 40 mm; Ignite the gasoline for a free burning of 30 seconds; Then, hold the lifejacket, keeping its bottom 250 mm higher than the test plate edge, and move the lifejacket through the flame with postures of upright, forward, and free lifted, the flame-cross time is to be 2 seconds. At last, check the lifejacket after being away from the flame. The results are to be in compliance with the requirement of 4.6.

5.7 Wear

5.7.1 According to Table 5.7.1 and the following provisions, select 6 healthy testers who are not familiar with lifejackets for the tests of 5.7.2 and 5.7.3:

- (1) The tested women are to be at least 1 person, but not more than 2, while the tested women are not to exceed 1 in each height range;
- (2) Unless otherwise specified, the recognition to the lifejacket based on the test results from each tested are to be accepted.

Tab.5.7.1

Height (m)	Weight W (kg)			
	50<W≤60	60<W≤70	70<W≤80	W>80
1.4<H≤1.6	1	1	—	—
1.6<H≤1.8	—	1	1	—
H>1.8	—	—	1	1

Note: ① Each case of "1" indicates that 1 tested are to be selected;
② Each case of "—" indicates that no selection for that height and weight range.

5.7.2 Testees are required to wear ordinary dresses and to be provided with no help, guidance, or prior demonstration for the jackets wearing. The lifejacket is to be in a standby state, and the testing time is recorded from ordering to the completion of wearing. The lifejacket wearing can only be construed as the completed when testees have already put on the lifejackets and adjusted them properly for conducting the flooding performance test by all means of securing the lifejackets. The results are to be in compliance with the requirements of 4.7.1.

5.7.3 For every testee, if the first wearing of lifejacket exceeds 1 minute or not completed, then after being demonstrated or guided, the testee is to wear again the lifejacket according to the order of 5.5.2 under circumstances of no guidance. The results are to be in compliance with the requirements of 4.7.2.

5.8 Flooding performance

5.8.1 This test is to simulate the performances of lifejackets for saving an incompetent person or extremely exhausted person, and indicate that the lifejackets will not excessively limit people's water activities.

All tests are to be carried out in calm water.

5.8.2 Tests are to be performed by at least 6 persons as stated in Table 5.7.1, and are to select only those people who are good at swimming because only they have the ability to relax in the water.

5.8.3 The “get right” test for lifejackets is to be in accordance with the following steps:

(1) Simulate the completely exhausted state: Testees are to maintain a prone position with face down, and look up so as to keep the mouth out of water. Testers are to prop up the testee’s feet with the same width of the shoulder and make them separated and keep the heels just under the surface of water. The testees are to unbend the legs and place arms in the outside legs. The testees are to gradually relax his body to the natural floating state according to the following steps:

- ① Relax arms and shoulders;
- ② Relax legs;
- ③ Relax spine and neck;
- ④ Immerse the head into the water and keep normal breathing.

In the relaxing phase, the testees are to keep face down stably.

(2) After testee immerses his face and keeps relaxed, testers are to immediately let go the testee’s feet. The recording time is from releasing the testee’s feet to the testee’s mouth leaving away from water surface (that is the turn-over time, which is accurate to 0.1 seconds);

(3) The above tests are to be performed for 6 times, and the results of which are to meet the requirements of 4.8.1.

5.8.4 After the lifejacket “get right” test, without any adjustment to the body or lifejacket position, the testees are to be measured by a universal measuring tool when he keeps floating state of static balance with face up. The results are to meet the requirements of 4.8.3.

- (1) Clear height;
- (2) Trunk Angle;
- (3) Facial plane Angle.

5.9 Diving

5.9.1 The testee who wears lifejacket dives into the water vertically at the height of 3 m. The tested is to seize the lifejacket to avoid injuries. In the water, the testee keeps relaxed and simulates the extremely exhausted state. After the testee is static in the water, record the clear height of water surface to the mouth, and check if there is any damage to the lifejacket and attachments. The results are to be in compliance with the requirements of 4.9.

5.10 Materials Testing

5.10.1 Wrapping cloth are to be performed with the following tests:

(1) Tensile strength: Tailor five pieces of samples (250mm × 50mm) in warp and weft and place them at ambient temperature of $20 \pm 2^\circ\text{C}$ and relative humidity of $65 \pm 4\%$ for 24 hours. Set the tensile speed of $100 \pm 10\text{mm/min}$ and gauge length of 200 mm for tensile strength tests, and record the maximum tensile strengths when samples are fracturing. The test results are to meet the requirements of 4.10.1.

(2) Tensile strength after aging: Tailor five pieces of samples (250mm × 50mm) in warp and weft, place the samples’ front side to directly face lights, keeping the centers of which to be irradiated vertically by the lights. The irradiance is to be 0.55W/m^2 , black panel temperature is to be $(63 \pm 2)^\circ\text{C}$, and photoperiod is to be 144 minutes including 120 minutes light cycle and 24 minutes dark cycle, 102 minutes illumination for light cycle/18 minutes illumination accompanied with water spray, dark cycle of 24 minutes accompanied with water spray. The tests are to be totally performed for 303 hours. After illumination, the tests are to be performed in accordance with 5.10.1 (1) and the results are to meet the requirements of 4.10.1.

5.10.2 Ligature are to be performed with the following tests:

(1) Tensile strength: Tailor five pieces of samples of 250m lengths and place them at ambient temperature of $20 \pm 2^\circ\text{C}$ and relative humidity of $65 \pm 4\%$ for 24 hours. Set the tensile speed of $100 \pm 10\text{mm/min}$ and gauge length of 200 mm for tensile strength tests, and record the maximum tensile strengths when samples are fracturing. The average tensile strength is to meet the requirements of 4.10.1.

(2) Tensile strength after aging: Tailor five pieces of samples of 250m lengths and perform illumination tests according to 5.10.1 (2). After illumination, perform 5.10.2 (1) test, and the test results are to meet the requirements of 4.10.1.

5.10.3 Buckles are to be performed with the following tests:

(1) Tensile strength: Select five samples connected by ligatures and place them at ambient temperature of $20 \pm 2^\circ\text{C}$ and relative humidity of $65 \pm 4\%$ for 24 hours. Set the tensile speed of $300 \pm 10\text{mm/min}$ and gauge length of 200 mm for tensile strength tests, and record the maximum tensile strengths when samples are fracturing. The average tensile strength is to meet the requirements of 4.10.1.

(2) Tensile strength after aging: Select five samples and perform illumination tests according to 5.10.1 (2).

After illumination, perform 5.10.2 (1) test, and the test results are to meet the requirements of 4.10.1.

5.10.4 Stitching threads are to be performed with the following tests:

Tailor five samples of stitching threads of 300mm lengths and place them at ambient temperature of $20 \pm 2^\circ\text{C}$ and relative humidity of $65 \pm 4\%$ for 24 hours. Set the tensile speed of $250 \pm 10\text{mm/min}$ and gauge length of 250 mm for tensile strength tests, and record the maximum tensile strengths when samples are fracturing. The average tensile strength is to meet the requirements of 4.10.1.

5.10.5 Buoyancy core materials should be performed with the following test:

Select 12 buoyancy core materials of lifejackets and perform the following tests. The samples' sizes are to be $300\text{mm} \times 300\text{mm} \times 25\text{mm}$ and are to be recorded at the beginning and the end of the test.

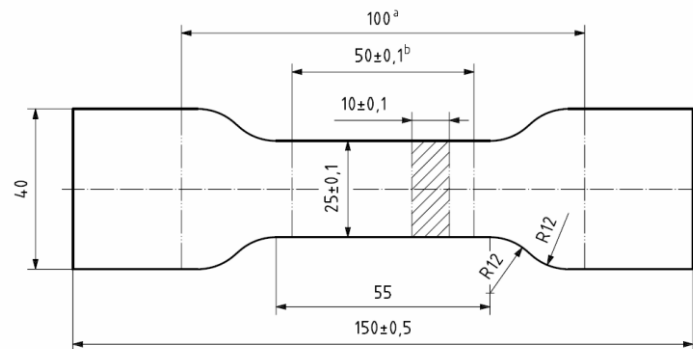
(1) Temperature cycling: The test is to be performed in accordance with 5.3. After the test, check the appearance of samples and cut up two samples to check their internal structures, while the test results are to meet the requirements of 4.9.1.

(2) Compression and water absorption: The test is to be carried out in fresh water. Immerse each sample under the water head of 1.25m for 7 days, then measure and record the buoyancy of 1 and 7 days immersion, the results are to meet the requirements of 4.10.3 (3).

The test is to select the following samples:

- ① 2 samples under supply condition;
- ② 2 samples having been through the temperature cycling tests as 5.8.5 (1) specified;
- ③ 2 samples having been through the temperature cycling tests of 5.8.5 (1) and the diesel oil resistance test of 4.10.3 (2) where after;

(3) Tensile strength: The tensile strength at fracturing time is to be performed before the group tests specified in 5.8.5 (2) ③. Each group is to select 10 pieces of samples in 5 warps and 5 wefts (the dumbbell shaped samples are to be taken as Figure 5.10.5), while the sample thickness is not to exceed 10mm and the tensile speed is to be 50mm/min when both ends of samples are fixed in the machine chucks. Record tensile force values when samples are broken. The tensile forces of samples are to be not less than 140kPa at the original state, and the tensile strength reduction after group tests are not to exceed 25% of the original state.



In the figure, “a” is the distance between chucks (mm); “b” is the effective area of breaking (mm)

Figure 5.10.5

6. Inspection rules

6.1 Inspection classification

6.1.1 Lifejacket inspections include type inspection and factory inspection.

6.2 Type inspection

6.2.1 Lifejackets are to be carried out with type inspection under one of the following conditions:

- (1) Identification of new products (fixed types);
- (2) Significant changes in structures, materials, crafts, etc., which are enough to affect product performances or qualities;
- (3) Every five years after mass production;
- (4) Resume production after being suspended for more than 2 years;
- (5) Requested from the competent authorities.

6.2.2 The inspection items and sequences of life jacket type inspection are to be carried out in accordance with Table 6.2.2.

表6.2.2

No.	Inspection Items	Type Inspection	Factory Inspection
1	appearance	×	×
2	sewing requirements	×	×
3	force	×	—

4	buoyancy and buoyancy loss	×	×
5	temperature cycling	×	—
6	flame resistance	×	—
7	wear	×	—
8	flooding performance	×	—
9	diving	×	—
10	material	×	—

Note: ① “×” is always checked;
② “—” is never checked.

6.2.3 Samples for the type inspection of lifejackets are 4 pieces.

6.2.4 If the test items of samples all meet the requirements, the type inspection for lifejackets is to be construed as qualified. If one of the items fails to meet the requirements, the type inspection for lifejackets is to be failed.

6.3 Factory inspection

6.3.1 The inspection items of lifejackets factory inspection and sequences are to be carried out in accordance with Table 3.

6.3.2 The lifejacket appearance and processing quality are to be checked one by one; other items are to be sampled, the lifejackets processed with same techniques, same materials, and produced consecutively are to be construed as the same batch, and each batch is to include 2000 pieces, while pieces less than 2000 may also be counted as one batch. 2% of the batch are to be sampled. If the 2% of the batch fails to reach 2, then 2 pieces are to be sampled.

6.3.3 Only all inspection items for lifejackets meet the requirements, can the factory inspection be determined as qualified. If the appearance, processing quality and accessories fail to meet the requirements, re-inspection is allowed to be performed after renovation. If the re-inspection meets the requirements, the factory inspection may be determined as qualified; however, if the re-inspection still fails to meet the requirements, the factory inspection of lifejackets is to be construed as disqualified. Reduplicated sampling is to be taken for re-inspection in case one of other items fails to meet the requirements. If the re-inspection meets the requirements, the factory inspection may be determined as qualified; if the re-inspection still fails to meet the requirements, the factory inspection of lifejackets is to be construed as disqualified.

7. signs, packaging, transportation and stowage

7.1 signs

7.1.1 The lifejackets passed in factory inspection are to be marked with symbols, including:

- (1) Name and type of lifejacket;
- (2) Manufacturing standards of lifejacket;
- (3) Inspection marks from Inspection agency;
- (4) Name of manufacturer, date, number or batch number of production.

7.2 Packaging, transportation

7.2.1 Lifejacket packaging are to be able to prevent erosion from rains and snows and avoid damages in transportation.

7.3 Stowage

7.3.1 Lifejackets are to be stowed in a dry warehouse without being squeezed.

CHAPTER 5 RADIOCOMMUNICATION EQUIPMENT

Section 1 GENERAL PROVISIONS

5.1.1 General requirements

5.1.1.1 The design, construction and test of the marine radiocommunication equipment are to comply with the relevant requirements of this Chapter, or the Guidelines of the Standards recognized by the CCSISC.

5.1.1.2 Any self-propelled ship is to be capable of transmitting and receiving the following communications:

- (1) Ship-to-ship communications;
- (2) Ship-to-shore and shore-to-ship communications.

Unless otherwise specified in this Chapter, the ships may comply with item (1) above mentioned.

5.1.1.3 The radiocommunication equipment which is fitted in accordance with the requirements of this Chapter, is to provide the following functions of communications:

- (1) Distress and safety communications;
- (2) General radiocommunications.

At all time, the distress call and communications are to be ensured to be made prior to other communication.

5.1.1.4 Each self-propelled ship must be provided with the equipment capable of receiving navigation safety information

5.1.1.5 Radiocommunication equipment (other than the portable ones) are to be powered by two power supplies, one is the ship's main source of electrical power which is powered by the individual feeder line of the main switchboard or the sub-switchboard of nav aids; the other one is emergency power supply or temporary emergency power supply or special power supply provided for radiocommunication equipment. The power-on time of such special power supply may not less than 1hour.

For the ships of which main sources of electrical power are equipped in accordance with the requirements of 2.3.3.2 (1) and 2.3.3.3 of this Part can be powered only by the main sources of electrical power.

5.1.2 Terms and definitions

5.1.2.1 *Radiocommunication Equipment* means the equipment conducting communication by radio wave in space, except ship's internal communication equipment.

5.1.2.2 A *ship Station* means a mobile station engaged in mobile communication service on waterways and installed on board a ship which does not lie permanently at anchor, except survival craft station.

5.1.2.3 A *coastal station* means a land station engaged in mobile communication service on water- ways.

5.1.2.4 *Navigation safety information* means navigational and meteorological warnings, meteorological forecasts and other urgent safety related messages broadcasted to ship.

5.1.2.5 A *navigation safety snformation receptor* means the radiocommunication equipment which receives navigation safety information.

5.1.2.6 A *general Radiocommunication* means operational and public correspondence traffic, other than distress, urgency and safety messages.

Section 2 PROVISION OF RADIOCOMMUNICATION EQUIPMENT ON BOARD

5.2.1 Provision

5.2.1.1 Passenger ships, pusher (tug) ships and cargo ships are to be provided with radiocommunication equipment in accordance with the requirements given in Table 5.2.1.1 (1) groups of ships and Table 5.2.1.1 (2)

minimum quota of radiocommunication equipment.

Table 5.2.1.1 (1)

Type of ship ^①	Group 1	Group 2	Group 3
Passenger ship (category)	Passenger ships of Category I and II	Passenger ships of Category III and IV	Passenger V
Pusher (tug) ship (kW)	≥883	368≤~<883	88≤~<368
Cargo ship (GT)	≥1000	300≤~<1000	100≤~<300

Notes: ① The categories of passenger ships refer to the provisions stipulated in Section 2, CHAPTER 1 of this Part;

kW refers to total power of propelling machinery of ship.

GT refers to gross tonnage of ship.

Table 5.2.1.1 (2)

No.	Description	Symbol	Frequency	Working category	Quantities according to groups of ships		
					Group 1	Group 2	Group 3
1	VHF radiotelephone	VHF	156~174MHZ	F _{3E} or G _{3E}	2	1 ^①	1
2	Outward broadcast apparatus				1	1	1
3	Navigation safety information receiver ^②				1	1	1

Notes: ① Passenger ships in Group 2 are to be provided with two VHF radiotelephone.

② If other equipment is capable of receiving navigation safety information, The MF/HF radio installation may be dispensed with.

5.2.2 Special requirements on provision

5.2.2.1 Except for passenger ships, pusher (tug) ships and cargo ships, all other self-propelled ships which are not mentioned in this Chapter, such as working ships, beacon vessels, supply ships etc., are to be treated as the cargo ship of the same gross tonnage (GT).

5.2.2.2 For ro-ro passenger ships type 1 and type 2, the radiocommunication equipment are to be provided according to Group 1 in table 5.2.1.1 (2).

5.2.2.3 The fire fighting ships, are to be provided with radio equipment according to the relevant requirements of pusher (tug) ships given in Table 5.2.1.1.(1) and 5.2.1.1.(2), based on the total power of propelling machinery of this ship.

5.2.2.4 For the ships which are provided with collective life-saving equipment in accordance with the requirements of 4.2.4 of this Part, two portable VHF's are to be fitted with.

5.2.2.5 Pusher (tug) ships that total propelling machinery power is less than 88kW and cargo ships less than 100GT are to be at least fitted with one portable VHF (or VHF), one portable outward broadcast apparatus and one navigation safety information receiver.

5.2.2.6 Non-self-propelled ships, such as passenger barges, dangerous cargo barges, oil barges carrying crude oil with a flash point less than 60°C and manned barges more than 600GT etc. are to be at least provided with one portable VHF (or VHF) and one portable outward broadcast apparatus.

5.2.2.7 For vehicle-passenger ferries and pushers (tugs) pushing (tugging) the fleet consisting of pushers (tugs) and vehicle-passenger ferry barges, the radiocommunication equipment are to be provided according to the requirements for passenger ships in Table 5.2.1.1. (1) and 5.2.1.1 (2).

5.2.2.8 For passenger ferries engaged on the voyages of continuous upstream duration more than half an hour but no more than one hour, calculated from departure position to destination position, and engaged in short distance transportation between the fixed wharfs at the banks, the radiocommunication equipment are to be provided according to the requirements for passenger ships of category V in Table 5.2.1.1. (1) and 5.2.1.1 (2).

Section 3 BASIC TECHNICAL REQUIREMENTS FOR RADIOCOMMUNICATION EQUIPMENT

5.3.1 Environmental conditions

5.3.1.1 The radiocommunication equipment are to be capable of normal operating under following environmental conditions:

(1) Ambient air-temperature

- High temperature + 55 °C;
- Low temperature - 10°C (for closed spaces);
- 25°C (for open decks).

(1) Humidity

- Relative humidity is 95%±3% at an ambient temperature of 40°C and below;
- Relative humidity is 70%±3% at an ambient temperature of over 40°C.

(2) Inclination

- List up to 10°;
- Trim up to 5°.

(3) The vibration, shock, oil vapors and moulds likely to arise under normal service of ships;

Unless otherwise specified, environmental testing of radiocommunication equipment are to carry out in accordance with Type Test Procedure of the Marine Electrical and Electron Produce in effect at the time and relevant national standards.

5.3.2 Power supply

5.3.2.1 The radiocommunication equipment are to be capable of normal by operating under the following voltage variation and frequency fluctuation of the power supply:

(1) Voltage:

- Supplied by generating set: ±10% of the rated voltage;
- Supplied by accumulator battery: +30% ~ -25% of the rated voltage.

(2) Frequency: ±5% of the rated frequency.

5.3.2.2 Means are to be made for protection of the interior components of the radio equipment from damage as a result of wrong sequence in the controls or due to overcorrect, ultra-voltage, transient current and reversal of the power supply polarities.

5.3.3 Electromagnetic interference

5.3.3.1 A reasonable and practicable measure is to be made for the elimination and suppression of the electromagnetic interference between radio equipment and other shipborne equipment.

5.3.3.2 For the equipment installed near standard magnetic compass or steering magnetic compass, the minimum safety distance between the equipment and the magnetic compass is to be indicated on the equipment.

5.3.4 Protection for safety

5.3.4.1 All radiocommunication equipment are to have security measures and easy for maintenance.

5.3.4.2 The enclosure of radio equipment are to be such a protection type as appropriate to the sit where the equipment is installed.

5.3.4.3 The enclosure of radio equipment are to, as far as practicable, be capable of being opened without application of any tools and, when the enclosure is being opened, the capacitors fitted in the high voltage circuits of transmitters are to be capable of being automatically discharged.

5.3.4.4 The enclosure of radio equipment are to be provided with a reliable earthing connection, and any terminal of the power supply are to be not grounded.

5.3.4.5 Any component of radiocommunication equipment with a peak voltage of more than 55V are to be so protected that it cannot be inadvertently touched and are to be fitted with an appropriate warning mark.

5.3.4.6 Proper measures are to be taken to prevent from damage to operators due to the radiation of

radio-frequency electromagnetic energy.

5.3.5 Operation control

5.3.5.1 The operational control units of the radiocommunication equipment are to be so designed that the quantity, functions and arrangement are to, as far as practicable, be simple, quick and efficient.

5.3.5.2 Each control unit is to be arranged to reduce wrong handling as far as possible. In the event of a wrong handling having been happened to a certain control unit, measure are to be taken to prevent the radiocommunication equipment from being damaged and operators from being injured.

5.3.5.3 Sufficient lighting illumination are to be provided for radiocommunication equipment to enable identification of the control units and monitor instruments at any time. The illumination may be an adjusted, if necessary.

5.3.5.4 During normal operation, the control units and the monitor instruments are to be easy to adjustment and identification. The control units which aren't frequently to be handled are to be not arranged in the site where persons are easy to nearness.

5.3.5.5 The radiocommunication equipment are not to vary its own normal functions when a certain component of the equipment being connected with other device.

5.3.5.6 If a digital input panel of the radiocommunication equipment is marked with numbers "0" to "9", the arrangement of these numbers are to comply with the requirements of recommendation E161/Q11 of International Telegraph and Telephone Consultative Committee [CCITT].

5.3.6 External connection

5.3.6.1 The radiocommunication equipment are to be provided suitable external connection when necessary.

5.3.6.2 All external connections, where nearby, are to have identification markings.

5.3.7 Nameplates

5.3.7.1 Any radiocommunication equipment is to be fitted with the identification nameplate on which the name of manufactory (marking), series number of product and approval marking of the Administration are to be indicated.

Section 4 INSTALLATION OF RADIOCOMMUNICATIN EQUIPMENT

5.4.1 General requirements

5.4.1.1 The radiocommunication equipment (except portable) are to be fixedly located in wheelhouse. When the ships happen to inclination, vibration and shock in service, the equipment would not move and remain to normal operation.

5.4.1.2 The radio equipment are to be installed easily to be adjusted, operated and maintained, and be located not less than 50mm apart from the bulkhead.

5.4.1.3 The feeder connected between radiocommunication equipment and lead-in of antenna are to be as short as possible.

5.4.1.4 Radiocommunication equipment are to be installed in the position free from harmful interference generated by machinery, electrical disturbance or other interference sources in order to ensure the electromagnetic compatibility and avoid the mutual interference between the radiocommunication equipment and other equipment or systems.

5.4.1.5 Operation regulation for radiocommunication equipment are to be fitted in the position where the equipment is installed so as to make distress and safety communication accurately and rapidly.

5.4.2 Selection of antennas

5.4.2.1 Antenna assembly are to be selected based on the frequency bandwidth, communication distance, ship's principal dimensions, etc. in order to obtain high gain directivity.

5.4.2.2 The transmitting antenna are to have appropriate power capacity and be with a structure capable of eliminating corona effect. The receiving antenna are to be highly capable of receiving signal and anti-interference.

5.4.2.3 Measures are to be taken to match the input impedance (or radiating resistance) of antenna with the characteristic impedance of feeder, and to match the characteristic impedance of feeder with the output impedance of transmitter or the input impedance of receiver, in order to ensure high efficiency of radiocommunication.

5.4.3 Installation

5.4.3.1 The antenna and down-lead wire is to be located, as far as possible, far away from ship's metal structures such as funnels, ventilators, masts and superstructures, with a space of not less than 1m.

5.4.3.2 The insulation resistance of antenna in relation to ship's hull is to be not less than 20M Ω in dry weather, and not less than 2 M Ω under excessive humidity, when tested with a DC 1000V megameter.

5.4.3.3 The antenna is to be protected from thunder striking. Where the antenna is located outside protective range of ship's lighting conductor, another separate lighting conductor are to be additionally provided.

5.4.4 Installation of loudspeaker of outward broadcast apparatus

5.4.4.1 The loudspeaker is to be installed in the position from which the information delivered by wheelhouse can be transmitted to any direction.

Section 5 TECHNICAL REQUIREMENTS FOR VHF

5.5.1 General requirements

5.5.1.1 VHF radiotelephone (hereafter referred to as VHF) is applicable to radiotelephone communication between ship and ship or ship and shore with regard to mobile communication service for near distance on waterways.

5.5.1.2 VHF's are to be capable of operating on single-frequency or on single and two-frequency channels. It isto be possible to transmit/receive distress and safety information between ship and ship or ship and shore on channel 6 (156.3 MHz).

5.5.1.3 The VHF isto comprise at least as follows:

- (1) a transmitter/receiver (including loudspeaker);
- (2) an antenna (vertically polarized type);
- (3) a telephone handset with a press-to-transmit;
power supply device (additional).

5.5.2 Main technical requirements

5.5.2.1 The main technical requirements of VHF's are to be as follows:

- (1) frequency's range: 156.0~174MHz;

There are to be sufficient quantities of channels within such frequency range. The channel 6 (156.3MHz), channel 16 (156.8MHz) and another channel is to at least be available.

- (2) frequency range operating on single-frequency channels:156.3 ~ 156.875MHz;
- (3) frequency range operating on dual-frequency channels:

Transmit frequency band: 156.025 ~ 157.425MHz;

Receiving frequency band: 160.625 ~ 162.025MHz.

- (4) class of emission: F₃E or G₃E;
- (5) frequency tolerance: $\leq 10 \times 10^{-6}$;
- (6) neighboring channel interval: 25 kHz.

5.5.3 Operating control of VHF

5.5.3.1 The VHF is to be in normal work within 1 min after switched on while there is to be a visual indication after switched on.

5.5.3.2 The VHF is to be capable of indicating the operating channel number and displaying the visual indication.

5.5.3.3 The changing time taken to switch from the transmit to the receive condition, and vice versa, is not to exceed 0.3s; the switching time of channel is not to exceed 5s; during switching, the VHF is to be not under transmitting condition.

5.5.3.4 The transmitting output power is not to exceed 25W, and devices are to be provided for reducing the transmitting output power to a value of 1W or below.

5.5.3.5 The receiver is to meet the following requirements:

- (1) The sensitivity of receiver is to be equal to or higher than 2 μ V when signal-to-noise ratio reaches 20dB;

- (2) The disturbance rejection is to be so ensured that the wanted signal is not seriously affected by unwanted signals;
- (3) A manual volume control is to be fitted in order to vary audio output of the receiver;
- (4) The receiver is to be provided with squelch control;
- (5) The press-to-transmit switch for changing from transmission to reception is to be fitted when operating on single-frequency channels. Additionally, facilities for operating on dual-frequency channels may be provided.

5.5.3.6 Except protection devices, when the antennae circuit is operated and the antenna terminals are shorted, the VHF is to be not damaged.

5.5.3.7 Loudspeakers and telephone handset are to comply with following requirements:

- (1) The receiver output power is to be suitable for the loudspeaker and telephone handset. The audio output is to be sufficient to be heard in the ambient noise level likely to be encountered on board ships;
- (2) It is to be possible to switch off the loudspeaker without affecting the audio output of the telephone handset, if provided;
- (3) In the transmit condition during simplex operation, the output of receivers is to be reduced;
- (4) In the transmit condition during simplex operation, only the telephone handset is to be in circuit. Care are to be taken to prevent any electrical and audio feedback, which could cause singing.

5.5.3.8 The VHF antenna is to be vertically polarized and, as far as practicable, be omnidirectional in the horizontal plane. In addition, the antenna is to be suitable for efficient radiation and reception for signals on operating frequency.

Section 6 TECHNICAL REQUIREMENTS FOR PORTABLE VHF RADIOTELEPHONES

5.6.1 General requirements

5.6.1.1 Portable VHF radiotelephone is applicable to on-scene radiotelephone communication between ship and ship or between ship and survival craft (or craft).

5.6.1.2 Portable VHF radiotelephones are to be capable of operating on single frequency channel. It is to be possible to transmit/receive distress and safety information between ship and ship or between ship and survival craft (or craft) on channel 16 (156.8MHz), and also collision avoidance information between ship and ship on channel 6 (156.3MHz).

5.6.1.3 The p-VHFs are to be an integrate equipment comprised at lease transmitter, receiver, antenna, battery, microphone with press-to-transmit switch and loudspeaker.

5.6.1.4 The p-VHFs are to meet the following using requirements:

- (1) It is to be possible to be operated as simply as possible by unskilled personnel with single hand, other than the channel selection switch;
- (2) The enclosure of p-VHFs are to be not easily broken when collided and provided with a protection class not less than IP55;
- (3) There are to be provisions for its attachment to the clothing of user;
- (4) When prolonged exposed to sunlight, the performance of p-VHFs are to be resistant to deterioration.

5.6.2 Main technical requirements:

5.6.2.1 The main technical requirements of p-VHFs are to be as follows:

- (1) Frequency range: 156.3~156.875MHz (on single frequency channel);
Channel 16 (156.8MHz), Channel 6 (156.3MHz) and another one channel is to be at least possessed within such frequency range.
- (2) Class of emission: F₃E or G₃E;

- (3) Frequency tolerance: $\leq 10 \times 10^{-6}$.

5.6.3 Operating control

5.6.3.1 The operating control of p-VHFs is to generally meet following requirements:

- (1) The VHFs are to be in normal work within 5s after switched on while there is to be a visual indication after switched on;
- (2) The p-VHF are to be provided with easily controlled channel selection switch and indication marks for identifying channel number, especially for channel 16;
- (3) The output power of the transmitter is to be generally controlled within 0.25w to 1w; when the output power exceeds 1W, devices to reduce the power to 1W or less are required;
- (4) The receiver is to meet following requirements:
 - ① The sensitivity of receiver are to be equal to or higher than $2\mu\text{V}$ when signal-to-noise ratio reaches 12dB;
 - ② The disturbance rejection is to be so ensured that the wanted signal is not seriously affected by unwanted signals;
 - ③ A manual volume control is to be fitted in order to vary audio output of the receiver;
 - ④ The audio output of the receiver is to be sufficient to be heard in the ambient noise likely to be encountered on board ship or survival craft (or raft);
 - ⑤ A squelch control is to be provided;
- (5) The p-VHF is to be not damaged due to the effects of opening circuiting or short-circuiting the antenna;
- (6) The antenna is to be vertically polarized and, as far as practicable, be omnidirectional in the horizontal plane. In addition, the antenna is to be suitable for efficient radiation and reception of signals on operating frequency.

5.6.4 Power supply

5.6.4.1 The primary battery of the p-VHF is to have sufficient capacity to ensure 4hours' operation at its highest rated power with a duty cycle of 1:9. The duty cycle is defined as 6s transmission, 6s reception above squelch operating level and 48s reception below squelch operating level.

5.6.4.2 The p-VHF is to be still equipped with at least one set of reserve battery with the same capacity.

5.6.4.3 The expiry date of the primary batteries is to be clearly marked on the exterior of the battery.

Section 7 TECHNICAL REQUIREMENTS FOR OUTWARD BROADCAST APPARATUS

5.7.1 General requirements

5.7.1.1 The outward broadcast apparatus are applicable to single-direction voice communication to around adjacent ships and to nearer bank of waterway.

5.7.1.2 The outward broadcast apparatus are to at least comprises as following:

- (1) A amplifier;
- (2) A loudspeaker;
- (3) A microphone (including the pickup);
- (4) A radio and antenna (if provided).

The amplifier may either be as a part of marine command broadcasting apparatus or be a separate device.

5.7.1.3 The broadcasting apparatus are to be provided a minimum output power of not less than 25 (other than portable).

5.7.1.4 The broadcasting apparatus fitted on board pusher (tug) ship-team are to be provided with sufficient volume output power in order that the voice conducted is able to be efficiently heard throughout

from an end of ship-team to another end of ship-team.

5.7.1.5 Principal technical requirements of the broadcast apparatus are to be as follows:

- (1) Pass-band: 150 ~ 5000Hz;
- (2) Frequency response (non-uniformity within the range of pass-band): $\leq 2\text{dB}$;
- (3) Non-linear distortion: $\leq 7\%$;
- (4) Signal-noise ratio: $\geq 46\text{dB}$.

5.7.2 Operating control

5.7.2.1 The operating control of outward broadcasting apparatus are to generally comply with the following requirements:

- (1) The apparatus are to be in normal work with a visual indication after being powered on for 1s;
- (2) A master control switch or a power switch is to be provided;
- (3) A manual volume control is to be fitted;
- (4) A selection switch capable of changing functions accurately and rapidly is to be provided;
- (5) Power indicating devices are to be provided to give information when nominal output power is equal to or higher than 250W.

5.7.2.2 In case the rated output power of the outward broadcasting apparatus may be equal to or higher than 50W, reliable electric protective devices are to be equipped to ensure the apparatus will be not damaged due to load open circuit or short circuit.

5.7.2.3 The output power and impedance of loudspeaker are to match with that of amplifier.

5.7.2.4 The broadcasting apparatus are to be in stabilization and may not produce obvious audio singing.

5.7.3 Miscellaneous

5.7.3.1 If the apparatus is fitted with radio, the technical requirements of the radio are to be designed in accordance with relevant national standards.

5.7.3.2 The portable broadcasting apparatus are to be capable of ensuring clear voice to be transmitted and are to be designed according to national relevant industry standards or equivalent standards.

5.7.3.3 The portable broadcasting apparatus are to be at least equipped with one set of reserve battery with the same capacity or one auto-charging equipment.

Section 8 TECHNICAL REQUIRMENTS FOR NAVIGATION SAFETY INFORMATION RECEIVERS

5.8.1 General requirements

5.8.1.1 The navigation safety information receiver is used to receive navigational and meteorological warnings, meteorological forecasts and other urgent safety related messages via radio-wave.

5.8.1.2 For pushers (tugs) with a total power of propelling machinery of less than 88kW and cargo ships with a gross tonnage of less than 100GT, it is possible for only to receive meteorological warnings or meteorological forecasts.

5.8.1.3 The information receiver is to be generally a separate single-direction radio-receiver or be an integration made up with other radio equipment together.

5.8.1.4 The information receiver is to generally consist of antenna, receiver, loudspeaker and power supply (for addition), etc.

5.8.2 Main requirements

5.8.2.1 For the information receiver, operation frequency and working category (corresponding to emission class of transmitting station) are to conform with those of transmitting station in order to ensure that the relative meteorological and navigation safety information are received accurately, rapidly and clearly when the ships are normally in service.

5.8.2.2 If the information receiver is a constituted part contained in the radio- communication equipment give in Table 5.2.1.1(2) of this Part or a constituted function thereof, the relevant technical requirements suitable for the information receiver are to remain unchanged. If the information receiver is a separate single-direction receiver, the relative national or industry technical standards are to be complied with.

5.8.2.3 The information receiver is to have a minimum output power of not less than 6W.

5.8.2.4 Operating control of the information receiver are to at least meet the following requirements:

- (1) The apparatus are to be in normal work with a visual indication after being powered on for 1s;
- (2) A master control switch or a power switch is to be provided;
- (3) A manual volume control is to be fitted.

5.8.2.5 The information receiver, as far as practicable, is to be so designed as to have the following auto-control functions:

- (1) Self-identification information function. Before the information is coming, the alert identification signal is to be able to be received.
- (2) Auto-watch keeping function. The information receiver must be in mite without alert identification signal or safety information .
- (3) Auto-recording function. It is possible to record, display or print the navigation safety information automatically.

5.8.3 Power supply

5.8.3.1 For the information receiver with self-supplied battery, the battery is to have capacity capable of operating 4h continuously and provide at least one set of reserve battery with the same capacity or one auto-charging device.

CHAPTER 6 NAVIGATIONAL EQUIPMENT

Section 1 GENERAL PROVISIONS

6.1.1 General requirements

6.1.1.1 Design, manufacture, installation and test of navigational equipment are to comply with the relevant provisions of the present Chapter or applicable provisions of standards accepted by [CESISC](#).

6.1.1.2 Navigational equipment are to be so constructed and installed that it is readily accessible for operation, inspection and maintenance, and a precaution against inadvertently touching dangerous voltage within the equipment are to be provided for operation and for repair and test in case of enclosure to be opened.

6.1.1.3 The protection type of enclosure for navigational equipment is to be appropriate to the conditions of the location where such equipment is installed.

6.1.1.4 The casing of navigational equipment is to be provided with a reliable earthing connection provided that neither terminal of the source is not caused to be earthed.

6.1.1.5 Operation gears of navigational equipment are to be marked with clear and durable symbols and words to indicate its purpose and operation.

6.1.1.6 All living parts except earthing points of antenna and casing are to be located within the enclosure.

6.1.1.7 Navigational equipment are to be provided with a device to fix external wiring.

6.1.1.8 Circuit and constructor of navigational equipment are to be provided with a precaution against damaging the equipment due to inadvertent operation.

6.1.1.9 Navigational equipment are to be provided with sufficient illumination to enable identification of control and clear reading of display at all times. A dimmer are to be provided.

6.1.1.10 The minimum allowable thermal insulation resistance of navigational equipment is to be not less than the values shown in Table 6.1.1.10.

Table 6.1.1.10

Navigational equipment	Item of equipment	Value of insulation resistance (MΩ)
Radar	Power supply system	1.0
	High-frequency circuits	10.0
Echo-sounding equipment	The whole system	1.0
	Oscillator (measured with 1000V megohm meter)	10.0
Other equipment		1.0

Note: Unless otherwise specified, the megohm meter applied in measuring is to be not less than 500V in voltage.

6.1.1.11 Navigational equipment are to be provided with a nameplate indicating the manufacturer, type and serial number and an approval mark.

6.1.1.12 Radars are to be supplied by separate feeder from the main switchboard. Radar using D.C.24V power source may be supplied by separate feeder from the battery charging/discharging panel.

6.1.1.13 Echo-sounding equipment are to be supplied by separate feeder from the distribution switchboard for navigation aids.

6.1.1.14 The illumination for the card are to be supplied by the main power source and emergency power source (if any), and may only be supplied by the main power source if the diameter of the card is less than 100mm.

Section 2 NAVIGATIONAL EQUIPMENT ON BOARD

6.2.1 Navigational equipment on board

6.2.1.1 Navigational equipment of passenger ships (including ro-ro passenger ships type 1 and type 2, vehicle-passenger ferries), cargo ships and pushers (tugs) are to be provided, respectively depending on the areas of navigation, passenger ship categories, and gross tonnage (GT) of cargo ships or total rated power (kW) of pushers (tugs) in accordance with the requirements of Table 6.2.1.1.

Table 6.2.1.1

No	Name of navigational equipment	Area of navigation	Minimum amount required (set)								
			Passenger Ships (categories) ^①			Cargo Ships (GT)			Pusher (Tugs) (kW)		
			Category 1 and 2	Category 3 and 4	Category 5	≥1000	300≤~<1000	<300	≥883	368≤~<883	<368
1	Magnetic compass	A	1	1		1	1	1	1	1	1
		B ^②	1	1		1	1		1	1	
2	Radar ^③	A	1	1	1	1			1		
		B	1	1	1	1			1		
3	Depth Sounder	A	1			1			1		
		B	1			1			1		
4	Searchlight ^④	A, B, C	2	2	1	2	2	1	2	2	1
		J ₁ , J ₂	3	3	2	3	3	2	3	3	2
5	Rudder indicator	A, B, C	1	1	1	1	1	1	1	1	1
6	Main engine or propeller speed indicator	A, B, C	1	1	1	1	1	1	1	1	1
7	Hand lead	A, B, C	To be equipped according to actual needs								

Notes: (1) The categories of passenger ships refer to the provisions stipulated in Section 2 of CHAPTER 1 of this Part.

(2) Means the lakes in Service Area B;

(3) Passenger ships of category 4 and 5 need not be provided with radars provided that they do not navigate in night or in fog. For passenger ships type 1 and type 2, cargo ships with gross tonnage of 1000 or above and tugs with the total power of propeller of 883kW or above, the diameter of the radar display is to be not less than 180mm;

(4) The rated power of searchlight are to be not less than 1kW when the main electrical power source is generated by generating sets independent of main engine that is fitted according to 2.3.3.1 and 2.3.3.2 of this Part and the power supply for lighting is A.C.220V. When new light source is adopted, the luminous flux or light intensity is to be not less than that of 1kW incandescent searchlight. The rated power of searchlight is to be not less than 0.1kW when the storage battery sets are used as the main electrical power source.

At least one incandescent searchlight is to be provided as a standby searchlight for the ship. The ship which does not navigate at night may be exempt from the provision of searchlight.

6.2.2 Special requirements for navigational equipment on board

6.2.2.1 Except passenger ships, cargo ships and pushers (tugs), navigational equipment for other self-propelled ships are to be provided in accordance with the requirements for the cargo ships navigating in the same service areas and with the same gross tonnage (GT).

6.2.2.2 Non-self-propelled ships may be provided with navigation equipment as needed.

6.2.2.3 The ships are to be fitted with certain hand leads, bulkhead clocks, inclinometers, binoculars and so on.

6.2.2.4 Ships with the gross tonnage of 100 or above are to be fitted with a grade A or B shipborne automatic identification system (AIS). Grade A AIS are to meet IEC 61993-2 Maritime Navigation and Radiocommunication Equipment and Systems-Automatic Identification Systems (AIS)-PART TWO: Class A Shipborne Equipment of the Universal Automatic Identification System (AIS)- Operational and Performance Requirements, methods of test and required test results. Grade B AIS are to meet IEC 62287-1 Maritime Navigation and Radiocommunication Equipment and Systems-Class B Shipborne Equipment of the Automatic Identification System (AIS)- Part 1: Carrier-sense time Division Multiple Access (CSTDMA) Technique.

6.2.2.5 Passenger ships and liquid cargo ships with the gross tonnage of 1000 or above are to be fitted with a shipborne electronic chart system (ECS).The shipborne electronic chart system is to meet the requirements of IMO MSC.232 (82) resolution on Electronic Chart Display and Information System (ECDIS).

Section 3 INSTALLATION OF NAVIGATIONAL EQUIPMENT

6.3.1 Installation of magnetic compasses

6.3.1.1 The magnetic compass is to be installed in such a place that the effect of ship's magnetic field is at its minimum and is to meet the requirements in Table 6.3.1.1 as much as possible. If the magnetic compass is installed near the fore bulkhead of wheelhouse, it is to be ensured not to affect the normal operation of magnetic compass. Standard compasses are to be as far as possible from fixed or movable steel parts.

Table 6.3.1.1

Name of material	Bulkhead & Other magnetic metal structure	Deck above the top of compass	Electrical & radio navigational aids	Searchlight of less than 500W	Searchlight of 500W or more
The minimum distance from magnetic compass (m)	1	1	To be determined according to the requirements of specification	2	2.5

6.3.1.2 The magnetic compass is to be installed as far as possible on the longitudinal vertical centerline of the ship. The lubber line is to indicate the ship's heading with an accuracy of $\pm 0.5^\circ$. If the magnetic compass is installed aside, the center line of compass is to be ensured to parallel with the longitudinal vertical centerline of ship, its error is to be not more than $\pm 0.5^\circ$.

6.3.1.3 The vertical axis of magnetic compasses is to keep vertical with the horizontal plane of ship as far as possible in the absence of the ship's trim and list.

6.3.1.4 If the standard compass is provided on board ship, it is to be installed on ship's compass deck so that from its position the view is as uninterrupted as possible, for the purpose of taking horizontal and celestial bearings.

6.3.1.5 The D.C power supply wiring passing the vicinity of the magnetic compass is to be of double-core cable, so as to avoid the strong magnetic field thus induced to affect the changing of the compass deviation.

6.3.1.6 Binnacles for all magnetic compasses installed on board ship, whether they are of desk or stand type, are to be secured with non-magnetic studs to the hard wooden seating or pedestals which are connected firmly to the deck. The height and position of the binnacle are to be suitable for steering and observation.

6.3.1.7 Magnetic compasses on exposed decks are to be equipped with the waterproof case.

6.3.2 Installation of radars

6.3.2 Installation of radar antenna

(1) The radar antenna is to be installed in suitable height depending on the ship's type and special circumstances and considering both measuring far distance objects and minimum ranging.

(2) The radar antenna is to be installed in suitable height depending on the ship's type and special circumstances and considering both measuring far distance objects and minimum ranging;

(3) The radar antenna is to be installed in such a place that the efficiency of display is not affected by other objects near the radar antenna and the heading of the ship are to have the best view;

(4) The radar antenna are to be installed in such a way that the number of bends in the waveguide is to be reduced to a minimum and the compass deck is to be kept watertight at the penetration of the waveguide.

6.3.2.2 Installation of two radars

(1) Where two radars are required to be equipped on board they are to be so installed that each radar can be operated individually and both can be operated simultaneously without being dependent upon another and failure of either radar would not interrupt the power supply to the other radar and not cause adverse affection.

(2) Where two radars operating separately in the S band (10cm band) and in the X band (3cm band) are installed, the antenna of the former is to be arranged higher than that of the latter.

6.3.3 Installation of depth sounders

6.3.3.1 Installation of display of depth sounder

(1) The display is to be installed in the wheelhouse, but single digital display or flashing neon-light display is permitted to install on the operation platform in the wheelhouse;

(2) The continuous recorder is to be installed in such a place that the helmsman is convenient for observation.

6.3.3.2 Installation of oscillator of depth sounder

(1) The oscillators of the depth sounder are to be fitted in the ship's bottom in places least affected by ship's vibration and where no eddy flow and water cavity are likely to be formed;

(2) There is to be no other instruments that work simultaneously with echo-sounding equipment and

produce ultrasonic and no any openings that likely interfere with the sounder in the vicinity of the oscillator. The oscillator is to be fitted as far as practicable from the machinery and electrical equipment that produce noise and electro-magnetic interference on board ship;

(3) The oscillators are to be so installed that their emitting and receiving surfaces are on same horizontal plane and at the same horizontal height in the absent of the ship's trim and list. his provision also applies to the mobile oscillator;

(4) Where an oscillator is fitted in opening of the ship's bottom, its surface is to be even with the surface of hull. If oscillator can not be installed horizontally due to the curvature of hull, the deviation from the horizontal plane is to be not more than $\pm 1.5^\circ$ or to adopt fore-and-aft stream liners.

(5) The oscillators are to be installed in such a way as not to produce any effect on the structural strength and watertightness of hull, upon completion of installation, the watertightness test is to be carried out;

(6) The emitting surface of the oscillators is to be not painted;

(7) The cables connecting oscillator with emitter and receptor are to, if practicable and reasonable, adopt a shielding cable with impervious sheathing e.g. polyvinyl chloride, ploychloroprene, chlorosulphonated-ploythylene, etc. The cables between oscillator and watertight connecting box on the main deck are to be laid in steel pipes;

(8) The enclosure of the sounder, connecting cables and steel pipes are to be effectively earthed;

(9) The oscillators installed in oil-tankers are to provide special airtight compartments or trunks. For ships other than oil-tankers, they are to be, as far as possible, provided with special compartments or trunks which fit with manholes and provide enough space for the purpose of installation and maintenance.

Section 4 TECHNICAL REQUIREMENTS FOR MAGNETIC COMPASSES

6.4.1 General requirements

6.4.1.1 The magnetic compass card is to be graduated in 360 single degrees, starting from North 000° or 360° clockwise to 360° .

Graduation interval is to be 1° , if the diameter of the card is more than 130mm;

Graduation interval is to be 2° , if the diameter of the card is 130mm or less;

Graduation interval is to be 5° , if the diameter of the card is 75mm.

6.4.1.2 The magnetic compass is to be provided with a numerical indication every ten degrees. The cardinal point is to be indicated by the capital letters N, E, S and W, and the corner point, if necessary, is to be indicated by letters NE, SE, SW and NW. The North point may instead be indicated by a suitable emblem.

6.4.1.3 The magnets used for the directional system are to be of high magnetic remanence and are to have a high coercivity of at least 18000A/m. Except correcting elements and indicating magnetic pointer, magnetic compasses are to be made of non-magnetic material.

6.4.1.4 The glass of compass basin are to be clear and bright and have no air bubbles; the compass basin stored liquid is to be absolutely watertight; the liquid stored in compass basin are to be colorless and have no precipitate.

6.4.1.5 The graduation error of four cardinal points N,E,S and W is not to exceed 0.2° .

6.4.1.6 The card of the steering compass is to clearly be readable both in daylight and artificial light at a distance of 1.4m. The use of a magnifying glass is permitted.

6.4.2 Main technical performance

6.4.2.1 The magnetic compass is to operate normally at the ambient air temperature from -20°C to $+60^\circ\text{C}$.

6.4.2.2 The directional error of the magnetic compass (composed of inaccuracies in graduation, eccentricity of the card on its pivot and inaccuracy of orientation of the card on the magnetic system) is not to exceed 1.5° on any heading.

6.4.2.3 The error due to friction is not to exceed $(9/H^8)^\circ$ after a deflection of directional system of 5° at a temperature of $20^\circ\text{C}\pm 3^\circ\text{C}$.

6.4.2.4 The eddying error of directional system is not to exceed $(40/H)$ after the card rotates a revolution by $240\pm 10\text{s}$ at the ambient air temperature of $20^\circ\text{C}\pm 3^\circ\text{C}$, where, H is the horizontal component of the magnetic flux density at its location, in μT .

6.4.2.5 The directional system is to remain a freedom when the compass is tilted up to 10° in any direction. Even if the compass is not suspended in gimbals and is tilted up to 30° , the directional system is to remain a freedom.

6.4.2.6 After a deflection of 40° at a temperature of $20^\circ\text{C}\pm 3^\circ\text{C}$ half a rolling period of directional system are to be not less than that obtained from the following formula:

$$\sqrt{\frac{288}{H}} \text{ s or } 0.06d\sqrt{\frac{18}{H}} \text{ s, whichever is the greater.}$$

where: d --- the diameter of the card (mm).

H --- the horizontal component of the magnetic flux density at its location, in μT .

6.4.2.7 After a deflection of directional system of 90° , the time taken to return finally to within 2.5° from the original point is not to exceed that obtained from the following formula:

$$\sqrt{\frac{64800}{H}} \text{ s or } 0.4d\sqrt{18} \text{ s, whichever is the less.}$$

where: d, H ---samed as defined in 6.4.2.6 of this Section.

6.4.3 Correcting devices and deviation correcting

6.4.3.1 Where the diameter of the compass card exceeds 130mm, its binnacle is to be provided with devices for correcting semicircular and quadrant deviations due to:

- (1) the horizontal components of the ship's permanent magnetism;
- (2) heeling error;
- (3) the horizontal components of the induced horizontal magnetism; and
- (4) the horizontal components of the induced vertical magnetism.

6.4.3.2 The correcting devices are to ensure that no serious changes of deviation occur under the operational and environmental conditions likely to be experienced onboard ships and particularly considerable alteration of magnetic latitude.

6.4.3.3 For magnetic compasses installed, the values of residual deviation as corrected are to comply with the following requirements:

- $\pm 3^\circ$ for the standard compass;
- $\pm 5^\circ$ for the steering compass.

6.4.3.4 Compensation of magnetic compass deviation for the magnetic compass installed on board ship and the preparation of the deviation table are to be carried out not at least once a year. Deviation tables or residual deviation curves are to be available at all time.

6.4.3.5 Compensation of magnetic compasses deviation are to be carried out under one of the following circumstances:

- (1) After every alteration in the construction of a ship or shifting of magnetic material in the vicinity of the compass;
- (2) Before sea trial and putting into service of the new ships constructed;
- (3) After carrying cargoes of appreciable magnetic material;
- (4) After a long berthing of the ship with its position pointed in a particular direction, if the deviation of the compass is found to have changed significantly;
- (5) After sustaining thunder-stroke, fire, collision, strand, or after electrical welding or striking of the hull, if the deviation of the compass is found to have changed significantly;
- (6) When residual deviation exceed the values specified in 6.4.3.3 of this Section;
- (7) After shifting of the compass.

⁸ H is the horizontal component of the magnetic flux density in the location of the magnetic compass, in μT , the same below.

6.4.4 Construction

6.4.4.1 With the exception of the illumination, no electrical power supply is to be allowed for operating the magnetic compass.

6.4.4.2 Magnetic compasses installed on board a ship are to be provided with the following accessories ensuring their normal operation:

- (1) Standard compasses are to be fitted with bearing taking devices with reading accuracy $\pm 0.25^\circ$;
- (2) Steering compasses are to be provided with magnifiers for magnifying the compass card reading;
- (3) Spare compensating magnets.

Section 5 TECHNICAL REQUIREMENTS FOR NAVIGATIONAL RADARS

6.1.1 General requirements

6.5.1.1 Provisions of navigational radars on board a ship are to be of assist to safety navigation of ship. The type of radars is to be selected reasonably depending on the ship's type and area of navigation.

6.5.1.2 The radar under normal navigation conditions of a ship is to be capable of displaying an indication and bearing in regard to other surface vessels, obstructions, buoys, banks of channel, etc. within certain vicinity around this ship, in order to assist to navigation and to avoiding collision.

6.5.1.3 The display unit of the radar is to provide either of the following sets of range scales:

0.75, 1.5, 3, 6, 12, 24 (km);

0.5, 2, 3, 4, 8, 16, 32 (km).

6.5.1.4 Where range scales are provided in accordance with the provisions of 6.5.1.3 of this Section, on the range scales of 0.5(km) and 0.75(km) at least tow range rings are to be provided and on each of the other range scales at least four to six range rings are to be provided.

6.5.1.5 The radar is to clearly indicate the range scales displayed and the distance between range rings at all times.

6.5.1.6 The radar is to be provided with a variable electronic range marker device with a numeric reading of range.

6.5.1.7 It is to be possible to vary the brilliance of the fixed range rings and variable range marker and to remove them completely from the display.

6.5.1.8 The radar is to be capable of properly functioning under the following voltage variations of the power supply:

A.C.: $\pm 10\%$ of the rated voltage, $\pm 6\%$ of the rated frequency.

D.C.: + 30%~ -25% of the rated voltage.

6.5.1.9 The radar is to be provided with devices against overcurrent and overvoltage and accidental reversal of the power supply polarity.

6.5.1.10 If the radar is supplied by several electrical power sources, arrangements for changing from one electrical power source to the other are to be provided. When the radar is changed to the other electrical power source, the radar is to be capable of normally operating immediately.

6.5.2 Range performance

6.5.2.1 The radar under normal condition of transmitting electromagnetic waves, when its antenna is mounted at a height of 10m above the water level, is to give a clear indication of the objects specified in Table 6.5.2.1. When the ship is oscillated and listed up to $\pm 10^\circ$ all objects are to keep to be observed.

Table 6.5.2.1

No.	Dimension of objects	Indicating range (km)
1	Banks of 60m above water-level	20
2	Banks of 6m above water-level	7
3	A ship of 500GT	7
4	A small vessel of 10m in length	3
5	An object such as a buoy having an effective echoing area of approximately 10m ²	2

6.5.3 Main technical performance

6.5.3.1 The main technical performance of radars are to be not less than values specified in Table 6.5.3.1 when radar antenna is mounted at a height of 5m to 10m above the water level.

Table 6.5.3.1

No.	Main technical item	Performance	No.	Main technical item	Performance
1	Minimum ranging	35m	4	Discrimination in range	1.0% of the range scale in use or 30m, whichever is the greater
2	Range accuracy	30m	5	Discrimination in azimuth	±1°
3	Accuracy in azimuth	2.5°	6	Heading error	±1°

6.5.4 Heading indicators

6.5.4.1 The heading of the ship is to be indicated by a line on the display with maximum error not greater than listed in Table 6.5.3.1. The thickness of the displayed heading line is to be not greater than 0.5 degrees.

6.5.4.2 Provisions are to be made to switch off the heading indicator by a device which can not leave in the "heading marker off" position.

6.5.5 Anti-clutter devices

6.5.5.1 Suitable means are to be provided for suppression of unwanted echoes from water clutter, rain, snow and other forms of precipitation, clouds, sandstorms as well as anti-homofrequency asynchronous interference.

6.5.5.2 The anti-clutter controls are to be capable of adjusting manually and continuously and are to be inoperative in fully anti-clockwise positions.

6.5.6 Operation

6.5.6.1 The radar is to be capable of being switched on and operated from the display position. Operational controls are to be accessible and symbols of operational controls are to be easy to identify and use.

6.5.6.2 After switching on from cold, the radar is to become fully operational within 4 min.

6.5.6.3 The radar can be brought to an operational condition from a standby condition within 15 seconds.

Section 6 TECHNICAL REQUIREMENTS FOR ECHO-SOUNDING EQUIPMENT

6.6.1 General requirements

6.6.1.1 The echo-sounding equipment are to be capable of measuring the most depth and the least depth of channels that ship intend to navigate and are to be provided at least with two range scales. It is recommended that the range scale for shallow water is 0 to 10 m and the range scale for deep water is 0 to 100 m (or more). For ships navigating only on shallow water channel, the sounder or portable sounder may be provided with only one range scale of shallow water.

6.6.1.2 The least sounding depth is to be not more than 0.3 m.

6.6.1.3 The indication errors of range scales for shallow water of 0 to 10 m are not to exceed ±1.0%; The indication errors of range scale for deep water of 0 to 100 m are not to exceed ±0.1% or are to comply with the relevant standards.

6.6.1.4 The forms of depth display of the sounder may be digital or a continuous record. The display are to be provided with a warning device which actuates when water depth approaches the depth setting of ship.

6.6.1.5 The depth display or continuous recorder is to be provided with operational controls for switching on the sounder, changing-over range scale and adjusting clarity of depth reading. The sounder is to be capable of being switched on by only one operational action.

6.6.1.6 The proportion on continuous recorder paper tape are to be as big as possible but the record scale is to be not less than 2.5mm per 0.5 meter water depth on the range scale for shallow water.

6.5.1.8 The sounder is to be capable of normally operating under the following voltage variations of the power supply:

(1) A.C.: ±10% of the rated voltage, ±6% of the rated frequency;

(2) D.C.: + 30%~ -25% of the rated voltage.

6.5.1.9 The sounder is to be provided with protection devices against overcurrent, overvoltage and accidental reversal of the power supply polarity.

6.6.1.9 Where the sounder is supplied by several electrical power sources, arrangement is to be made

for changing from one electrical power source to another, when sounder changes to the other electrical power source the sounder is to be capable of normally operating immediately.

Section 7 TECHNICAL REQUIREMENTS FOR OTHER NAVIGATIONAL EQUIPMENT

6.7.1 General requirements

6.7.1.1 Except specified in Sections 4, 5 and 6 of this Chapter, the performance, construction, etc. of the other navigational equipment are to comply with marine technical requirements and they are to be attached with marine product certificates.

6.7.1.2 Bulkhead clocks are to be of good construction with accurate time and capable of working normally under any ship's rolling and pitching conditions.

6.7.1.3 Telescopes are to be so stowed in the boxes that they are readily available. There are to be a soft mats and drying agents in the boxes.

6.7.1.4 Sounding poles are to be a good bamboo pole and are to be painted with depth marks.

6.7.1.5 Sounding plummets are to be made of lead or iron of 3 to 6kg in weight. Its bottom is to have a concave hole for the use of collecting river bottom mud. The fiber rope of 25 to 40m in length is to be provided in accordance with weight of plummet and is to be with length marks.

6.7.1.6 The nautical information such as charts, navigation guides, lists of tide and navigation notes are to be provided on board depending on the need for service areas.

CHAPTER 7 SIGNALS

Section 1 GENERAL PROVISIONS

7.1.1 General requirements

7.1.1.1 Signals of ships engaged on the river at territorial boundaries are to be provided in accordance with an agreement or accord signed by China government with neighboring country governments.

7.1.1.2 Provisions of additional signal lights specially prescribed by port authorities or required by owners are to be taken into account but provisions of Signals specified in this PART can not be affected.

7.1.1.3 Where it is impracticable for Signals to comply fully with the provisions of this PART due to special construction and purpose of ship, such non-compliance are to be approved by [CCSISC](#).

7.1.1.4 The signals complying with the International Regulations for Preventing Collisions at Sea, 1972 may be considered meeting the requirements of this Chapter.

7.1.2 Signals

7.1.2.1 Signals includes:

- (1) lights;
- (2) shapes and flags;
- (3) sound signal appliances.

7.1.3 Definitions

7.1.3.1 A *sailing vessel* means a vessel principally equipped for propulsion by sail.

7.1.3.2 A *high speed craft* means a craft that the speed in smooth water is equal to or exceeding 35km/h.

7.1.3.3 *Length of a ship* L_E means the maximum length of a ship defined in the General of the Guidelines.

7.1.3.4 *Height above the hull* means height above the uppermost continuous deck. This height is to be measured from the position vertically beneath the location of the light.

7.1.3.5 A *ship not under command* means a ship which through some exceptional circumstance is unable to maneuver as required by the Administration, and is therefore unable to keep out of the way of another ship.

7.1.3.6 A *ship restricted in her ability to maneuver* means a ship which from the nature of her work is restricted in her ability to maneuver as required by the Administration, and is therefore unable to keep out of the way of another ship, it is to include:

(1) a ship engaged in laying, servicing or picking up a navigation mark, submarine cable or pipeline across river;

(2) a ship engaged in dredging, surveying or underwater operations;

(3) a ship engaged in replenishment or transferring persons, provisions or cargo while underway;

(4) a ship engaged in a towing operation which severely restricts the towing ship and her tow in their ability to deviate from their course;

(5) other ships restricted in her ability to maneuver.

7.1.3.7 A *ship constrained by her draught* means a ship which, because of her draught in relation to the depth of waterway is restricted in her ability to maneuver and avoid.

Section 2 LIGHTS

7.2.1 Technical requirements for lights

7.2.1.1 Main characteristics of lights such as categories, colours, range of visibility and horizontal sector etc. are to comply with the requirements specified in Table 7.2.1.1

Table 7.2.1.1

No.	Lights	Color	Range of visibility (km)			Horizontal sector (°)	
			$L_E \geq 50m$	$50 > L_E \geq 30m$	$L_E < 30m$	Total angle	Distribution
1	Masthead light	White	6	5	3	225	From right ahead to 22.5 degrees abaft the beam on either side
2	Sidelight, port	Red	4	3	2	112.5	From right ahead to 22.5 degrees abaft the beam on port side
3	Sidelight, starboard	Green	4	3	2	112.5	From right ahead to 22.5 degrees abaft the beam on starboard side
4	Sternlight	White	4	3	2	135	From right aft to 67.5 degrees on each side
5	Bow light	White	2	2	2	180	Form right fore to 90 degrees on each side
6	All-round light	White, red, green, yellow	4	3	2	360	All round the horizon
7	Flashing light	Red, green, yellow	4	3	2	360	All round the horizon
		White	4				
8	Two-color combined light	Green on starboard, red on port			1	225	From right ahead to 22.5 degrees abaft the beam on either side
9	Three-color combined light	Red, white, green			1	360	From right ahead to 22.5 degrees abaft the beam on either side, green sector on starboard side, red sector on port side, white sector from fight aft to 67.5 degrees on each side
10	Rotating flashing light	Red	2			360	All round the horizon

7.2.1.2 The chromaticity of all lights is to conform to the standards which lie within the boundaries of the area of the diagram, (see Annex I to the present Regulations) specified for each color by the International Commission on Illumination (CIE).

The boundaries of the area for each color are given by indicating the corner coordinates, which are specified in Table 7.2.1.2.

Table 7.2.1.2

Light color	Coordinates	Corner					
		1	2	3	4	5	6
White	X	0.310	0.310	0.453	0.525	0.525	0.443
	y	0.283	0.348	0.440	0.440	0.382	0.382
Green	X	0.028	0.009	0.300	0.203		
	y	0.385	0.723	0.511	0.356		
Red	X	0.721	0.660	0.680	0.735		
	y	0.259	0.320	0.320	0.265		
Yellow	X	0.612	0.575	0.575	0.618		
	y	0.382	0.406	0.425	0.382		

7.2.1.3 The range of visibility of lights is to be determined by measuring their luminous intensity. The minimum luminous intensity of lights is to be calculated by following formula:

$$I = 0.2D^2 \times 1.128^D$$

where: *I*---the minimum luminous intensity, in cd;

D---range of visibility (luminous range) of the light, in km.

Here luminous intensity of lights is considered as a result obtained from the sources of lights and the whole system of the lights, and is not that of the sources of lights solely.

7.2.1.4 Horizontal sectors of lights

(1) In the forward direction, sidelights as fitted on board ship are to show the minimum required

intensities. The intensities are to decrease to reach practical cut-of between 1 degree and 3 degrees outside the prescribed sectors;

(2) For sternlights, masthead lights and sidelights, the minimum intensities are to be maintained at 22.5 degrees abaft the beam up to 5 degrees within the limits of the sectors prescribed in Table 7.2.1.1. From 5 degrees within the prescribed sectors the intensity may decrease by 50% and the intensity is to decrease to reach practical cut-off at not more than 5 degrees outside the prescribed sectors.

(3) Horizontal sectors of all-round lights are to be not obscured by masts, topmasts or superstructures within angular sectors of more than 6 degrees.

7.2.1.5 Vertical sectors of lights

(1) The vertical sectors of electrical lights as fitted on board ship with the exception of lights on sailing ships are to ensure that:

(1) At least the required minimum intensity is maintained at all angles from 5 degrees above to 5 degrees below the horizontal;

(2) At least 60 per cent of the required minimum intensity is maintained from 7.5 degrees above to 7.5 degrees below the horizontal.

(2) In the case of sailing ships, the vertical sectors of electrical lights as fitted are to be ensure that:

(1) At least the required minimum intensity is maintained at all angles from 5 degrees above to 5 degrees below the horizontal;

(2) At least 50 per cent of the required minimum intensity is maintained from 25 degrees above to 25 degrees below the horizontal.

7.2.1.6 All lights are to be capable of operating normally throughout an ambient temperature range of -30°C to +50°C.

The temperature rising of the ends of cable conductors of lights is not to exceed +40°C.

The glazy optical parts of lights are to be capable of withstanding sudden change in temperature.

7.2.1.7 The insulation resistance between current-carrying parts, and between current-carrying parts and light casing are to be not less than the values specified in Table 7.2.1.7.

Table 7.2.1.7

Rated voltage of light (V)	Test voltage (V) (measured by D.C. megger)	Insulation resistance (MΩ)	
		Cold condition	Hot condition
>60	500	100	10
≤60	250	10	1

7.2.1.8 The insulation dielectric strength between current-carrying parts, and between current-carrying parts and light casing are to be capable of withstanding alternating test voltage values specified in Table 7.2.1.8 at any frequency from 25Hz to 100Hz for a duration of one minute without any breakdown or flash over.

Table 7.2.1.8

Rated voltage (V)	Test voltage (V)
≤60	1000
60~300	2000

7.2.1.9 Lights are to operate reliably where the voltage of the power supply varies from +6% to -10% of the rated value and the frequency varies within ±5% of the rated value. The cable to be selected for the lights is to be such that the voltage drop in the cable is not to exceed 6% of the rated voltage.

7.2.1.10 Lights are to be capable of withstanding the vibration and shock likely to arise in normal service of ship.

(1) Requirements for vibration test:

Frequency range of 2Hz to 13.2Hz with an amplitude ±1mm;

Frequency range of 13.2Hz to 80Hz with an acceleration amplitude±0.7g.

(2) Shock:

The design and construction of lights are to be paid regard to the shocking effect likely to occur in normal service of ships.

7.2.1.11 Lights are to be made of such materials that they are corrosion-resistant, dampproof,

flam-retardant, underformable ageing-resistant and are to be not affected by mould. The inside of light casing is preferred to be painted by matt black and the outside is painted by grey. hose parts that are frequently opened and closed are to be not made of aluminum alloy. Where steel is adopted for the construction of lights, it are to be protected by an effective coating.

The requirements for flashing lights in light color, ambient temperature, electrical characteristics, materials, nameplates, marine product certificates as well as reliability of operation are to be the same as those of lights.

7.2.1.12 The bulbs used for lights are to be of marine type approved by the Administration.

7.2.1.13 The construction and marks of lights are to comply with the following requirements:

(1) The construction of lights is to be of a portable type and their construction is to be such that fitting and removal, hoisting and lowering, and replacement of parts are to be readily carried out. Provision is to be made to prevent the bulbs from spontaneous uncoupling and loosening.

(2) An outside connection wiring manner is to be adopted for lights.

(3) Except all-round lights the top of light casing is to be marked with an arrow indicating the direction of the bow or stern.

(4) The top of light casing is to be marked in the same color as that of the lights.

(5) Every light casing is to provide a nameplate indicating the description of the light, range of visibility, specification of bulb, voltage, name of manufacturer, serial number, date of manufacture and inspection mark and approval number. A trade mark and inspection mark can be accepted in lieu of a nameplate for the light of small size where it is impossible to affix the nameplate to the light due to its size.

(6) The serial number and approval number is to be marked on the edge of all lenses or colored light filter.

(7) Every light is to be attached with a Certificate of Products for Marine Service.

7.2.1.14 The horizontal luminous intensity of the flashing lights is to be not less than that determined by the formula:

$$I_f = (1 + 0.2/t) \cdot I$$

where: I_f --horizontal luminous intensity of the flashing lights, in cd;

t --flash duration in second;

I --luminous intensity as specified by 7.2.1.3, in cd.

7.2.1.15 Flashing frequency of flashing lights is from 50 to 70 flashes per minute.

7.2.1.16 The protection of enclosure of electrical lights is to be of Type IP55 and automatic drainage devices may be fitted on the casing of lights.

7.2.2 Provision of lights

7.2.2.1 The basic sets of lights are to be provided for ships in compliance with Table 7.2.1.1.

Table 7.2.2.1

Quantity Type of the ships	Lights														
	Mast-head white light	Mast-head green light	Red side-light	Green side-light	Bow light	White stern-light	All-round white light ^①	All-round red light ^②	All-round green light	Flashing red light	Flashing yellow light	Flashing green light	Flashing white light ^③	Rotating flashing red light	
Self-propelled ship	1 ^④		1	1		1	1	2	1	1		1	1		
Ferry	1		1	1		1	1	2	3 ^⑤	1		1	1		
Tug	3 ^⑥	1 ^⑦	1	1		2	1	2	1	1		1	1		
Barge			1	1	1	1	1	2	1						
Working ship	1		1	1		1	1	2	1	1		1	1		
High speed ship	1		1	1		1	1	2			1		1		
Supervision ship	1		1	1		1	1						1	1	

Beacon ship	1		1	1		1	1		2				1	
Pontoon ship							1	2	1					

Notes: ① Two all-round white lights provided for a ship of 50m and more in length are regarded as forward and after anchor lights and the forward anchor light is to be higher than the after anchor light. Except pontoon ship and sailing ship.

② The ship intended for carrying dangerous goods and the ship constrained by her draught are to be provided with an additional all-round red light.

③ Flashing white lights are to be located on yard of mast.

④ Self-propelled ships of 50m and more in length are to be provided with an additional white masthead light at after mast.

⑤ Two of the all-round green lights are to be located on yard of mast.

⑥ Pushers and tugs for towing rafts are to be provided with three white masthead lights. Towing tugs or tugs for towing and pushing are to be provided with two white masthead lights.

⑦ To apply to tugs towing rafts.

7.2.3 Special requirements for provision of lights

7.2.3.1 In a double ended ship, an additional set of masthead lights, sidelights and stern lights are to be provided.

7.2.3.2 On barge of more than 80m in length, red sidelights and green sidelights are to be located respectively at the bow and the stern.

7.2.3.3 The discharge pipeline stretched out by working ship under dredging operation is to be provided with an all-round white light every 50m apart between the forward end of pipe and the after end of pipe.

7.2.3.4 The number of following lights may be exempted from duplex light numbers, provided that these lights are the same in technical requirements and their positioning complies with the requirements of 7.2.4 of this Section. But two sets of lights with different purposes are to be exhibited distinctively:

(1) Masthead white light for signal ship and tug under navigating solely and for tug under towing.

(2) All-round red light for ship not under command, ship restricted in their ability to maneuvers, ship intended for carrying inflammable or explosive cargoes and ship constrained by their draught.

(3) The same lights in the special purpose lights.

7.2.3.5 Ships towed (including ships towed alongside) or objects towed are to be provided with lights in compliance with the requirements in Table 7.2.2.1 for the barges.

7.2.4 Installation of lights

7.2.4.1 Lights are to be placed where they can best be seen.

7.2.4.2 The horizontal and vertical sectors of lights other than all-round lights are to comply with the requirements of 7.2.1.4 and 7.2.1.5. Horizontal sectors of all-round lights are to be not obscured by masts, topmasts or superstructures within angular sectors of more than 6 degrees.

7.2.4.3 When two lights or more are carried in a vertical line, they are to be spaced as follows:

(1) On a ship of 50m or more in length such lights are to be spaced not less than 1.5m apart, and the lowest of these lights are to be placed at a height of not less than 4.5m above the hull.

(2) On a ship of 30m or more but less than 50m in length, such lights are to be spaced not less than 1m apart and the lowest of these lights are to, except where a towing light is required, be placed at a height of less than 3m above the hull.

(3) On a ship of less than 30m in length, such lights are to be spaced not less than 0.6m apart and the lowest light of these lights are to, except where a towing light is required, be placed at a height of not less than 1m above the hull.

(4) Where more than two lights are carried, they are to be equally spaced.

7.2.4.4 Lights fixed in their regular position are to be so constructed that their fixing, removal and servicing can be carried out easily. Hoistable lights are to be provided with suitable devices for lifting the lights to positions complying with the requirements of this Section.

7.2.5 Installation of masthead lights

7.2.5.1 Masthead lights are to be carried to the fore and aft centerline of the ship and are to be so placed as to be above and clear of all other lights and obstructions. When only one masthead light is carried, the height above the hull is to comply with the requirements of 7.2.4.3.

7.2.5.2 Where ship is required to carry after masthead light the after masthead light like the forward

masthead light are to be placed on the fore and aft centerline of the ship and are to be at least 3m vertically higher than the forward masthead light. The horizontal distance between the forward and after masthead lights is to be not less than one half of the length of the ship. When the mast is laid down an all-round white light is to be carried above the center of connection line between light sources of two sidelights where it is not obscured in lieu of masthead lights.

7.2.6 Installation of sidelights

7.2.6.1 Sidelights are to be placed symmetrically on the port and starboard sides of the uppermost deck of the ship but they are to be not outside ship's side and are to be at a height above the hull not greater than three quarters of that of the forward masthead light, meantime they are to avoid all obstructions that may obscure light of sidelights and are to be not interfered with by deck lights.

7.2.7 Installation of sternlight

7.2.7.1 Sternlights are to be placed, as nearly as possible at the stern of the ship, on the fore and aft centerline of the ship, but are not to be higher than the sidelight.

7.2.8 Installation of bow lights

7.2.8.1 Bow lights are to be placed on the suitable position of bow of barge being pushed ahead, but are to be not higher than the sidelight.

7.2.9 Installation of auxiliary white lights of tugs

7.2.9.1 For the sake of convenient steering of ships or rafts towed fore, white lights are to be placed on the rear of funnel or mast of tug and above the sternlight, but its lights are not to show before the beam on either side.

7.2.10 Installation of lights of working ships

7.2.10.1 Working ships are to be carried two all-round red lights and an all-round white light. Their connection lines form an equilateral triangle with acme pointing up. An all-round red light is on the acme of the triangle and on both ends of bottom side, an all-round white light is on navigable side and another all-round red light is on non-navigable side. Their spacing and height are to comply with the requirements of 7.2.4.3.

7.2.11 Installation of maneuver lights

7.2.11.1 An all-round white light is to be placed on the same fore-aft vertical plane with one masthead light or more but is to be not lower than the forward masthead light. Its range of visibility is to be at least 4km.

7.2.12 Installation of lights for ferries across river

7.2.12.1 Two all-round green lights on ferry across river are to be placed at both ends of mast yard.

7.2.13 Installation of lights for ships contained by their draught

7.2.13.1 Three all-round red lights are to be exhibited in a vertical line. Their spacing and height are to be in compliance with the requirements of 7.2.4.3.

7.2.14 Installation of lights for ships not under command

7.2.14.1 Two all-round red lights are to be placed in a vertical line. Their spacing and height are to be in compliance with the requirements of 7.2.4.3.

7.2.15 Installation of lights for ships carrying dangerous goods

7.2.15.1 An all-round red light is to be placed at the mast yard.

7.2.16 Installation of flashing lights

7.2.16.1 Port-red and starboard-green flashing lights are to be so placed as to be above the sidelight and to avoid obstructions that may obscure their lights. Their horizontal sectors are to as far as possible be in compliance with the requirements of 7.2.1.4 (3).

Section 3 SHAPES AND FLAGS

7.3.1 Technical requirements for shapes

7.3.1.1 Shapes (except shapes for ferry) are to be black and their types and sizes are to comply with the requirements of Table 7.3.1.1.

Table 7.3.1.1

Shape	Technical parameter	$L_E \geq 30m$	$L_E < 30m$
Ball	Diameter D	0.6	0.3
	Length L	0.6	0.3
Cross	Width B	0.6	0.3
	Diameter D	0.6	
Cylinder	Height H	1.2	
	Diameter D	0.6	0.6
Diamond	Length L	1.2	1.2
	Height H	0.6	0.6
Cone	Diameter of bottom circle D	0.6	0.6

Note: unit in the Table is m.

7.3.2 Technical requirements for flags

7.3.2.1 The specification of flags is to comply with the requirements of Table 7.3.2.1.

7.3.3 Other provisions for shapes and flags

7.3.3.1 Shapes and flags are to be provided on their both upper and lower ends with halyards of suitable length and devices for jointing them one to another. The vertical distance between the flags as well as shapes is to be not less than 0.5m, for ship of less than 30m in length the distance may be correspondingly reduced.

7.3.3.2 Shapes and flags are to be made of durable, light material resistant to deterioration of color. Shapes for special purpose may be made of rigid material.

7.3.4 Provision of shapes

7.3.4.1 Shapes for ships are to be provided in accordance with Table 7.3.4.1.

7.3.4.2 Ships constrained by their draught are to be additionally provided with a cylinder.

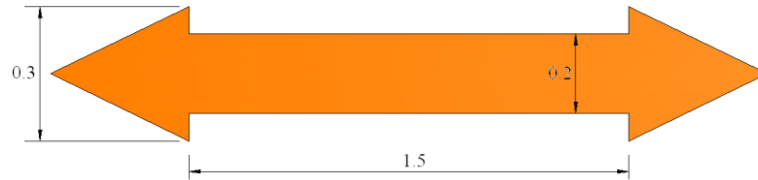
7.3.4.3 Ferries under navigation at day are to hoist a shape of orange double arrowhead of the fore-aft direction at one side of the mast yard. The main body of the shape is 1.5m in length and 0.2m in breadth, the arrowhead is an equilateral triangle of side length of 0.3m (see Figure 7.3.4.3).

Table 7.3.2.1

No.	Name	Principle sizes (mm)										
1	National flag	The color and design of the flags are to comply with the provisions promulgated by the Government. Their sizes are as follows:										
		No.	Length					Width				
		2	2400					1600				
		3	1920					1280				
		4	1440					960				
2	International signal flag	A set of signal flags consists of forty flags, including 26 numeral flags, 3 substitutes and 1 answering pendant. Their color and design are to be the same as illustrated in International Code of Signals, 1969. the sizes are as follows:										
		No.	Flag		Flag with gap			Burgee		Substitute		
			L	B	L	B	L_1	H	B	H	B	B_1
		2	1350	1200	1600	1200	530	1800	1200	2500	900	200
		Small 2	1030	900	1200	900	400	1350	900	1900	600	150
3	700	600	800	600	270	900	600	1200	380	100		
4	500	350	630	350	210	700	350	750	250	60		
3	Red flag	600					400					
4	Hand flag	A set of hand flags consists of two flags of the same color and design of "O" or "P" flags as illustrated in the International Code of Signals. Their size are about 350x350.										

Table 7.3.4.1

Type of ships	Working ship	Ferry across river	Others
Ball	3	3	3
Cross	1		
Diamond	1		
Double arrowheads		1	



(Units: m)

Figure 7.3.4.3

7.3.5 Provision of flags

7.3.4.1 Flags for ships are to be provided in accordance with Table 7.3.5.1

7.3.5.2 Oil tankers and oil tugs are to be additionally provided with two carriage dangerous goods flags as same size as its flags.

Quantity

Table 7.3.5.1

Items	Length of the ship	Quantity	Self-propelled ships		Non-self-propelled ships
			$L \geq 60\text{m}$	$L < 60$	
National flag	No.2	2	2		
	No.3	2		1	According to actual needs
	No.4			1	According to actual needs
	No.5			2	According to actual needs
International signal flag	No.2	1 set			
	No.3	According to actual needs	According to actual needs		
	No.4			1 set	According to actual needs
Red flag		1	1	1	According to actual needs
Hand flag		1	1	1	According to actual needs

7.3.6 Provision of symbol design and symbol flags

7.3.6.1 For passenger ferries, the symbol designs are to be painted on both sides of the funnel or conspicuous positions. The symbol designs are to be oval, as shown in Figure 7.6.3.1. In Figure 7.6.3.1, the sea blue color is a color of standard No. PB 05 in national standard GB3181 Paint Color Standard Specimens. The symbol designs may be scaled according to actual needs. The oval dimension is to be with the ratio of short axis and long axis of 1:1.3.



Figure 7.6.3.1

7.3.7 Storage of shapes

7.3.7.1 Shapes are to be stored in a locker fixed in vicinal position where they are hoisted or are to be stored in a special locker fixed in the vicinity of the wheelhouse.

7.3.8 Storage of flags

7.3.8.1 Flags are to be stored in a special locker fixed in the wheelhouse, and it is preferable that locker is divided into many small and large shelves storing respectively various flags. Mane of flags are to be indicated above the shelves.

7.3.8.2 A sufficient number of suitable pulleys and halyards is to be fixed on both sides of mast. Each halyard is to be provided with a set of hooks. Some halyards are to be let to the vicinity of the wheelhouse. Suitable devices to make fast the halyards are to be fixed.

Section 4 SOUND SIGNALS

7.4.1 Technical requirements for sound signal appliances

7.4.1.1 Technical requirements for sound signal appliances are listed in Table 7.4.1.1.

Table 7.4.1.1

No.	Name	Range of fundamental frequency or diameter	Sound pressure level (dB)	Range of audibility (km)
1	Large-sized whistle	130~350Hz	138	3
2	Medium-sized whistle	250~700Hz	130	2
3	Small-sized whistle	250~700Hz	120	1
4	Large-sized bell	≥300m	110	1
5	Small-sized bell	≥200m	110	0.5

7.4.1.2 The sound pressure level of a directional whistle on the forward axis is to be not less than that required in Table 7.4.1.1. If whistles are of a combined system sounded simultaneously, the frequency of any one whistle is to differ from those of the others by at least 10Hz.

7.4.1.3 A whistle is to be capable of producing the prolonged blast of 4—6 seconds duration and short blast of about 1 second duration. The sound produced by a whistle is to be of even tone with no vibration, hissing or distortion. The beginning and end of each signal are to be distinct and abrupt.

7.4.1.4 If a whistle is provided with an automatic control device for fog signal, it is to ensure time regulation of signal sounding at intervals of not more than 2 minutes for one prolonged blast produced. It is to be capable of being cut off at any time and a manual actuation control is to be also provided.

7.4.1.5 Gongs and bells are to be made of corrosion-resistant material and designed to give a clear tone, and are to be provided respectively with a beetle and a striker, the mass of the striker is to be not less than 3% of the mass of the bell.

7.4.2 Provisions of sound signal appliances

7.4.2.1 Sound signal appliances of self-propelled ships are to be provided in accordance with Table 7.4.2.1. Non-self-propelled ships with staff are to be only provided with bell and non-self-propelled ships without staff may be not provided with sound signal appliances.

7.4.2.2 The bells and gongs may be replaced by other devices having similar sound characteristics and either of them may be provided.

Quantity

Table 7.4.2.1

Item	Quantity	Length of the ship		
		$L \geq 70m$	$70m > L \geq 30m$	$L < 30m$
Large-sized whistle	1			
Medium-sized whistle			1	
Small-sized whistle				1
Bell	1	1	1	1
Gong	1	1	1	1

7.4.3 Placing of whistles

7.4.3.1 Whistles are to be so placed as not to be lower than the top of the uppermost deck house and the emitted sound not to intercept by superstructures.

7.4.3.2 The control handles or buttons of whistles are to be placed at a position within the wheelhouse

where they can easily be operated.

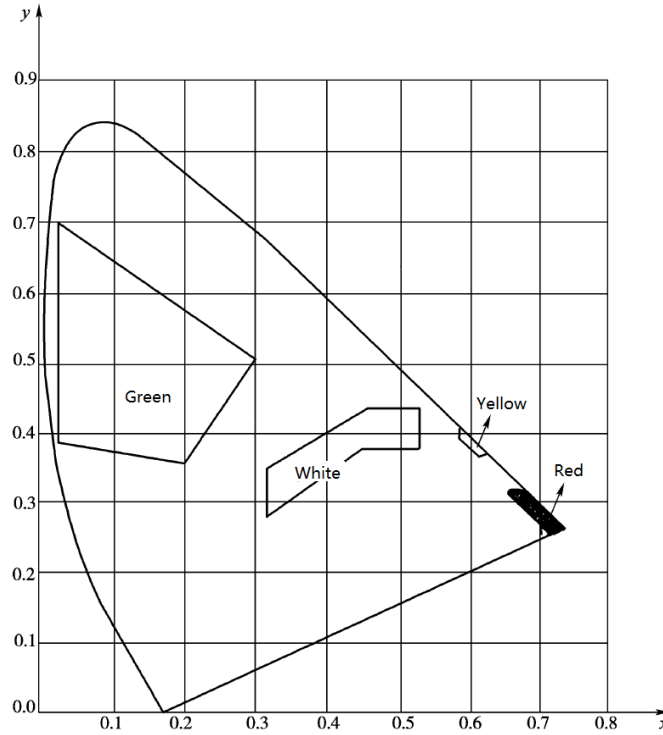
7.4.3.3 The whistles other than electrical whistles, fixed in vicinity of the wheelhouse are to be actuated by one control handle fixed in the wheelhouse with mechanical transmission connected to the whistle directly.

7.4.4 Storage of gongs

7.4.4.1 Gongs and their beetles are to be so placed as to be readily available and be indicated with an obvious mark.

Appendix 1 CHROMATICITY OF LIGHTS (SCHEMATIC DIAGRAM)

The chromaticity of all navigation lights is to conform to the following standards which lie the boundaries of the area of the diagram specified for each color by the International Commission on Illumination, as shown below.



CHAPTER 8 INTACT STABILITY

Section 1 GENERAL PROVISIONS

8.1.1 Application

8.1.1.1 This Chapter applies to calculating the intact stability of inland waterways ships. Except where otherwise stated, this Chapter is not applicable to floating docks.

8.1.1.2 Where a ship needs to pass through an area or section of higher grade, it is to comply with the requirements of stability for such an area (section).

8.1.2 General requirements

8.1.2.1 The stability of ships is to meet the Guidelines of Section 2 and Section 3 of this Chapter.

8.1.2.2 When calculating the stability of ships, the loading conditions are to meet the Guidelines of Section 3 of this Chapter.

8.1.2.3 Where the stability under the special loading condition is not as sufficient as that under the basic conditions specified in Section 3 of this Chapter, such stabilities are to be re-calculated.

8.1.2.4 When the stability of a ship in the arrival condition without ballast is unsatisfactory, the stability of the ship at mid-way is to be calculated as the same ballast as fully loaded departure condition.

8.1.2.5 When calculating the stability of the ship under various loading conditions, unless otherwise stated, the amount of fuel, water and stores are to be taken as 100% for departure, 50% for mid-way and 10% for arrival.

8.1.2.6 When the stability of the ship is not in compliance with the requirements and the ship needs permanent water ballast, it is subject to the agreement of the ship owner and [CCSISC](#) beforehand. The conditions of permanent water ballast are to be recorded in the stability report. The permanent ballast is to be iron weight, cement block etc. and efficient means are to be taken to ensure the reliability of the ballast.

8.1.2.7 When calculating the stability of the ship, the crew on duty are to be assumed to be in their position and other crews are to be in their cabins; a weight of 75kg is to be assumed for each crew. The passengers are to be in the compartments or on the deck in normal conditions, and a weight of 75kg should be assumed for each passenger. The cargoes are to be in the cargo holds or on the deck in normal conditions. The weight of the luggage of each passenger are to be determined by the ship owner according to detailed conditions of routing lines, and with the agreement of the survey organization.

For ro-ro ships, ro-ro passenger ships type 1 and type 2 and vehicle-passenger ferries, the gross weight of the vehicles is to be determined according to the designed conditions. The height of the center of gravity for the trucks and their cargoes above the vehicle deck is taken as that of the cargoes loaded to the restricted height, but not less than 2.5m. The gravity of empty vehicles is determined according to the design data of the vehicles, and the gravity of the cargoes is taken as half the vertical distance measured from the bottom plate of the vehicle's cargo floor to the restricted cargo height. The height of the center of gravity for empty passenger vehicles and empty commercial vehicles is determined according to the design data of the vehicles.

The height of the center of gravity for cargos (dry cargos and liquid cargos), oil and water is to be taken as the position of centroid corresponding to the proposed loading condition according to the type and stowage. The center of gravity of load on hook is to be supposed at the point of suspension.

The height of the center of gravity for passengers and crews is to be taken as 1.0m above the deck level at his/her standing. Where the height of the center of gravity for passengers is taken as 0.3m above the seat at his/her seating, it is to be noted in the calculation report.

The effect of sheer and camber is to be taken into account for determining the height of the center of gravity of passengers.

8.1.2.8 For the multi-purpose ships, the height of the center of gravity is to be calculated according to the corresponding type of ships in accordance with Section 3 of this Chapter. Non-crane ships with lifting appliance are to meet the stability requirements for operating of crane ships besides the corresponding requirements for the type of ships.

8.1.3 Determination of lightship displacement and position of the centre of gravity

8.1.3.1 On completion of construction, newly built ships are to be subject to an inclining test. The first ship of the same type ships (series ships) built by the same yard are to be subject to an inclining test. If alternations or modifications which may affect the stability are made to the subsequent ships, they are to be re-tested.

8.1.3.2 Where the conditions of light ships are changed essentially as a result of conversion or repair, except the conditions mentioned in 8.1.3.5 of this Section, the ship is to be subjected to an inclining test on completion of the work.

8.1.3.3 The purpose of the inclining test is to determine the actual position of the center of gravity and displacement of light ship. A report of inclining test containing the information such as the actual position of the center of gravity, displacement and initial metacentric height of the light ship are to be prepared on the basis of the test result and submitted to [CCSISC](#).

8.1.3.4 Inclining tests are to be performed by the shipyard, with attendance of concerned parties, such as the ship owner, designer and [CCSISC](#). The test can be carried out only when the preparation work has been reviewed in all aspect by all parties mentioned above.

8.1.3.5 Where the conditions of light ships occur as a result of conversion, change, refitting and repair, if there are inclining test report as well as the detailed weight and center of gravity of lightship changes and when the relative error of lightship displacement with the inclining test data is within $\pm 2\%$, the lightship displacement and position of the centre of gravity may be determined by conversion based on the inclining test report.

8.1.3.6 The method mentioned in 8.1.3.7 of this Section may substitute the inclining test for the following ships:

- (1) pontoons;
- (2) ships without superstructures and deckhouses;
- (3) non-propulsion ships only with freeboard deck and topside deck and of which a total length of the superstructures and deckhouses is less than 0.25 times the ship's length.

8.1.3.7 For the ships mentioned in 8.1.3.6 of this Section, the lightship displacement and position of the centre of gravity may be determined according to the following methods:

(1) measuring and recording the draught at both sides in way of the mid-ship, fore and aft, and measuring and recording the temperature and gravimetric density of the water;

(2) calculating the displacement and longitudinal coordinate of the gravity of light ship in the basis of the draught and the gravimetric density of the water, and the calculation method is same as that used in the inclining test;

(3) the vertical coordinate of the center of gravity of light ship is to be determined by calculating. When calculating the center of gravity of light ship, the estimate of lightship displacement and center of gravity is to provide the center of gravity of light ship on the safe side, such as, the moulded depth is taken as the vertical coordinate of the center of gravity of main hull and 2/3 of the height is taken as the vertical coordinate of the center of gravity of superstructures and deckhouses; or, the vertical coordinate of the center of gravity of deck structure is at the upper edge of decks, the vertical coordinate of the center of gravity of bottom structure is at the upper edge of the bottom frame, the vertical coordinate of the center of gravity of side structure is at 2/3 of its height;

(4) when the vertical coordinate of the center of gravity of light ship is determined according to (3), the vertical coordinate of the center of gravity is to be corrected by the difference between light ship displacement and estimate obtained based on (2). When weight decreases, it is to be proposed that the vertical coordinate of the center of gravity of the decreased weight is at the baseline; when weight increases, it is to be proposed that the vertical coordinate of the center of gravity of the increased weight is at the top of the ship.

8.1.3.8 For the ships of which the actual position of the centre of gravity and displacement of light ship is determined in accordance with the method specified in 8.1.3.5 and 8.1.3.7 of this Section, a report of measurement and calculation is to be prepared to replace the report of inclining test.

8.1.3.9 As for crane ships and dredgers, when the lightship displacement and position of the centre of gravity under navigating, operating and sheltering from wind is different, the inclining test is to be conducted according to navigating conditions and the obtained results are then converted to the lightship displacement and position of the centre of gravity under operating and sheltering from wind.

8.1.4 Stability calculation, stability report and safe loading manual

8.1.4.1 Acceptable methods used in navy architecture are to be adopted in all calculations relating to stability. Where computer be used in calculation, the method is to be indicated, and the input data and the results are to be submitted.

8.1.4.2 Where the design parameters equal the intermediate quantity of corresponding parameters, the actual value is obtained by interpolation.

8.1.4.3 The intact stability report is to at least include the following content:

- (1) Significant parameter and calculation instruction;
- (2) Main direction of use;
- (3) Stability summary for basic loading conditions;
- (4) Curve or values of permissible height of the center of gravity;

- (5) Calculation for windage area;
- (6) Calculation for free surface correction of liquid tanks;
- (7) Stability calculations of various loading conditions;
- (8) Position of flooding point and curve or values of flooding angles;
- (9) Position of limit angle of statical heel and curve or values of limit angles of statical heel.

8.1.4.4 Final stability calculation are to be conducted according to the inclining test report and submitted to **CCS/ISC** for approval.

8.1.4.5 Each ship is to be provided with the summary table of stability characteristics, which is prepared by the designer or the shipyard in accordance with the final stability calculation and subjected to the Administration for approval.

The format of the summary table of stability characteristics is shown in Annex I of this Chapter,

8.1.4.6 For the ships that have load manual, if the load manual includes final stability data, the load manual may replace the final stability report.

8.1.5 Loading and operation

8.1.5.1 Although the calculated stability has met the requirements of this Chapter, the captain should still navigate and operate cautiously, with due attention being paid to the loading conditions of the ship, meteorological conditions and hydrological conditions.

8.1.5.2 The ship loading is not to exceed the design condition range. The cargoes on board are to be so loaded and stowed as to avoid injury to the ship and persons and prevent the cargoes from losing overboard. When vehicles, containers, heavy goods and cargoes with special outlines are carried, they are to be efficiently secured, and when live cattle, such as live pigs, oxen, sheep and horses, they are to be transported in way of a combination of separate fences, separate cages and securing.

8.1.5.3 Trucks carried by ro-ro passenger ship type 1, ro-ro passenger ship type 2 and vehicle-passenger ferries are to within the vehicle carrying places and meet the requirements for passages of vehicle carrying places. Captains are to check the gross weight of a single vehicle and the gross weight of the vehicles planning to be carried before boarding and determine the layout according to the principle of balance loading.

8.1.5.4 Container ships are to load according to the designed container layout. When the designed number of containers carrying cargoes and the number of empty containers, the places of the designed containers carrying cargoes and empty containers are to be marked on the container layout. The places that are marked for empty containers are to only load empty containers.

8.1.5.5 Before navigating, captains are to check the flotation condition of ships to make ships float on even keel as much as possible. The initial heeling angle is not to exceed 0.5° and is not to exceed the range limited by the following conditions:

- (1) the minimum distance between trimmed waterline and freeboard deck is to be not less than the minimum freeboard specified in PART FOUR of the Guidelines;
- (2) the trim is to be not greater than the calculated range specified in 8.2.7.6 of this Section;
- (3) the visual range of wheel house is to meet the requirements specified in CHAPTER 9 of this Part (if applicable);
- (4) the trim by head is to be not greater than 0.5% of length between perpendiculars.

8.1.6 Simple stability criteria

8.1.6.1 For non-propulsion dry cargo ships and pontoons, etc. navigating in Service Area C, if only the freeboard deck and topside deck exist without load on the topside deck and they meet the following requirements, the stability may be regarded as being satisfactory.

(1) Non-propulsion dry cargo ships: (referring to the barges with goods in the holds not exceeding the freeboard deck, well-deck barges are exclusive):

$$\frac{B}{d} \geq 3.5 \qquad \frac{F}{B} \geq 0.05$$

(2) Pontoons without passengers:

$$\frac{B}{d} \geq 4.0 \qquad \frac{F}{B} \geq 0.06$$

where: B ---moulded breadth of the ship, in m;

d ---moulded draft in full load condition, in m;

F ---minimum freeboard in full load condition, in m.

Section 2 GENERAL REQUIREMENTS FOR STABILITY

8.2.1 General requirements

8.2.1.1 Except where otherwise stated in Section 3 of this Chapter, Ships are to meet the general requirements for stability of this Section.

8.2.1.2 The initial metacentric height is to be not less than 0.2m.

8.2.1.3 For ships navigating in Service Area A or B, the curves of righting lever are to meet the following requirements:

(1) When the lesser of the heeling angle θ_m or flooding angle θ_j corresponding to the maximum righting lever is equal to or greater than 20° , the area to the lesser of the heeling angle θ_m or flooding angle θ_j or 30° under the curves of righting lever (lever l_{d1} of dynamic stability is to be taken) is to be not less than A obtained by the following formulae:

$$A = 0.052 C_K C_L \quad \text{m}\cdot\text{rad}$$

where: C_K ---coefficient, for Service Area A, $C_K = 1$; for Service Area B, $C_K = 0.9$;

C_L ---coefficient, calculated according to the following formulae:

$$C_L = 0.7 + 0.015L$$

When $C_L > 1$, then $C_L = 1$.

where: L ---length of the ship, in m.

(2) When the lesser of the heeling angle θ_m or flooding angle θ_j corresponding to the maximum righting lever is less than 20° , the area to the angle under the curves of righting lever is to be not less than A obtained by the following formulae:

$$A = C_K [0.052 C_L + 0.0015(20 - \theta)] \quad \text{m}\cdot\text{rad}$$

where: C_K , C_L ---the same as 8.2.1.3 (1);

θ --- θ_m or θ_j , ($^\circ$), whichever is the lesser.

(3) The heeling angle θ_m corresponding to the maximum righting lever for the ships navigating in Service Area A is to be not less than 15° .

(4) The heeling angle θ_m corresponding to the maximum righting lever mentioned in this Chapter is without taking account of the flooding angle.

8.2.1.4 For ships navigating in Service Area A or B, the stability criterion numerals K_f are to comply with the following formulae:

$$K_f = \frac{M_q}{M_f} \geq 1; \text{ or}$$

$$K_f = \frac{l_q}{l_f} \geq 1$$

where: M_q ---minimum capsizing moment as determined when rolling effect is taken into account, in kN·m, see 8.2.3.1;

M_f ---wind heeling moment, in kN·m, see 8.2.5.1;

l_q ---minimum capsizing lever as determined when rolling effect is taken into account, in m, see 8.2.3.1;

l_f ---wind heeling lever, in m, see 8.2.5.1.

8.2.1.5 For ships navigating in Service Area C, the stability criterion numerals K_f are to comply with the following formulae:

$$K_f = \frac{M_{q0}}{M_f} \geq 1; \text{ or}$$

$$K_f = \frac{l_{q0}}{l_f} \geq 1$$

where: M_{q0} ---minimum capsizing moment as determined when rolling effect is taken into account, in kN·m, see 8.2.3.2;

M_f ---wind heeling moment, in kN·m, see 8.2.5.1;

l_{q0} ---minimum capsizing lever without taking account of rolling effect, in m, see 8.2.3.2;

l_f ---wind heeling lever, in m, see 8.2.5.1.

The stability criterion numeral K_f may also be calculated according to the following simplified formulae:

$$(1) K_f = \frac{9.81\Delta GM_1}{M_f} \cdot \frac{F}{B} \geq 1$$

$$\text{If } \frac{F}{B} \geq 0.125, \text{ then } \frac{F}{B} = 0.125.$$

where: M_f ---wind heeling moment, in kN·m, see 8.2.5.1;

Δ ---displacement for the loading condition being checked, in t;

GM_1 ---initial metacentric height corrected for free surface effect for the loading condition being checked, in m;

F ---minimum freeboard for the loading condition being checked, in m;

B ---maximum breadth of the freeboard deck, in m, the sponson deck is exclusive.

$$(2) K_f = \frac{9.81\Delta GM_1}{M_f} \cdot \frac{d}{B} \geq 1$$

$$\text{If } \frac{d}{B} \geq 0.125, \text{ then } \frac{d}{B} = 0.125.$$

where: M_f , Δ , GM_1 , B ---the same as 8.2.1.5 (1);

d ---moulded draught for the loading condition being checked, in m.

8.2.2 Additional requirements for ships navigating in Section J

8.2.2.1 Besides the requirements stipulated in 8.2.1, the ships navigating in Section J are to meet the requirements of 8.2.2.2 and 8.2.2.3.

8.2.2.2 For ships navigating in Section J, the area to the lesser of the heeling angle θ_m or flooding angle θ_j or 30° corresponding to the maximum righting lever is to be not less than A obtained by the following formulae:

$$A = 0.05C_L \quad \text{m·rad}$$

where: C_L ---the same as 8.2.1.3 (1)

8.2.2.3 For ships navigating in Section J, the stability criterion numerals K_f for various loading conditions are to comply with the following formulae:

$$K_J = \frac{M_{q0}}{M_J} \geq 1; \text{ or}$$

$$K_J = \frac{l_{q0}}{l_J} \geq 1$$

where: M_{q0} ---minimum capsizing moment without taking account of rolling effect, in kN·m, see 8.2.3.2;

M_J ---moment of heeling due to current velocity, in kN·m, see 8.2.6.1;

l_{q0} ---minimum capsizing lever as determined without taking account of rolling effect, in m, see 8.2.3.2;

l_J ---moment of heeling due to current velocity, in m, see 8.2.6.1.

8.2.3 Minimum capsizing moment or minimum capsizing lever

8.2.3.1 For ships navigating in Service Area A or B, the minimum capsizing moment or lever is to be determined as follows by means of the curve of dynamical stability when the rolling effect of the ship is taken into account:

Prolonging symmetrically the dynamical stability curve towards the negative direction of θ , and set a point on the negative side of the abscissa axis so that the length from this point to origin is equal to the rolling angle θ_1 , as obtained by calculation. Through this point, draw a line perpendicular to the abscissa axis, which intersects the prolonged dynamical stability curve at point A. From point A draw a line tangent to the dynamical stability curve or secant to the curve at the point which ends the curve. The angle which is less is taken. From point A draw a line parallel to the abscissa axis and lay off a segment AB equal to one radian (57.3°). Then from B draw a line perpendicular to AB, Which intersects the secant (or tangent) at point C. Segment BC is the minimum capsizing moment when the ordinate represents the moment M_d , and is the minimum capsizing lever when the ordinate represents the lever l_d , see Figure 8.2.3.1.

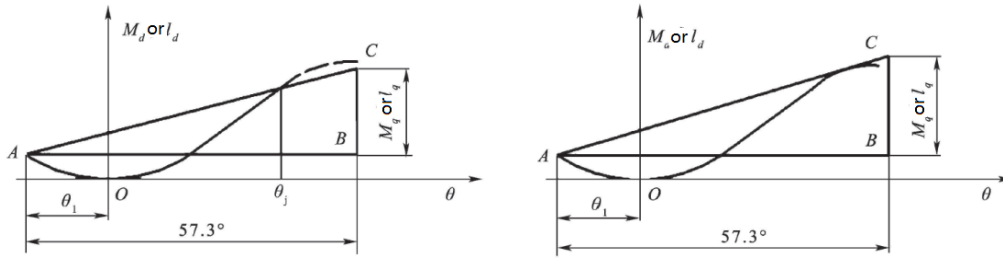


Figure 8.2.3.1

8.2.3.2 For ships only navigating in Service Area C or section J, the minimum capsizing moment or lever is to be determined as the following by means of the curve of dynamical stability, without taking account of the rolling effect.

The dynamical stability curve may not be prolonged symmetrically towards the negative direction of θ axis. The method is similar to 8.2.3.1, see Figure 8.2.3.2.

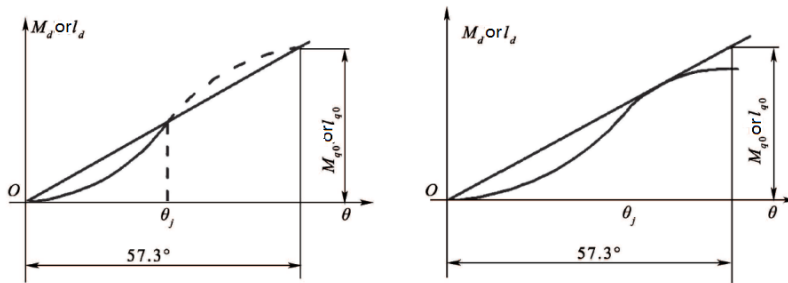


Figure 8.2.3.2

8.2.4 Amplitude of roll

8.2.4.1 For ships navigating in Service Area A or B, wave action to ship roll is to be considered. For round-bilged ships, the amplitude of roll θ_1 are to be obtained from the following formulae:

$$\theta_1 = 11.75 C_1 C_4 \sqrt{\frac{C_2}{C_3}} \quad (^\circ)$$

where: C_1, C_2, C_3, C_4 ---coefficient, to be taken from 8.2.4.2 to 8.2.4.7 respectively.

8.2.4.2 Coefficient C_1 in the formula for the calculation of amplitude of roll are to be taken from Table 8.3.4.2, depending on the period T_θ of ship's natural roll and navigation Service Area. The period T_θ of ship's natural roll is to be obtained from the following formulae:

$$T_\theta = \frac{(0.55 + 0.07 \frac{B_s}{d}) B_s}{\sqrt{GM_0}} \quad \text{s}$$

where: GM_0 ---initial metacentric height without being corrected for free surface effect for the loading

condition being checked, in m;

B_s ---maximum waterline breadth of the ship for the loading condition being checked, in m;

d ---moulded draught for the loading condition being checked, in m.

Table 8.2.4.2

T_θ (s)	≤ 3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	≥ 7.5	
C_1	Service Area A	0.223	0.217	0.210	0.204	0.197	0.183	0.159	0.130	0.091	0.081
	Service Area B	0.208	0.199	0.182	0.166	0.150	0.130	0.110	0.097	0.085	0.075

8.2.4.3 Coefficient C_2 in the formula for the calculation of amplitude of roll is to be taken from the following formula:

$$C_2 = 0.21 + 0.26 \frac{KG}{d}$$

If $C_2 > 1$, then $C_2 = 1$.

where: d ---the same as defined in 8.2.4.2;

KG ---vertical distance between of the center of gravity and the base line for the loading condition being checked, in m.

8.2.4.4 Coefficient C_3 in the formula for the calculation of amplitude of roll is to be taken from the following formula:

$$C_3 = f + 0.0025 \frac{B_s}{d}$$

If $\frac{B_s}{d} \geq 10$, then $\frac{B_s}{d} = 10$.

where: B_s, d ---the same as defined in 8.2.4.2;

f ---taken from Table 8.2.4.4, depending on the period T_θ of ship's natural roll.

Table 8.2.4.4

T_θ (s)	≤ 3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	≥ 7.5
f	0.00863	0.00858	0.00851	0.0084	0.00752	0.00606	0.00466	0.00388	0.00348	0.00330

8.2.4.5 Coefficient C_4 in the formula for the calculation of amplitude of roll is to be taken from Table 8.2.4.5, depending on the total area of bilge keels of the ship.

Table 8.2.4.5

$\frac{A_b}{LB_s}$ (%)	0	1.0	1.5	2.0	2.5	3.0	3.5	≥ 4.0
C_4	1.0	0.98	0.95	0.88	0.84	0.82	0.81	0.80

where: A_b ---total area of bilge keels, in, m^2 ;

L ---length between perpendicular, in m;

B_s ---the same as defined in 8.2.4.2.

For ships with bar keel, A_b is to be taken as the sum of total area of bilge keels and area of lateral projection of the bar keel.

8.2.4.5 For hard chine form ships, amplitude of roll is to be taken as 0.9 times of the calculation of amplitude of roll of round-bilged ships without bilge keels.

8.2.4.7 For ships of special shape, coefficient C_2 , C_3 and C_4 are to be taken with the agreement of [CESISC](#).

8.2.5 Wind heeling moment or wind heeling lever

8.2.5.1 The wind heeling moment M_f or the wind heeling lever l_f is to be obtained respectively from the following formulae:

$$M_f = pA_f(Z_f - a_0d) \times 10^{-3} \quad \text{kN}\cdot\text{m}$$

$$l_f = \frac{1}{9.81\Delta} pA_f(Z_f - a_0d) \times 10^{-3} \quad \text{m}$$

where: p ---calculated unit wind pressure, in Pa, see 8.2.5.2;

A_f ---ship's windage area for the loading condition being checked, in m², see 8.2.5.3;

Z_f ---vertical distance between the center of windage area and the base line for the loading condition being checked, in m, see 8.2.5.4;

d ---moulded draught of the ship for the loading condition being checked, in m;

Δ ---displacement for the loading condition being checked, in t;

a_0 ---coefficient for correction, see 8.2.5.5.

8.2.5.2 The calculated unit wind pressure p is to be determined by Table 8.2.5.2, depending on the vertical distance between the center of windage area and the actual waterline ($Z_f - d$) for the loading condition being checked and Service Area when the ship is in the upright position.

The calculated unit wind pressure P (Pa)

Table 8.2.5.2

Area of navigation	The vertical distance between the center of windage area and the actual waterline $Z_f - d$ (m)												
	≤1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	≥7.0
Service Area A	225	246	263	279	294	308	320	331	340	347	353	357	361
Service Area B	206	225	241	256	269	281	293	303	311	318	323	327	330
Service Area C	187	204	218	232	244	255	266	275	282	289	293	297	300

8.2.5.3 The windage area A_f of the ship is the projected lateral area of all parts on the centerline plane above the actual waterline for the loading condition being checked when the ship is in the upright position. The windage area consists of two parts, the continuous surfaces and discontinuous surfaces.

(1) The continuous surfaces include the projected lateral areas of the ship's hull, bulwarks, superstructures, deckhouses, hatchcoaming, hatchcovers deck machinery, awnings, mast derricks, booms, derrick posts, funnels, large ventilators, lifeboats, sampans, lifecrafts and other buoyant apparatus on the centerline plane; for ships carrying deck cargoes, the projection of these cargoes is to also be taken into account. For isolated circular section structures such as funnels, ventilators, masts, etc., the projected lateral areas are to be multiplied by a flow coefficient of 0.6.

(2) When calculating the projected lateral areas of the fixed open space for accommodating passengers, if the fixed open space for accommodating passengers is fitted with awning, the height is to be the average height from the lower surface of the awning to the upper surface of decks accommodating passengers; if the fixed open space for accommodating passengers is not fitted with the awning, the height is to be 1.90m. If the decks accommodating passengers (surfaces for passengers standing) is at the platform (or bed board or floor board) below the freeboard decks, the height is to be 1.90 - W (m), where: W is the distance between the decks accommodating passengers (or bed board or floor board) and the freeboard desk (m).

(3) The discontinuous surfaces include the projected lateral areas of riggings, rails, trusses of lattice type, aerials and those of various small objects on the centerline plane.

When calculating the projected lateral area of discontinuous surfaces, 2.5% of the projected lateral area of the continuous surfaces and 5% of the statical moment of the continuous surfaces calculated for the minimum draught of the basic loading conditions are to be taken for passenger ships, cargo ships and floating cranes; and 5% of the projected lateral area and 10% of the statical moment for tugs and liquid cargo ships. For all other loading conditions, the value of the projected lateral area and the statical moment of discontinuous surfaces are assumed to be the same as that obtained from the minimum draught mentioned above.

(4) The projected lateral area of discontinuous surfaces may be determined by precise calculation, in this case the overall areas taken into consideration are to be multiplied by the following filling factors:

For rails covered with meshed wire	0.6
For rails without meshed wire	0.2
For crane trusses of lattice type	0.5
For transverse trusses and riggings	0.6

Where the projections of two or more than two objects overlap one another on the longitudinal centerline plane, the overlapped area is only to be taken into account once.

(5) For floating crane and dredges, calculations of the windage area are to also be in compliance with the related requirements in Section 3 of this Chapter.

8.2.5.4 The vertical distance Z_f between the center of the windage area and the base line is to be the vertical distance when the ship is in the upright position. The center of the windage area is to be taken by determining gravity center.

8.2.5.5 The coefficient a_0 for correction in the formulae for calculating wind heeling moment or lever is to be obtained from the following formulae:

$$a_0 = 1.4 - 0.1 \frac{B_s}{d}$$

If $\frac{B_s}{d} \leq 4$, then $a_0 = 1$;

If $\frac{B_s}{d} \geq 9$, then $a_0 = 0.5$.

where: B_s ---maximum breadth of waterlines for the loading condition being checked, in m;
 d ---moulded draught for the loading condition being checked, in m.

8.2.6 Water heeling moment or water heeling lever

8.2.5.1 The influenced water heeling moment M_J and water heeling lever l_J is to be obtained from the following formulae respectively:

$$M_J = 9.81 C_J L_s d (KG - a_1 d) \quad \text{kN}\cdot\text{m}$$

$$l_J = C_J L_s d (KG - a_1 d) \frac{1}{\Delta} \quad \text{m}$$

where: L_s ---length of the waterline for the loading condition being checked, in m;

d ---moulded draught of the ship for the loading condition being checked, in m;

Δ ---displacement for the loading condition being checked, in t;

KG ---vertical distance between the center of gravity and the base line for the loading condition being checked, in m;

a_1 --- coefficient, to be taken from Table 8.2.6.1 (1) depending on the ratio $\frac{B_s}{d}$;

C_J ---coefficient of torrent, to be taken from Table 8.2.6.1 (2) depending on the coefficient f .

Table 8.2.6.1 (1)

$\frac{B_s}{d}$	≤ 4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	≥ 9.0
a_1	0.500	0.495	0.475	0.440	0.405	0.350	0.285	0.225	0.160	0.085

Table 8.2.6.1 (2)

f	≤ 1.0	2	3	4	5	6	7	8	≥ 9.0
C_J	0.255	0.279	0.301	0.326	0.346	0.358	0.365	0.372	0.377

where: B_s ---maximum waterline breadth for the loading condition being checked, in m;

f ---coefficient, $f = 0.013 \frac{V_J^2 \Delta}{L_s}$;

V_J ---velocity for computation, in m/s. For ships navigating in section J₁, when the maximum velocity

$V_m \leq 5.83\text{m/s}$, then $V_J = V_m$, and when $V_m > 5.83\text{m/s}$, then $V_J = 5.83\text{m/s}$. For ships

navigating in section J₂, when the maximum velocity $V_m \leq 4.44\text{m/s}$, then $V_J = V_m$, and when

$V_m > 4.44\text{m/s}$, then $V_J = 4.44\text{m/s}$. For ships having no power, the maximum velocity is to be taken as the velocity of the fleet.

8.2.7 Calculation of the curves of righting lever and flooding angle

8.2.7.1 When calculating the curves of righting lever, the effect of main hull and appendage as well as the following parts on the curves of righting lever are to be taken into account. The cargo hatch is not considered.

- (1) closed sponson deck;
- (2) closed connection bridge and anti-torsion box of catamaran;
- (3) the first tier superstructures that meet the requirements for closed superstructures in PART FOUR of the Guidelines;

(4) the first tier deckhouses that meet the requirements for closed deckhouses in PART FOUR of the Guidelines.

8.2.7.2 In 8.2.7.1 of the Section, the structural strength and the watertight integrity of the main hull, appendage, the parts mentioned in 8.2.7.1 (1) to 8.2.7.1 (2) are to meet the requirements in CHAPTER 2 of PART FIVE and PART FOUR of the Guidelines. The structural strength of the parts mentioned in 8.2.7.1 (3) to 8.2.7.1 (4) are to meet the requirements in CHAPTER 2 of PART FIVE. The deckhouses specified in 8.2.7.1 (4) are to be fitted with the passageways to upper deckhouses and the structural strength of the parts are to meet the requirements in CHAPTER 2 of PART FIVE of the Guidelines.

8.2.7.3 The space between heeling angles of the curves of righting lever is to be not greater than 5°.

8.2.7.4 The effect of the flooding angle opening is to be taken into account when calculating the curves of righting lever:

(1) The minimum angle of heel exceeding which water can ingress from unclosed openings is called the flooding angle θ_j ;

(2) The openings that cannot keep close in service although equipped with weathertight installments are to also be regarded as the flooding angle openings;

(3) The side scuttles which can keep close in service and air pipes on the weather-deck and small from openings from which water cannot flood in may not be regarded as flooding angle openings;

(4) When the top edge of the passenger/cargo hatch coaming above the freeboard deck is taken as the opening of the flooding angle, the actual height of the hatch coaming is taken; when the top edge of other hatch coamings (the hatch coaming except passenger/cargo hatch coaming), cabin and doghouse doorsill above the freeboard deck is taken as the flooding angle and the height of hatch coamings, cabin and doghouse doorsill is greater than 0.2m, 0.2m is taken into account.

8.2.7.5 Unless specified otherwise, the righting lever stability curve is effective before the flooding angle. When the angle of heel is greater than the flooding angle, the stability curve is to be terminated at the corresponding angle of flooding and the ship should be considered to have entirely lost its stability.

8.2.7.6 Flooding angle is generally calculated on the basis of the designed trim. Where the initial trim in the running adversely affect the flooding angle, the influence is to be taken into account.

8.2.7.7 Under any loading condition, the effects of free surfaces of liquid on the initial metacentric height and the righting lever curves are to be taken into account in accordance with the following requirement:

(1) For liquid tanks of which the free surface and loading capacity do not change during the voyage, such as liquid cargo tanks and water ballast spaces, the effect of free surfaces is to be calculated according to the effect of 50% full liquids or actual loading capacity;

(2) Where the liquid tanks, such as the consumable liquid tanks, liquid cargo tanks, polluted oil and water tanks and ballast tanks have free surfaces, the initial metacentric height and the righting lever curves of the ship are to be corrected for the free surface effect of liquids, with the liquids in tanks resumed as to be 50%. If the form of the liquid tanks is special and there is more effect of the free surface according to the effect of 50% full liquids, the effect should be calculated in accordance with the condition.

For consumable liquid tanks and ballast tanks, it should be assumed that at least a single tank on the centerline or a pair of side tanks for each kind of liquid has free surfaces, and the tank or combination of tanks should be those which develop the greatest free surface effect.

(3) For tanks fully loaded, the effect is to be calculated, with the liquids in tanks resumed as to be 98%;

(4) Except being required by (2) the free surfaces effect of liquids on the initial metacentric height and stability curves may not be taken into account for liquid tanks filled up to 98% of tank capacity and more, and tanks with residual liquid less than 5% of capacity of tank.

(5) If communicating tubes are set between two or more liquid tanks, these tanks are to be taken as one tank when calculating the effect of free surface.

8.2.7.8 The righting lever curves correction for free surface effect may calculate in accordance with Annex II. The method of correcting the center height of gravity may also be used.

Section 3 SPECIAL REQUIREMENTS FOR STABILITY

8.3.1 General requirements

8.3.1.1 The limit angle of statical heel is to be the angle of flooding at the edge of freeboard deck or the angle at which the mid-point of bilge comes out of water, whichever is the lesser. If scuttles are provided under freeboard deck, the limit angle of statical heel is to be taken as the flooding angle at the underneath edge of the scuttle. If the sponson deck is provided on the ship the limit angle of statical heel is to be taken as the angle of flooding at the edge of the sponson deck.

For Passenger Ships of Category V, the limit angle of statical heel is to be taken as the above value or 10°, whichever is the lesser; for other passenger ships, the limit angle of statical heel is to be taken as the above value or 12°, whichever is the lesser;

For fire fighting ships, the limit angle of statical heel is to be taken as the above value or 8°, whichever is the less.

For other vessels (except dredgers and floating cranes), the limit angle of statical heel is to be taken as the above value or 14°, whichever is the less.

8.3.1.2 The stability of power-propelled ships from turning round with full speed is to meet the following requirements:

(1) Under the moment or lever resulting from turning round with full speed, the angle of statical heel gained from the curves of righting levers or moments is to be not greater than the limit angle of statical heel;

(2) The heeling moment M_v and lever l_v of power-propelled ships turning round with full speed are to be calculated respectively as the following formulae:

$$M_v = 0.441 \frac{\Delta V_m^2}{L_s} [KG - (a_2 + a_3 F_r) d] \quad \text{kN}\cdot\text{m}$$

$$l_v = 0.045 \frac{V_m^2}{L_s} [KG - (a_2 + a_3 F_r) d] \quad \text{m}$$

where: F_r ---Froude's coefficient, $F_r = \frac{V_m}{\sqrt{9.81L_s}}$;

L_s ---length of waterline for the loading condition being checked in m;

d ---moulded draught of the ship for the loading condition being checked, in m;

Δ ---displacement for the loading condition being checked, in t;

KG ---vertical distance between the center of gravity and the base line for the loading condition being checked, in m;

V_m ---the maximum speed in m/s, it is to be taken as free speed for tugs or pushers;

a_3 --- coefficient for correction, is to be calculated as the following formulae:

$$a_3 = 25F_r - 9$$

When $a_3 < 0$, then $a_3 = 0$; when $a_3 > 1$, then $a_3 = 1$;

a_2 --- coefficient for correction, is to be calculated as the following formulae:

$$a_2 = 0.9 \left(4.0 - \frac{B_s}{d} \right)$$

If $\frac{B_s}{d} < 3.5$, then $\frac{B_s}{d} = 3.5$;

If $\frac{B_s}{d} > 4.0$, then $\frac{B_s}{d} = 4.0$.

where: B_s --- the maximum breadth of waterline for the loading condition being checked.

8.3.2 Passenger ships

8.3.2.1 The stability of passenger ships is to be calculated for the following basic loading conditions:

- (1) fully loaded departure condition;
- (2) fully loaded arrival condition;
- (3) arrival condition with full number of passengers but without cargo (or with ballast) ;
- (4) arrival condition without passengers and cargo (or with ballast).

8.3.2.2 For passenger ships under the loading condition being checked, the angle of statical heel gained from the curves of righting levers or moments is to be not greater than the limit angle of statical heel at the effect of the heeling moment or lever (see 8.3.2.4) resulting from crowding of passengers to one side.

8.3.2.3 The passengers are to be distributed all spaces which are accessible to passengers, when the passengers are crowding to one side.

8.3.2.4 The heeling moment M_k and lever l_k when passengers are crowding to one side are to be calculated respectively as the following formulae:

$$M_k = 0.32 \sum C_i b_i n_i \quad \text{kN}\cdot\text{m}$$

$$l_k = \frac{0.32}{9.81\Delta} \sum C_i b_i n_i \quad \text{m}$$

where: i ---the order number of spaces for carrying passengers ;

Δ ---displacement for the loading condition being checked, in t;

n_i ---corresponding number of passengers of each space , it is to be calculated as the following formulae and by given in rounded figures:

$$n_i = \frac{N}{S} b_i l_i$$

b_i ---the maximum transverse distance accessible to passengers, in m;

C_i ---coefficient , it is to be taken as the following formulae:

If fixed seats or sleepers are fitted in spaces for carrying passengers, $C_i = 0.12 + 0.32 \frac{b_i l_i}{n_i}$;

If no fixed seats or sleepers are fitted in spaces for carrying passengers,
 $C_i = 0.17 + 0.30 \frac{b_i l_i}{n_i}$;

If $C_i \geq 0.92$, then $C_i = 0.92$.

where: N ---the total number of passengers;

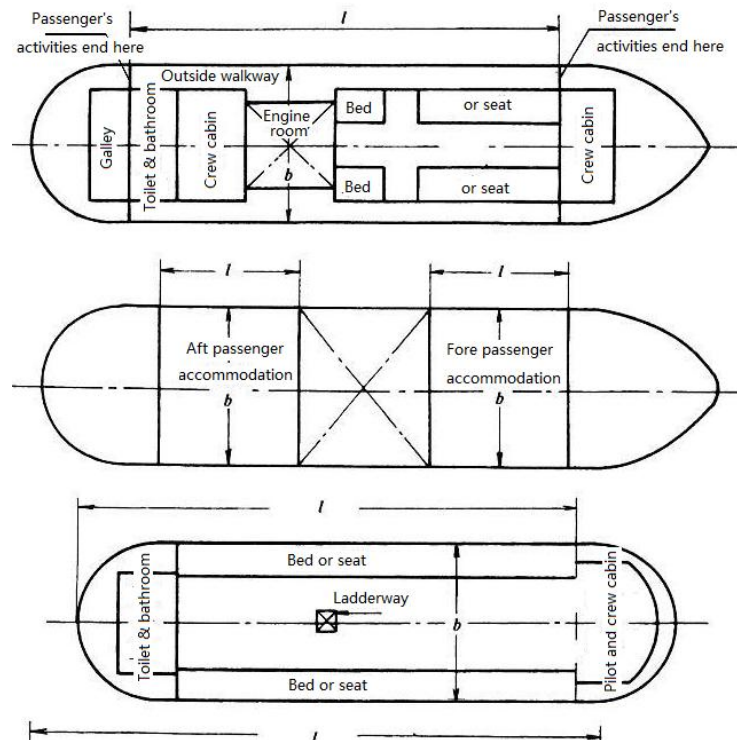
l_i ---the maximum longitudinal distance accessible to passengers, in m;

S ---the total area accessible to passengers in m^2 , it is to be taken from the following formulae:

$$S = \sum b_i l_i$$

The maximum transverse or longitudinal distance passengers may move refers to the maximum distance along the direction of ship's breadth or length passengers may extend in various places (including aisles, beds and seats), as shown in Figure 8.3.2.4.

When fixed seats (berths) and non-fixed seats (berths) are in a certain place, these two types of areas may be considered separately or be taken as non-fixed seats (berths).



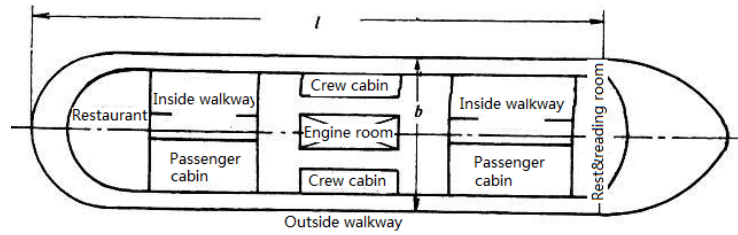


Figure 8.3.2.4

8.3.2.5 The stability is to comply with the requirements of criterion under the bad weather condition in addition to the above provisions. The stability criterion numeral K_{f0} calculated under various loading conditions is to comply with the following formulae:

$$K_{f0} = \frac{M_{q0}}{M_{f0}} \geq 1; \text{ or}$$

$$K_{f0} = \frac{l_{q0}}{l_{f0}} \geq 1$$

where: M_{q0} --- minimum capsizing moment with roll not to be taken into account, in kN·m, see 8.2.3.2 of this Section;

M_{f0} --- wind heeling moment of severe wind, in kN·m, see 8.3.2.6 of this Section;

l_{q0} --- minimum capsizing lever without taking account of rolling effect, in m, see 8.2.3.2 of this Section;

l_{f0} --- wind heeling lever of severe wind in m, see 8.3.2.6 of this Section.

8.3.2.6 The wind heeling moment M_{f0} or lever l_{f0} of severe wind is to be taken from the following formulae respectively:

$$M_{f0} = p_0 A_f (Z_f - d) \times 10^{-3} \quad \text{kN·m}$$

$$l_{f0} = \frac{1}{9.81\Delta} p_0 A_f (Z_f - d) \times 10^{-3} \quad \text{m}$$

where: A_f , Z_f , d , Δ --- the same as 8.2.4.1 of this Section;

p_0 --- unit wind pressure of severe wind for calculation, in Pa, it is to be taken from the following formulae:

$$p_0 = C_f \left(\frac{Z_f - d}{10} \right)^{0.2}$$

where: C_f --- service area coefficient, selected from Table 8.3.2.6.

Table 8.3.2.6

Area of navigation	Service Area A	Service Area B and C
C_f	1079	666

8.3.2.7 When the stability of sightseeing ships and tourist ships from turning round with full speed and for passengers crowding to one side is checked according to the requirements stipulated in 8.3.1.2 and 8.3.2.2, if there are multiple levels of places accommodating passengers (including sightseeing places), the effect of the rise of the center of gravity on stability caused by passenger distribution is to be taken into account:

(1) density of passenger distribution: for the spaces accommodating passengers (cabins), the density is calculated according to the ratified number of passengers of such spaces; for public spaces and service spaces, the number of passengers is to be calculated according to the number of seats/chairs or 2 persons per square meter, whichever the greater; for sightseeing spaces, the density is to be calculated according to the defined number of passengers;

(2) passengers are distributed in spaces accommodating passengers (cabins), public spaces, service spaces and sightseeing spaces from the top-down from the top deck;

(3) the height of the center of gravity for passengers is 1m above the deck or floor;

(4) the area of the spaces mentioned in Article (1) is to be calculated according to the provisions stipulated in 4.1.2.5 of CHAPTER 4 of PART SEVEN.

8.3.3 Dry cargo ships

8.3.3.1 Dry cargo ships include hatch cargo ships (barges), deck cargo ships (barges), well-deck ships (barges), timber carriers (barges) and bulk cement barges.

8.3.3.2 The stability of dry cargo ships is to be checked for the following basic loading conditions:

- (1) fully loaded departure condition;
- (2) fully loaded arrival condition;
- (3) arrival condition without passengers and cargo (or with ballast).

8.3.3.3 For ships carrying cargo in bulk, the righting lever should comply with the stability requirements of dry cargo ships after deducting the special heeling lever of bulk shift l_{sd} (see 8.3.3.4 and 8.3.3.5 of this Section). The angle of flooding θ_j is 20° or the angle determined according to 8.2.7 of this Chapter, whichever is the lesser.

8.3.3.4 The distribution of bulk cargo, weight calculation and determination of gravity center is to comply with the following provisions:

(1) The stowage calculation of bulk cargo is to be done according to the method shown as Figure 8.3.3.4. The cone of cargo is assumed to have an inclination to the horizontal of 37° . The projection of the end inclination surface of cargo on the longitudinal direction is not considered to be greater than 0.4 times of the breadth B_w of the cargo spaces.

(2) The volume under the deck camber is to be deducted in the process of stowage calculation.

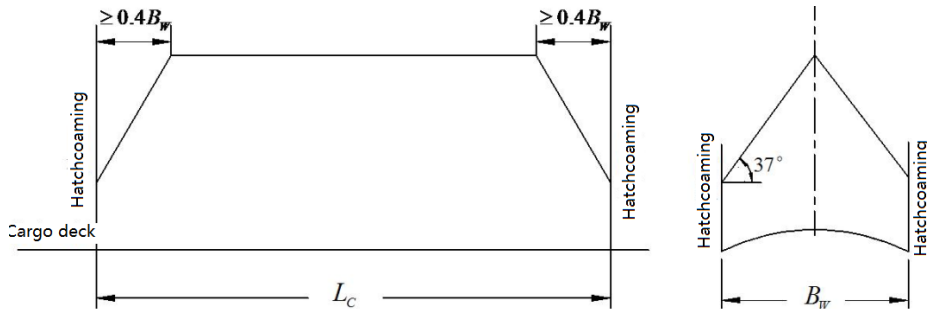


Figure 8.3.3.4 (1)

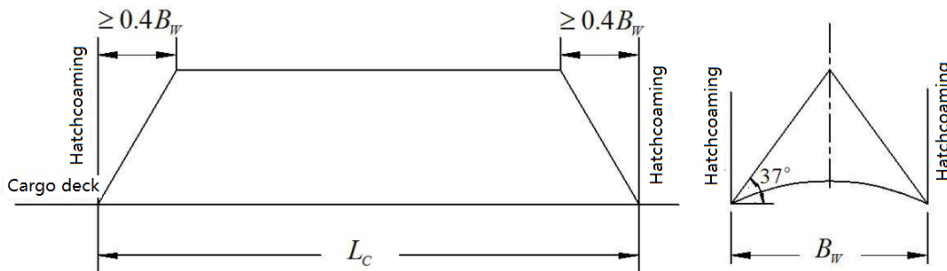


Figure 8.3.3.4 (2)

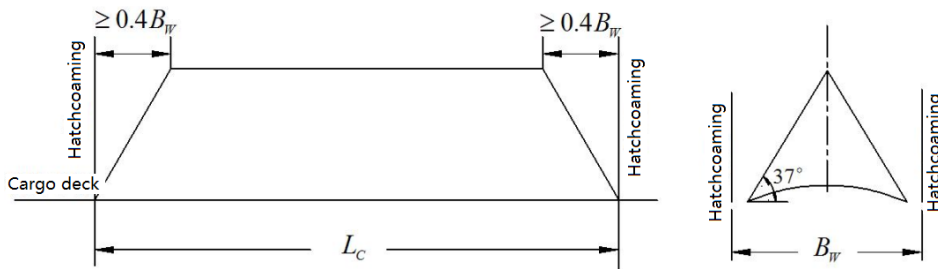


Figure 8.3.3.4 (3)

8.3.3.5 The special heeling lever l_{sd} of bulk shift is to be calculated according to the following formulae:

$$l_{sd} = 0.32a - 0.36a^2 + 0.25aD_c - 0.09aD_c^2 - 0.11a^2D_c - 0.025 \quad \text{m}$$

If $l_{sd} < 0$, then $l_{sd} = 0$.

where: a ---coefficient of inclination, $a = \frac{\theta}{57.3}$, where θ is the angle of heeling in ($^\circ$);

D_c ---coefficient of weight, $D_c = D_w / 1000$, where D_w is the cargo weight of the wedge in the above figures, in t; when $D_c > 1.5$, then $D_c = 1.5$.

8.3.3.6 For ships carrying cargoes in bulk and navigating in Service Area C, the area of the curves of righting levers obtained according to 8.3.3.3 is to be not less than 0.8 times of the value A calculated for ships navigating in Service Area B according to 8.2.1.3.

8.3.3.7 For ships carrying packed cargoes, heavy cargoes and cargoes with special dimensions, the weight and position of center of gravity of cargoes are to be calculated according to the type of cargoes and stowage. When ships carry heavy cargoes and cargoes with special dimensions, the heavy cargoes and cargoes with special dimensions are to be effectively secured.

8.3.3.8 For ships carrying timbers, the weight and position of center of gravity of timbers are to be calculated according to the unit weight and stowage. The stowage of timbers is to meet the following stipulations:

(1) timbers are to be distributed along horizontal direction as much as possible and stowed as close as possible;

(2) when timbers exceed the hatching coaming or cargo damper, the stowage, securing strength and method are to be approved by [CCSISC](#).

8.3.3.9 Bulk cement carriers are to meet the following stipulations:

(1) the effect of bulk slip and stowage stipulated in 8.3.3.3 and 8.3.3.6 is exempted for bulk cement carriers;

(2) the position of center of gravity of cargoes is taken at the centroid of cargo space of cargo hold;

(3) flooding angle θ_j is that determined according to 8.2.7 or 20° , whichever is the lesser.

8.3.3.10 For ships carrying dry bulk and timber in open air, the weight increase caused by water absorption under the working conditions in 8.3.3.2 (2) is to be calculated. Under normal conditions, the weight increase of yellow sand due to water absorption is to be 5% of the cargo weight; the weight increase of coal due to water absorption is to be 8% of cargo weight and the weight increase of timber and other dry bulk due to water absorption is to be 10% of cargo weight. The draught calculated based on this is to be not taken as the basis for checking freeboard.

8.3.3.11 For ships carrying dry bulk and timber in open air, if the ships are fitted with simple hatch cover and awning that can prevent green water and rain from entering deck, the calculation according to 8.3.3.10 is to be exempted.

8.3.3.12 Ships carrying wet bulk (such as hatch cargo ships/barges and deck cargo ships/barges, excluding self-unloading sand ships) are to meet the following stipulations besides the stipulations in 8.3.3.3 to 8.3.3.6:

(1) sumps/tanks are to be set according to the requirements for self-unloading sand ships in Section 3 of Chapter 10 of this Part;

(2) during the loading and voyage, the water logging in the sumps/tanks is to be timely discharged outboard;

(3) the effect of free surface of the liquid in the sumps/tanks is to be taken into account in calculating initial metacentric height and the curves of the righting lever;

(4) Where the cargo weight has included the weight of the water logging in the sumps/tanks, the water logging is to be not taken for an item of weight.

Ships carrying wet bulk are exempted from the calculation according to 8.3.3.10.

8.3.4 Liquid cargo ships

8.3.4.1 The stability of liquid cargo ships is to be checked for the following basic loading conditions:

(1) fully loaded departure condition;

(2) fully loaded arrival condition;

(3) partially loaded departure condition;

(4) partially loaded arrival condition;

(5) departure condition without cargo (or with ballast);

(6) arrival condition without cargo (or with ballast).

8.3.4.2 In calculating the loaded conditions mentioned in above 8.3.4.1 (3) and 8.3.4.1 (4), it is to be assumed to load 50% of each kind of liquid cargo in a pare of side tanks or in the tank arranged on the ship's center line.

8.3.5 Tugs (pushers)

8.3.5.1 The stability of tugs (pushers) is to be calculated for the following basic loading conditions:

- (1) departure condition;
- (2) arrival condition.

8.3.5.2 For tugs (pushers) on which the towing hook or towing post is provided, the initial metacentric height is to comply with the following formulae:

$$GM_0 \geq \frac{M_t}{9.81K(F/B)\Delta} \quad \text{m}$$

where: GM_0 ---initial metacentric height without being corrected for free surface effect for the loading condition being checked, in m;

M_t ---heeling moment due to the transverse jerk of towline in kN·m , see 8.3.5.3;

F ---minimum freeboard for the loading condition being checked, in m;

B ---maximum breadth of freeboard deck in m;

Δ ---displacement for the loading condition being checked, in t;

K ---coefficient , it is to be taken as Table 8.3.5.2 according to the service areas (sections).

Table 8.3.5.2

Service Area (section)	K
Service Area A, Torrent Section J ₁	0.85
Service Area B, Torrent Section J ₂	0.90
Service Area C	1.00

8.3.5.3 The heeling moment M_t due to the transverse jerk of towline is to be calculated according to the following formulae:

$$M_t = 0.64T_b(Z_t - d) \quad \text{kN·m}$$

where: Z_t ---vertical height of the suspension point of the towing hook above the base line in m;

d ---moulded draught of the ship for the loading condition being checked, in m;

T_b ---bollard pull, in kN, the value of design or test is to be taken.

8.3.6 Fire fighting ships

8.3.6.1 The stability of fire fighting ships is to be calculated for the following basic loading conditions:

- (1) departure condition;
- (2) arrival condition.

8.3.6.2 The amount of foamite in departure condition and arrival condition speculated in 8.3.6.1 is to be taken as 100% and 10% respectively.

8.3.2.2 For fire fighting ships under various loading condition the heeling moment or lever (see 8.3.6.5) due to jet of fire fighting guns, the angle of statical heel obtained from the curves of righting levers or moments is to be not greater than the limit angle of statical heel.

8.3.6.4 The stability criterion numeral K_a of fire fighting ships under various loading condition being checked is to comply with the following formulae:

$$K_a = \frac{M_q}{M_f + M_a} \geq 1; \text{ or}$$

$$K_a = \frac{l_q}{l_f + l_a} \geq 1$$

where: M_q ---minimum capsizing moment with roll taken into account in kN m, in kN·m ,see 8.2.3.1;

M_f ---wind heeling moment , in kN·m , see 8.2.5.1;

M_a ---jet heeling moment, in kN·m , see 8.3.6.5;

l_q --- minimum capsizing lever with roll taken into account in m, see 8.2.3.1;

l_f --- wind heeling lever, in m, see 8.2.5.1;

l_a --- jet heeling lever, in m, see 8.3.6.5.

8.3.6.5 The heeling moment M_a or lever l_a due to jet of fire fighting guns are calculated according to the following formulae:

$$M_a = \sum F_i (Z_i - a_0 d) \quad \text{kN}\cdot\text{m}$$

$$l_a = \frac{1}{9.81\Delta} \sum F_i (Z_i - a_0 d) \quad \text{m}$$

where: i —order number of fire fighting guns;

F_i ---jet counter-force when fire fighting guns are vertical to the longitudinal centerplane, in kN;

Z_i ---vertical height of gun muzzles above the base line when fire fighting guns are at the highest horizontal position in m;

d ---moulded draught of the ship for the loading condition being checked, in m;

Δ ---displacement for the loading condition being checked, in t;

a_0 ---coefficient for correction, see 8.2.5.5.

8.3.7 Container ships

8.3.7.1 The stability of container ships is to be checked for the following basic loading conditions:

- (1) fully loaded departure condition;
- (2) fully loaded arrival condition;
- (3) departure condition without cargo (or with ballast);
- (4) arrival condition without cargo (or with ballast).

8.3.7.2 When calculating the stability of container ships in full-loaded conditions as specified in 8.3.7.1, the following loading conditions are to be taken into account:

(1) where the number of containers is taken as the maximum designed number of containers carrying cargoes, the mass of the same type containers is to be taken as the same mass which may be possibly carried by the ship in full-loaded departure condition;

(2) where the number of containers is taken as the sum of the maximum designed number of containers carrying cargoes and the number of empty containers, the mass of the same type containers is to be taken as the same mass which may be possibly carried by the ship in full-loaded departure condition, and the mass of the empty container is to be taken as its dead weight.

8.3.7.3 When calculating the stability of container ships, the position of vertical center of gravity of each container is to be taken as half of the height of the container.

8.3.7.4 When calculating the wind heeling areas of container ships, the projected lateral area of containers stowed on decks is to be taken into account.

8.3.7.5 Under the heeling moment or lever (see 8.3.7.6) due to transverse wind, the angle of statical heel gained from the curves of righting levers or moments is to be not greater than the limit angle of statical heel.

8.3.7.6 The heeling moment or level due to transverse wind is to be taken as half of the value obtained from the formula in 8.2.5.1.

8.3.7.7 When calculating the curves of righting levers or moments, the effect of buoyancy of the container stowed on decks is to be not taken into account.

8.3.7.8 The initial metacentric height after the correction for free surface effect of liquids is to be not less than 0.3m.

8.3.7.9 The requirements of this Section are also applicable to non-container ships which carry containers on decks.

8.3.7.10 Intact stability in the load manual is to include the loading conditions mentioned in 8.3.7.1. Where the condition mentioned in 8.3.7.2 is one of the follows, the stability under this condition is to be calculated in addition according to 8.3.7.11.

(1) the mass of containers loaded with cargoes is less than 75% of the rated mass of the type of the containers;

(2) the number of containers is the sum of the maximum designed number of containers loaded with cargoes and the number of empty containers;

(3) the ballasts are carried on board to make the stability up to standard.

8.3.7.11 For the ships of which stability is calculated in accordance with the requirements in 8.3.7.10, intact stability in the load manual isto include the follows in addition:

- (1) the number of containers
 - ① is taken as the maximum designed number of containers loaded with cargoes;
 - ② is taken as the sum of the maximum designed number of containers loaded with cargoes and the number of empty containers.
- (2) calculations for the mass of containers
 - ① the mass of the empty container is to be taken as the dead weight of this type of containers;
 - ② the dereferencing range for the mass of containers loaded with cargoes with the same type:
 - a. 15% of the rated mass of this type of containers is as the start;
 - b. the rated mass of this type of containers as the termination;
 - c. the mass interval of containers for calculation is not to exceed 15% of the rated mass.
- (3) When calculating according to 8.3.7.11 (2), the method of reducing the number of containers or adding ballasts may be adopted to make the stability qualified.

8.3.7.12 Load manual is to be prepared on the basis of the calculation for intact stability and is to be approved by eesisc.

8.3.8 Floating cranes

8.3.8.1 The stability of floating cranes is to be checked for the following loading conditions:

- (1) Under navigating and sheltering from wind:
 - (1) with full fuel and stores;
 - (2) with 10% fuel and stores.
- (2) Under operating:
 - (1) with mass of load on hook, full fuel and stores;
 - (1) with mass of load on hook, 10% fuel and stores.

8.3.8.2 The stability of floating cranes is to be checked for navigating, operating and sheltering from wind conditions. For floating cranes engaged in harbor service, the calculation of stability for navigating condition may be exempted.

8.3.8.3 The following requirements are to be complied with for floating cranes in navigating condition:

- (1) The initial metacentric height after the correction of free surface effect of liquids is to be not less than 0.16 times of the moulded breadth;
- (2) The wind pressure stability criterion numeral K_f and/or torrent stability criterion numeral K_J is to meet the stipulations of 8.2.1 and 8.2.2;
- (3) For crane ships navigating in Service Area A and B and torrent service section, the maximum righting lever l_m isto be not less than 1.2 m or 0.11B , whichever is the least;
- (4) For crane ships navigating in Service Area A, the heeling angle θ_m corresponding to that lever is to be not less than 15°;
- (5) The initial metacentric height and the normalization value of the characteristics of righting levers curve may be exempted from check for catamaran crane ships.

8.3.8.4 The stability of floating cranes under operating conditions is to meet the following requirements:

- (1) Slewing floating cranes

$$GM_1 \geq \frac{M_f + M_x}{0.172\theta_r \Delta} \quad \text{m}$$

$$GM_1 \geq \frac{M_f}{0.515\Delta} \quad \text{m}$$

where: GM_1 ---initial metacentric height for the loading condition being checked, with the free surface effect of liquids and the effect of heavy load on hook to the initial metacentric height being taken into account , in m;

M_f ---wind heeling moment , in kN·m , see 8.3.8.6;

M_x ---heeling moment, in kN·m, due to load on the hook , see 8.3.8.10;

θ_r ---limit angle of statical heel for the loading condition being checked, in °, see 8.3.8.11.

Δ ---displacement of the ship under the loading condition being checked, in t.

While the operating condition of slewing floating cranes should be assumed to be the condition in which the heeling moment is the maximum heeling moment, and then the hook is at the highest position, the vertical

height of center of gravity of load on hook is to be supposed at the point of suspension.

(2) Fixed type floating crane

$$GM_1 \geq \frac{M_f + M_h}{0.172\theta_r \Delta} \quad \text{m}$$

$$GM_1 \geq \frac{M_f}{0.515\Delta} \quad \text{m}$$

where: GM_1 , M_f , Δ , θ_r ---the same as 8.3.8.4(1);

M_h ---heeling moment, in kN·m, due to transverse shifting of the ship, see 8.3.3.9.

The vertical height of center of gravity of load on hook is to be supposed at the point of suspension.

8.3.8.5 The stability of floating cranes under the condition of sheltering from wind is to meet the requirements of the following formulae:

$$GM_1 \geq \frac{M_f}{0.172\theta_r \Delta} \quad \text{m}$$

where: GM_1 , M_f , Δ , θ_r ---the same as 8.3.8.4(1).

8.3.8.6 The wind heeling moment M_f and wind heeling lever l_f of floating cranes is to be obtained from the following formulae, with the windage area to be segmented for every 15 m in height from the waterline upwards.

$$M_f = \sum p C_i A_{fi} (Z_{fi} - a_0 d) \times 10^{-3} \quad \text{kN·m}$$

$$l_f = \frac{1}{9.81\Delta} \sum p C_i A_{fi} (Z_{fi} - a_0 d) \times 10^{-3} \quad \text{m}$$

where: p ---calculated unit wind pressure, in Pa, see 8.3.8.7 of this Section;

i ---order number of segmented windage area;

A_{fi} ---windage area, in m², to be determined in accordance with 8.2.5.3 and 8.3.8.8 of this Chapter;

Z_{fi} ---vertical height of center of windage area above the base line, in m;

d ---moulded draught of the ship for the loading condition being checked, in m;

Δ ---same as defined in 8.3.8.4 of this Section;

a_0 ---coefficient for correction, see 8.2.5.5 of this Chapter;

C_i ---coefficient of height correction, to be obtained from Table 8.3.8.6.

Table 8.3.8.6

$Z_{fi} - d$ (m)	\geq	0	15	30	45	60	75
	$<$	15	30	45	60	75	90
C_i		1.00	1.16	1.32	1.44	1.53	1.61

8.3.8.7 The calculated unit wind pressure p is to be obtained from Table 8.3.8.7 in accordance with the Service Area and the condition of floating cranes.

Table 8.3.8.7

Condition	Navigation			Operation	Shelter from wind	
	Grade A	Grade B	Grade C	Irrespective of area of navigation	Service Area A	Service Area B and C
Calculated unit wind pressure P (Pa)	361	330	300	176	1079	666

8.3.8.8 When calculating the windage area of floating cranes, the following requirements are to also be complied with:

(1) for crane trusses of lattice type, a filling factor of 0.5 is to be taken;

(2) where the projection of several objects overlap one another on the longitudinal centerline plane, the overlapped area is to be multiplied by an overlapping factor of 1.5;

(3) The center of windage area of the load on hook is assumed to be located at the point of suspension, and the windage area A_f of the load is to be obtained from the following formula:

$$A_f = 2.78W^{0.56} \quad \text{m}^2$$

Where: mass of load on hook, in t.

8.3.8.9 The heeling moment M_h due to transverse shifting is to be calculated according to the following formulae:

$$M_h = 0.5P_h \left(Z_h - \frac{d}{2} \right) \quad \text{kN}\cdot\text{m}$$

where: P_h ---pull force of transverse shifting winch, in kN;

Z_h ---vertical distance between the action point of transverse shifting fowls and the base line for the loading condition being checked, in m;

d ---same as defined in 8.3.8.6.

8.3.8.10 For slewing floating cranes, the maximum heeling moment M_x is to be calculated according to the following formulae when the lib levers are out of board:

$$M_x = 12.75W_x b_x - 1.3M_i \quad \text{kN}\cdot\text{m}$$

where: W_x ---gross weight of jib lever hangers, hooks and loads, in t;

b_x ---horizontal distance between the center of gravity of the above weight and the longitudinal centerline plane, in m;

M_i ---balance moment of balance parts of the lifting machines, in kN·m.

8.3.8.11 The limit angle of statical heel θ_r of floating cranes under the condition of navigating or sheltering is to be equal to 0.8 times of the flooding angle at the deck edge, 0.8 times of the angle at the center point of bilge which is above water surface, or 8°, whichever is the least.

The limit angle of statical heel θ_r of floating cranes in operating condition is not to exceed 5° for slewing floating cranes and 3° for non-slewing floating cranes.

8.3.8.12 For floating cranes navigating in Service Area A or B, the amplitude of roll θ_1 is to be obtained in accordance with the following formula:

(1) for catamaran floating cranes, the amplitude of roll θ_1 is to be calculated according to 8.3.11.7 of this Section;

(2) for monohull floating cranes, the amplitude of roll θ_1 is to be calculated according to the following formulae:

$$\theta_1 = 11.75C_1 \sqrt{\frac{C_2}{C_3}} \quad (^\circ)$$

where: C_1, C_2, C_3 ---coefficient, calculated in accordance with 8.3.8.13 to 8.3.8.15 respectively.

8.3.8.13 The coefficient C_1 in the formula for calculating the amplitude of roll is to be taken from Table 8.2.4.2 according to the period of natural roll of the floating cranes T_θ and service area.

The period T_θ of ship's natural roll is to be obtained from the following formulae:

$$T_\theta = \frac{(0.73 + 0.046 \frac{B}{d})B}{\sqrt{GM_0}} \quad \text{s}$$

where: B ---moulded width of the ship, in m;

d ---same as defined in 8.3.8.6;

GM_0 ---initial metacentric height, in m, of the floating crane for the loading condition being checked, without taking into account the correction for free surface effect of liquids.

8.3.8.14 The coefficient C_2 in the formula for calculating the amplitude of roll is to be calculated in accordance with the following formula:

$$C_2 = 0.66 - 0.05 \frac{B}{d} + 0.11 \frac{KG}{d}$$

If $C_2 > 0.85$, then $C_2 = 0.85$.

where: B ---same as defined in 8.3.8.13;

d ---same as defined in 8.3.8.6;

KG ---vertical height of the center of gravity of the floating crane above the base line for the loading condition being checked, in m.

8.3.8.15 The coefficient C_3 in the formula for calculating the amplitude of roll is to be calculated in accordance with the following formula:

$$C_3 = \frac{1}{dKG} (18dKG + 49BKG + 37dGM_0 - 6BGM_0) \times 10^{-4}$$

If $C_3 < 0.05$, then $C_3 = 0.05$.

where: B , GM_0 ---same as defined in 8.3.8.13;

d ---same as defined in 8.3.8.6;

KG ---same as defined in 8.3.8.14;

8.3.8.16 The stability of floating pile driver is to be checked according to the requirements for fixed type floating cranes. The limit angle of statical heel of floating pile driver in operation is to be not greater than 4° .

8.3.9 Dredgers

8.3.9.1 The stability of dredgers with mud holds is to be checked for the following loading conditions:

(1) Under navigating and sheltering from wind:

(1) without mud in mud holds^①, with full fuel and stores ;

(2) without mud in mud holds^①, with 10% fuel and stores.

(2) Under operating:

(1) with full mud in mud holds, with full fuel and stores;

(2) with full mud in mud holds, with 10% full fuel and stores;

(3) with half mud in mud holds, with 50% full fuel and stores;

8.3.9.2 For dredgers without mud holds, the stability for the following basic loading conditions is to be checked under the conditions of navigating, operating and sheltering from wind:

(1) with full fuel and stores;

(2) with 10% fuel and stores;

8.3.9.3 The stability for dredgers under the condition of navigating (including the navigation in operation area) is to comply with the following requirements:

(1) The wind pressure stability criterion numeral K_f and/or torrent stability criterion numeral K_J are to meet the stipulations of 8.2.1 and 8.2.2;

(2) The initial metacentric height after the correction of free surface effect of liquids is to comply with the following requirements:

① For dredgers with mud holds, the initial metacentric height after the correction of free surface effect of liquids of sludge in mud holds is to be not less than 0.6m;

② For dredgers without mud holds, the initial metacentric height is to be not less than 0.3m.

(3) For dredgers navigating in Service Area A and B and section J, the curve of righting arm is to meet the following requirements:

① For box type bucket dredgers and cutter suction dredgers, the maximum value of righting levers l_m is to be not less than 0.25m, and the heeling angle θ_m corresponding to that lever is to be not less than 20° . If the angle is less than 20° but greater than 15° , the maximum value l_m is to be not less than the value obtained from the following formula:

$$l_m = 0.25 + 0.018(20 - \theta_m) \quad \text{m}$$

where: θ_m ---the angle corresponding to the maximum righting lever, in ($^\circ$).

② For box type grab dredgers, the maximum value l_m of righting levers is not to be less than 1.2m or 0.11B, whichever is the lesser;

③ For crane ships navigating in Service Area A, the heeling angle θ_m corresponding to that arm is to

be not less than 15°;

④ For normal type dredgers, the righting lever curves are to be in compliance with the requirements of 8.2.1.3 and 8.2.2.2.

(4) The initial metacentric height and the normalization value of the characteristics of righting levers curve may be exempted from check for catamaran dredgers.

8.3.9.4 The stability of dredgers under operating conditions is to meet the following requirements:

(1) Cuttersuction dredgers

$$GM_1 \geq \frac{M_f + M_h + M_d + M_p}{0.172\theta_r \Delta} \quad \text{m}$$

where: GM_1 ---initial metacentric height after correction of free surface effect of liquid for loading being checked, in m;

M_f ---wind heeling moment , in kN·m , see 8.3.9.6;

M_h ---heeling moment, in kN·m, due to transverse shifting of the ship, see 8.3.3.9;

M_d ---heeling moment of spuds , in kN·m, see 8.3.9.10;

M_p ---heeling moment due to soil discharging , in kN·m, see 8.3.9.11;

θ_r ---limit angle of statical heel of the ship under the loading condition being checked, in °, see 8.3.9.13;

Δ ---displacement of the ship under the loading condition being checked, in t.

The operating condition of cutter suction dredgers is to be assumed as the condition under which the open cutter is at the lowest position, and the discharge tube (slots) and mud tube are full of mud.

(2) Bucket dredgers

$$GM_1 \geq \frac{M_f + M_h + M_p}{0.172\theta_r \Delta} \quad \text{m}$$

where: GM_1 , M_f , M_h , M_p , θ_r , Δ ---the same as 8.3.9.4(1).

The operating condition of bucket dredgers is to be assumed as the condition under which the bucket is at the highest position and lowest position (the dredging depth is equal to the draught); the discharge tubes (slots) and all of the mud buckets with mouth upward are full of mud.

(3) Grab dredgers

$$GM_1 \geq \frac{M_f + M_x}{0.172\theta_r \Delta} \quad \text{m}$$

$$GM_1 \geq \frac{M_f}{0.515\Delta} \quad \text{m}$$

where: GM_1 , M_f , θ_r , Δ ---the same as 8.3.9.4(1);

M_x ---heeling moment for the lib arm out board, in kN·m, see 8.3.9.12. The operation state of grab dredgers is to presume that when the maximum heeling moment generated due to lib arms being out of board, the grab is at the highest position.

8.3.9.5 The stability for dredgers sheltering from wind, which have no power for propulsion, is to comply with the following formula:

$$GM_1 \geq \frac{M_f}{0.172\theta_r \Delta} \quad \text{m}$$

where: GM_1 , M_f , θ_r , Δ --- the same as 8.3.9.4(1).

8.3.9.6 The wind heeling moment M_f or lever l_f is to be calculated in accordance with the following formulae respectively:

(1) Bucket dredgers and trailing suction dredgers are to comply with the requirements of 8.2.5.1, 8.2.5.3, 8.2.5.4, 8.2.5.5 and 8.3.9.7;

(2) Cutter suction dredgers and grab dredgers:

$$M_f = \sum pC_i A_{fi} (Z_{fi} - a_0 d) \times 10^{-3} \quad \text{kN·m}$$

$$l_f = \frac{1}{9.81\Delta} \sum p C_i A_{fi} (Z_{fi} - a_0 d) \times 10^{-3} \quad \text{m}$$

where: p ---calculated unit wind pressure, in Pa, see 8.3.9.7;

i ---order number of segmented windage area;

A_{fi} ---windage area, in m^2 , to be determined in accordance with 8.2.5.3 and 8.3.9.8;

Z_{fi} ---vertical height of center of windage area above the base line, in m;

d ---moulded draught of the ship for the loading condition being checked, in m;

Δ ---same as defined in 8.3.9.4;

a_0 ---coefficient for correction, see 8.2.5.5;

C_i ---same as defined in 8.3.8.6.

8.3.9.7 The calculated unit wind pressure P is to be obtained from Table 8.3.9.7 in accordance with the Service Area and the condition of dredgers.

Table 8.3.9.7

Condition		Navigation			Operation	Shelter from wind	
Area of navigation		Grade A	Grade B	Grade C	Irrespective of area of navigation	Service Area A	Service Area B and C
Calculated unit wind pressure P (Pa)	Bucket dredgers, cutter-suction dredgers, and grab dredgers	361	330	300	176	1079	666
	Trailing suction dredgers, Hopper barge and Reclamation craft	361	330	300	—	—	—

8.3.9.8 When calculating the windage area of dredgers, the following requirements are to also be complied with:

(1) for crane trusses of lattice type, a filling factor of 0.5 is to be taken;

(2) where the projection of two or more than two objects overlap one another on the longitudinal centerline plane, the overlapped area is to be multiplied by an overlapping factor of 1.50.

8.3.9.9 The heeling moment M_h due to transverse shifting is to be calculated according to the following formulae:

$$M_h = 0.5 P_h \left(Z_h - \frac{d}{2} \right) \quad \text{kN}\cdot\text{m}$$

where: P_h ---pull force of transverse shifting winch, in kN;

Z_h ---vertical distance between the action point of transverse shifting fouls and the base line for the loading condition being checked, in m; For cutter-suction dredgers, the action point of transverse shifting fouls is at the position of the pulling ring of the cutter ladder, When the dredger has the maximum dredging depth, the pulling ring of the cutter ladder (action point) may be under the base line, then the value of Z_h is to be taken as negative value, and the result value M_h is to be taken as absolute value in Formula 8.3.9.4.

d ---same as defined in 8.3.9.6.

8.3.9.10 The heeling moment M_d due to the setting down of spuds is to be calculated according to the following formulae:

$$M_d = 9.81 W_d b_d \quad \text{kN}\cdot\text{m}$$

where: M_d ---weight of one spud, in t;

b_d horizontal distance between the central line of spuds and the longitudinal centerline plane, in m.

8.3.9.11 The heeling moment M_p due to the soil discharging from gunwale to overside is to be calculated in accordance with the following formula:

$$M_p = 9.81 W_p b_p \quad \text{kN}\cdot\text{m}$$

where: W_p ---gross weight of mud in the soil discharging facility, in t;

b_p ---horizontal distance between the center of gravity of mud in the soil discharging facility and the longitudinal centerline plane, in m.

8.3.9.12 For grab dredgers, the maximum heeling moment M_x is to be calculated according to the following formulae when the lib levers are out of board:

$$M_x = 12.75W_x b_x - 1.3M_i \quad \text{kN}\cdot\text{m}$$

where: W_x ---gross weight of jib lever hangers, grab and mud, in t;

b_x ---horizontal distance between the center of gravity of the above weight and the longitudinal centerline plane, in m;

M_i ---balance moment of balance parts of the lifting machines, in kN·m.

8.3.9.13 The limit angle of statical heel of dredgers θ_r under the condition of navigating or sheltering from wind is to be equal to 0.8 times of the flooding angle at the edge deck, 0.8 times of the angle at the center point of bilge which is comes above the water surface or 8° , whichever is the least.

When dredgers are in operating condition, the requirements ensuring operating normally for the limit angle of statical heel are to be given by the ship owner.

8.3.9.14 For dredgers with mud holds, the free surface effect of sludge in mud holds to stability is to be calculated. When the density of sludge in mud holds is not greater than 1.4t/m^3 , the flooding out of the sludge from the overflow port or hatch are to be considered when the ship incline. Then, the righting lever curves are to be calculated in accordance with the real value of the displacement and the center of gravity of the sludge.

8.3.9.15 For dredgers navigating in Service Area A or B, the amplitude of roll θ_1 is to be calculated in accordance with the following formula:

(1) The amplitude of roll θ_1 of catamaran dredgers is to be calculated in accordance with the requirements of 8.3.11.7;

(2) The amplitude of roll θ_1 of trailing suction dredgers and other common type dredgers is to be calculated in accordance with the requirements of 8.2.4;

(3) The amplitude of roll θ_1 of box type grab dredgers is to be calculated in accordance with the requirements 8.3.8.12 (2);

(4) The amplitude of roll θ_1 of box type bucket dredgers and cutter suction dredgers is to be calculated in accordance with the following formula:

$$\theta_1 = 11.75C_1 \sqrt{\frac{C_2}{C_3}} \quad (^\circ)$$

where: C_1, C_2, C_3 ---coefficient, calculated in accordance with 8.3.9.16 to 8.3.9.16 respectively.

8.3.9.16 The coefficient C_1 in the formula for calculating the amplitude of roll is to be taken from Table 8.2.4.2 according to the period of natural roll of the floating cranes T_θ and service area.

The period T_θ of ship's natural roll is to be obtained from the following formulae:

$$T_\theta = \frac{(0.7 + 0.076 \frac{B}{d})B}{\sqrt{GM_0}} \quad \text{s}$$

where: B ---moulded width, in m;

d ---same as defined in 8.3.9.6;

GM_0 ---initial metacentric height, in m, of the floating crane for the loading condition being checked, without taking into account the correction for free surface effect of liquids.

8.3.9.17 The coefficient C_2 in the formula for calculating the amplitude of roll is to be calculated in accordance with the following formula:

$$C_2 = 0.40 + 0.06 \frac{KG}{d}$$

If $C_2 > 0.85$, then $C_2 = 0.85$.

where: d ---same as defined in 8.3.9.6;

KG ---vertical distance between of the center of gravity and the base line for the loading condition being checked, in m.

8.3.9.18 The coefficient C_3 in the formula for calculating the amplitude of roll isto be calculated in

accordance with the following formula:

$$C_3 = \frac{1}{dKG} (77dKG + 66BKG + 55dGM_0 - 21BGM_0) \times 10^{-4}$$

If $C_3 < 0.04$, then $C_3 = 0.04$.

where: B , GM_0 ---same as defined in 8.3.9.16;

d ---same as defined in 8.3.9.6;

KG ---same as defined in 8.3.9.17.

8.3.9.19 The ships carrying mud exclusively are to comply with the requirements for liquid cargo ships in 8.3.4 of this Section and the provisions in 8.3.9.14 and 8.3.9.20.

8.3.9.20 For dredgers with mud holds, the calculation of the stability criterion numeral K_f and/or K_J are to be added when unsymmetrical soil discharging happens due to failure of the control of the mud door:

(1) The parallel movement distance Y_{g1} of the ship's center of gravity is to be calculated in accordance with the following formula:

$$Y_{g1} = \frac{WY}{\Delta_1} \quad \text{m}$$

where: W ---gross weight of the mud discharged from the mud hold, in t;

Y ---horizontal distance between the gravity center of mud discharged and the longitudinal centerline plane, in m;

Δ_1 ---displacement of dredger after soil discharging, in t:

$$\Delta_1 = \Delta - W$$

where: Δ ---displacement of the ship before soil discharging, in t .

W ---same as above.

(2) The righting lever l_1 and the lever l_{d1} of dynamic stability of the ship is to be calculated in accordance with the following formula:

$$l_1 = l - Y_{g1} \cos \theta \quad \text{m}$$

$$l_{d1} = l_d - Y_{g1} \sin \theta \quad \text{m}\cdot\text{rad}$$

where: l ---calculated righting lever when the displacement is Δ , and the gravity center is at the longitudinal centerline plane, in m;

l_d ---calculated lever of dynamic stability when the displacement is Δ , and the gravity center is at the longitudinal centerline plane, in m·rad;

θ ---amplitude of transverse heeling, in °;

Y_{g1} ---parallel movement distance of the gravity center of the ship, in m.

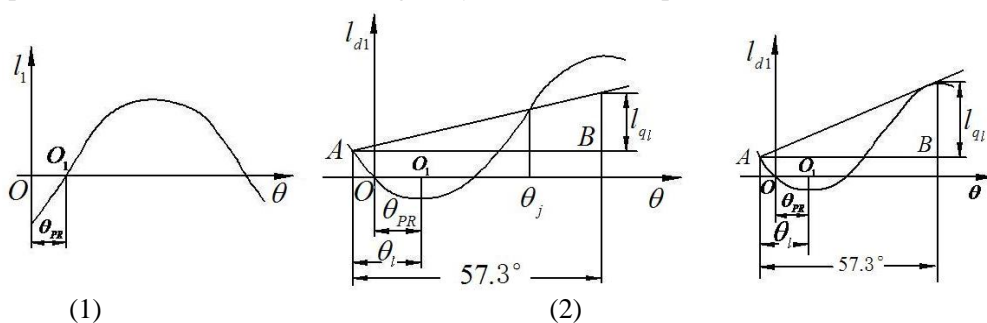


Figure 8.3.9.20

The form of the dynamic stability curves and righting lever with an angle of statical heel calculated in accordance with the above formula is shown as Figure 8.3.9.20, θ_{PR} in the figure is the angle of statical heel.

(3) The calculation of amplitude of roll θ_l :

When the density of mud in mud holds is not greater than $1.4t/m^3$, the amplitude of roll θ_l is to be taken as 6° .

When the density of mud in mud holds is greater than $1.4t/m^3$, the amplitude of roll θ_l is to be

calculated in accordance with the following formula with the dynamic characteristics of soil discharging taken into account:

$$\theta_l = 6 + 0.2\theta_{PR} \quad (^\circ)$$

(4) The minimum capsizing lever l_{ql} is to be calculated as follows:

One point from O_1 to the left direction of axis of abscissa θ is to be equal to amplitude of roll θ_l , as shown in Figure 8.3.9.20 (2). The other methods are to be the same as 8.2.3.1.

8.3.10 Pontoons

8.3.10.1 The stability of pontoons is to be calculated for the following basic loading conditions:

- (1) fully loaded berthing;
- (2) berthing without cargo (or with ballast).

8.3.10.2 The stability is to be checked under berthing and sheltering from wind.

8.3.10.3 The limit angle of statical heel is to be the angle of flooding at the edge of freeboard deck or the angle at which the mid-point of bilge comes out of water or 10° , whichever is the least.

8.3.10.4 The stability under berthing is to comply with the following requirements:

- (1) the initial metacentric height, righting levers curve, wind pressure stability criterion numeral K_f and/or torrent stability criterion numeral K_J are to meet the stipulations of 8.2.1 and 8.2.2;
- (2) when checking righting levers curve, the heeling angle θ_m corresponding to the maximum righting lever for the ships navigating in Service Area A is to be not less than 10° ;
- (3) the initial metacentric height and the normalization value of the characteristics of righting levers curve may be exempted from check for catamaran pontoons;
- (4) for catamaran pontoons, the amplitude of roll is to be calculated according 8.3.11.7;
- (5) for restaurant pontoons, the angle of statical heel gained from the curves of righting levers or moments is to be not greater than the limit angle of statical heel at the effect of the heeling moment or lever resulting from crowding of passengers to one side.

8.3.10.5 The stability of floating cranes under the condition of sheltering from wind is to meet the requirements of the following formulae:

$$GM_1 \geq \frac{M_f}{0.172\theta_r\Delta} \quad \text{m}$$

where: GM_1 —initial metacentric height corrected for free surface effect for the loading condition being checked, in m;

M_f —wind heeling moment under sheltering from wind, in kN·m, see 8.3.10.6;

θ_r —limit angle of statical heel for the loading condition being checked, in $^\circ$, see 8.3.10.3;

Δ —the displacement for the loading condition being checked, in t.

8.3.10.6 The wind heeling moment M_f under sheltering from wind is to comply with the following formula:

$$M_f = pA_f(Z_f - a_0d) \times 10^{-3} \quad \text{kN}\cdot\text{m}$$

where: p —calculated unit wind pressure, in Pa. For Service Area A, $p = 1079$; for Service Area B and C, $p = 666$;

A_f —ship's windage area for the loading condition being checked, in m^2 ;

Z_f —vertical distance between the center of windage area and the base line for the loading condition being checked, in m;

d —moulded draught of the ship for the loading condition being checked, in m;

a_0 —coefficient for correction, see 8.2.5.5.

8.3.10.7 When dry cargos and liquid cargos are stored in pontoons, the pontoons are to meet the stipulations in 8.3.3 and 8.3.4.

8.3.11 Catamarans

8.3.11.1 Except where otherwise stated, this Section applies to passenger catamarans and catamaran car ferry. Catamaran floating crane, catamaran dredgers and catamaran pontoons are to meet the stipulations in 8.3.8, 8.3.9 and 8.3.10.

8.3.11.2 Only the stability in fully loaded departure condition is to be checked for catamaran.

8.3.11.3 When calculating the flooding angle, if the opening of the flooding angle is at the position of the non-watertight opening up the freeboard deck, only half of the height of the door coaming is to be taken into account.

8.3.11.4 The initial metacentric height and the normalization value of the characteristics of righting levers curve may be exempted from check.

8.3.11.5 The wind heeling moment or wind heeling lever is to be obtained from 8.2.5.1, where the coefficient a_0 for correction is to be taken as 0.5.

8.3.11.6 The windage area is to be 1.2 times of the value obtained from 8.2.5.3.

8.3.11.7 For catamaran navigating in Service Area A or B, the amplitude of roll θ_1 is to be obtained in accordance with the following formula:

$$\theta_1 = 11.75C_1C_4\sqrt{\frac{C_2}{C_3}} \quad (^\circ)$$

where: C_1, C_2, C_3, C_4 —coefficient, calculated in accordance with 8.3.11.8 to 8.3.11.11 respectively.

8.3.11.8 The coefficient C_1 in the formula for calculating the amplitude of roll is to be taken from Table 8.2.4.2 according to the period of natural roll of the floating cranes T_θ and service area.

The period T_θ of ship's natural roll is to be obtained from the following formulae:

$$T_\theta = \frac{1.05B}{\sqrt{GM_0}} \quad \text{s}$$

where: B —maximum moulded breadth of the freeboard deck, in m;

GM_0 —initial metacentric height, in m, of the floating crane for the loading condition being checked, without taking into account the correction for free surface effect of liquids.

8.3.11.9 The coefficient C_2 in the formula for calculating the amplitude of roll is to be calculated in accordance with the following formula:

$$C_2 = (0.21 + 0.26\frac{KG}{d})[1 - 0.363(\frac{B}{T_\theta^2})^2]$$

If $\frac{KG}{d} \geq 3.04$, then $\frac{KG}{d} = 3.04$;

If $\frac{B}{T_\theta^2} \geq 1.2$, then $\frac{B}{T_\theta^2} = 1.2$.

where: B —same as defined in 8.3.11.8;

T_θ —period of natural roll, see 8.3.11.8;

d —moulded draught of the ship for the loading condition being checked, in m;

KG —vertical distance between of the center of gravity and the base line for the loading condition being checked, in m.

8.3.11.10 The coefficient C_3 in the formula for calculating the amplitude of roll is to be calculated in accordance with the following formula:

$$C_3 = 0.024 f_3 f_4$$

where: f_3 —coefficient, it is to be taken from Table 8.3.11.10 (1) in accordance $\frac{\sqrt[3]{\nabla}}{b}$.

Table 8.3.11.10 (1)

$\frac{\sqrt[3]{\nabla}}{b}$	≥ 2.0	1.9	1.8	1.7	1.6	≤ 1.5
f_3	1.00	1.29	1.54	1.83	2.13	2.42

Where: ∇ — gross displacement volume of the ship under the loading condition being checked, in m³.

b — maximum waterline breadth of the ship for the loading condition being checked, in m;

f_4 — coefficient, it is to be taken from Table 3.10.3.11(2) in accordance with W/b .

Table 8.3.11.10 (2)

W/b	≤ 0.5	0.7	0.9	1.1	1.3	1.5	≥ 1.7
f_4	0.68	0.80	1	1.23	1.48	1.75	2.01

where: W —distance between inside shells at waterline for the loading condition being checked, in m .

8.3.11.11 The coefficient C_4 in the formula for calculating the amplitude of roll is to be calculated in accordance with the following formula:

When the coefficient of the total area of the bilge keel $\frac{A_b}{Lb} \geq 0.03$, then $C_4 = 0.9$;

When the coefficient of the total area of the bilge keel is less than 0.03 or the bilge keel is not fitted, C_4 is to be taken as 1.

where: A_b —total area of bilge keels , in, m²;

L —length between perpendicular, in m;

b —same as defined in 8.1.11.10.

8.3.11.12 For catamaran navigating in section J, the water flow heeling moment or lever is to be taken as 2 times of the calculation value of one sidehull.

8.3.11.13 For catamarans, it may be exempted to check the stability in the turning round.

Appendix 1 TABLE OF SUMMARIZING STABILITY OF SHIPS

The aim of preparing the summarizing tables is to enable operators to well know the stability under all loading conditions of ships they operate. The table not only consists of the stability under the basic loading conditions but also includes unfavorable stability of the ship in service due to unsuitable loading condition. At the same time, measures to improve the stability should be taken according to the adverse loading conditions. The table of summarizing stability of ships should be prepared according to stability calculation after building.

The table format is to be recommended as the following:

Table 1-1 applies to passenger ships;

Table 1-2 applies to cargo ships;

Table 1-3 applies to tugs(pushers);

Table 1-4 applies to engineering ships.

The items may be added or reduced according to the actual condition; tables of other types of ships may be made according to the above table forms.

Summarizing Table of Stability of Pushers (Tugs)

Table 1-3

Ship name	Power	kW	Principals dimensions	Overall length	m	Length between perpendiculars	m	Design waterline length	m	Preparation unit and date																					
				Moulded breadth	m	Max. breadth	m	Camber	m	Builder and date																					
				Moulded depth	m	Design draught	m	Min. freeboard	m	Place and date of inclining test																					
Lightship	Displacement	t	Fixed ballast	Weight	t	Opening position of flooding angle	Vertical coordinate	m	Position of limit angel of statical heel	Vertical coordinate	m																				
	Vertical coordinate of gravity	m		Vertical coordinate of gravity	m		Transverse coordinate	m		Transverse coordinate	m																				
	Longitudinal coordinate of gravity	m		Longitudinal coordinate of gravity	m		Longitudinal coordinate	m		Longitudinal coordinate	m																				
No.	Loading condition	Basic requirements for stability															Special requirements for stability					Remarks									
		Draught for calculation, d	Displacement Δ	Vertical coordinate of gravity of the ship KG	Longitudinal coordinate of gravity of the ship XG	Flooding angle θ_j	Limit angle of statical heel θ_r	Initial metacentric height and characteristic values of curves of righting levers							Criteria of wind pressures			Criteria for torrent sections		Turning round			Transverse jerk								
The initial metacentric height not corrected for the free surface of liquid G/M_0	The initial metacentric height corrected for the free surface of liquid G/M_1							Angle corresponding to the max. righting lever θ_{max}	The max. righting lever l_{max}	The righting lever l_j corresponding to θ_j	The rarea under curve of righting lever l_{dj}	The rarea under curve of righting lever l_{dm} corresponding to θ_m	Criteria of initial metacentric hight and curve of righting lever	Amplimide of roll θ_1	Wind heeling lever l_k	The mim. Heeling lever l_q	Stability criterion numeral K_f	Water heeling lever l_w	The mim. Heeling lever l_q	Stability criterion numeral for torrent sections K_s	Heeling lever due to turning round l_t	Angle of statical heel due to tuming round θ_v	θ_r / θ_v	Heeling moment due to transverse jerk of towline M_t	Initial metacentric height required in th Guidelines $G M_t$	$G M_0 / G M_T$	Stability is qualified or not?				
1	2	m	t	m	m	(°)	(°)	m	m	(°)	m	m	m-rad		(°)	m	m		m	m		m	(°)		kN·m	m					

Summarizing Table of Stability of Working Ships

Table 1-4

Ship name	Power	kW	Principals dimensions	Overall length	m	Length between perpendiculars	m	Design waterline length	m	Preparation unit and date																											
				Moulded breadth	m	Max. breadth	m	Camber	m	Builder and date																											
Speed	km/h	Fr		Moulded depth	m	Design draught	m	Min. freeboard	m	Place and date of inclining test																											
Lightship	Displacement		t	Weight		t	Opening position of flooding angle	Vertical coordinate	m	Position of limit angle of statical heel	Vertical coordinate	m																									
	Vertical coordinate of gravity		m	Vertical coordinate of gravity		m		Transverse coordinate	m		Transverse coordinate	m																									
	Longitudinal coordinate of gravity		m	Longitudinal coordinate of gravity		m		Longitudinal coordinate	m		Longitudinal coordinate	m																									
Basic requirements for stability												Special requirements for stability																									
Initial metacentric height and characteristic values of curves of righting levers												Criteria of wind pressures				Criteria for torrent sections				Turning round		Heeling moment				Working		In port		Stability is qualified or not?	Remarks						
The initial metacentric height not corrected for the free surface of liquid												Amplitude of roll				Water heeling lever				Heeling lever due to turning round		Wind heeling moment M_f				Initial metacentric height required in the Guidelines GM_z											
The initial metacentric height corrected for the free surface of liquid												Wind heeling lever				The min. Heeling lever				Heeling moment due to transverse shifting of the ship M_{fh}		Heeling moment of spuds M_d				Initial metacentric height required in the Guidelines GM_b											
Angle corresponding to the max. righting lever θ_{max}												The max. righting lever l_{max}				The min. Heeling lever				Heeling moment due to soil discharging M_p		Heeling moment for the lib arm outboard M_s				Initial metacentric height required in the Guidelines GM_b											
The max. righting lever l_{max}												The max. righting lever l_{max}				The min. Heeling lever				Heeling moment for the lib arm outboard M_s		Initial metacentric height required in the Guidelines GM_z															
The min. Heeling lever												The min. Heeling lever				Stability criterion numeral for torrent				Heeling lever due to turning round		Heeling moment due to transverse shifting of the ship M_{fh}				Initial metacentric height required in the Guidelines GM_z											
Stability criterion numeral												Stability criterion numeral				Heeling lever due to turning round				Angle of statical heel due to turning round		Heeling moment of spuds M_d				Initial metacentric height required in the Guidelines GM_z											
Water heeling lever												Water heeling lever				The min. Heeling lever				Stability criterion numeral for torrent		Heeling moment due to soil discharging M_p				Initial metacentric height required in the Guidelines GM_b											
The min. Heeling lever												The min. Heeling lever				Stability criterion numeral for torrent				Heeling lever due to turning round		Heeling moment for the lib arm outboard M_s				Initial metacentric height required in the Guidelines GM_b											
Stability criterion numeral for torrent												Stability criterion numeral for torrent				Heeling lever due to turning round				Angle of statical heel due to turning round		Heeling moment for the lib arm outboard M_s				Initial metacentric height required in the Guidelines GM_b											
Heeling lever due to turning round												Heeling lever due to turning round				Angle of statical heel due to turning round				Wind heeling moment M_f		Heeling moment due to transverse shifting of the ship M_{fh}				Heeling moment of spuds M_d		Heeling moment due to soil discharging M_p		Heeling moment for the lib arm outboard M_s							
Angle of statical heel due to turning round												Angle of statical heel due to turning round				Wind heeling moment M_f				Heeling moment due to transverse shifting of the ship M_{fh}				Heeling moment of spuds M_d				Heeling moment due to soil discharging M_p		Heeling moment for the lib arm outboard M_s							
Wind heeling moment M_f												Wind heeling moment M_f				Heeling moment due to transverse shifting of the ship M_{fh}				Heeling moment of spuds M_d				Heeling moment due to soil discharging M_p				Heeling moment for the lib arm outboard M_s									
Heeling moment due to transverse shifting of the ship M_{fh}												Heeling moment due to transverse shifting of the ship M_{fh}				Heeling moment of spuds M_d				Heeling moment due to soil discharging M_p				Heeling moment for the lib arm outboard M_s													
Heeling moment of spuds M_d												Heeling moment of spuds M_d				Heeling moment due to soil discharging M_p				Heeling moment for the lib arm outboard M_s				Initial metacentric height required in the Guidelines GM_z													
Heeling moment due to soil discharging M_p												Heeling moment due to soil discharging M_p				Heeling moment for the lib arm outboard M_s				Initial metacentric height required in the Guidelines GM_z																	
Heeling moment for the lib arm outboard M_s												Heeling moment for the lib arm outboard M_s				Initial metacentric height required in the Guidelines GM_z																					
Initial metacentric height required in the Guidelines GM_z												Initial metacentric height required in the Guidelines GM_z				Initial metacentric height required in the Guidelines GM_b				Initial metacentric height required in the Guidelines GM_b																	
Initial metacentric height required in the Guidelines GM_b												Initial metacentric height required in the Guidelines GM_b				Initial metacentric height required in the Guidelines GM_b																					
Initial metacentric height required in the Guidelines GM_b												Initial metacentric height required in the Guidelines GM_b																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	

Appendix 2 RECOMMENDING METHOD FOR CALCULATING FREE LIQUID SURFACE OF TANKS

The heeling moment θM due to free liquid surface of tanks may be calculated according to the following formula:

$$M_{\theta} = 9.81Vb\rho K\sqrt{C_b} \quad \text{kN}\cdot\text{m}$$

- where: M_{θ} —heeling moment due to free liquid surface under any heeling angle, in $\text{kN}\cdot\text{m}$;
 V —total capacity of tanks, in m^3 ;
 b —maximum breadth of tanks, in m;
 ρ —density of liquids in tanks, t/m^3 ;
 K —coefficient, obtained from Table I in accordance with b/h of tanks and the heeling angle;
 C_b —block coefficient of tanks, $C_b = \frac{V}{blh}$;

- where: l —maximum length of tanks, in m;
 h —maximum height of tanks, in m.

Table 1

When $ctg\theta \geq \frac{b}{h}$

$$K = \frac{\sin\theta}{12} \left(1 + \frac{tg^2\theta}{2} \right) \times \frac{b}{h}$$

When $ctg\theta < \frac{b}{h}$

$$K = \frac{\cos\theta}{8} \left(1 + \frac{tg\theta}{b/h} \right) - \frac{\cos\theta}{12(b/h)^2} \left(1 + \frac{ctg^2\theta}{2} \right)$$

θ b/h	5°	10°	15°	20°	30°	40°	45°	50°	60°	70°	75°	80°	90°	θ b/h
20	0.11	0.12	0.12	0.12	0.11	0.10	0.09	0.09	0.07	0.05	0.04	0.03	0.01	20
10	0.07	0.11	0.12	0.12	0.11	0.10	0.10	0.09	0.07	0.05	0.04	0.03	0.01	10
5	0.04	0.07	0.10	0.11	0.11	0.11	0.10	0.10	0.08	0.07	0.06	0.05	0.03	5
3	0.02	0.04	0.07	0.09	0.11	0.11	0.11	0.10	0.09	0.08	0.07	0.06	0.04	3
2	0.01	0.03	0.04	0.06	0.09	0.11	0.11	0.11	0.10	0.09	0.09	0.08	0.06	2
1.5	0.01	0.02	0.03	0.05	0.07	0.10	0.11	0.11	0.11	0.11	0.10	0.10	0.08	1.5
1	0.01	0.01	0.02	0.03	0.05	0.07	0.09	0.10	0.12	0.15	0.16	0.16	0.17	1
0.75	0.01	0.01	0.02	0.02	0.04	0.05	0.07	0.08	0.12	0.15	0.16	0.16	0.17	0.75
0.5	0.00	0.01	0.01	0.02	0.02	0.04	0.04	0.05	0.09	0.16	0.18	0.21	0.25	0.5
0.3	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.03	0.05	0.11	0.19	0.27	0.63	0.3
0.2	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.04	0.07	0.13	0.27	0.63	0.2
0.1	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.04	0.06	0.14	1.25	0.1

CHAPTER 9 SHIP MANEUVERABILITY

Section 1 SHIP MANEUVERABILITY

9.1.1 General requirements

9.1.1.1 Unless otherwise specified, this Section applies to the following inland ships with rudders and screw propellers:

- (1) Cargo ships of 80m length or over;
- (2) Pusher fleet composed of pushers and barges of which total power of main engines is 883kw or over;
- (3) Passenger ships carrying more than 100 people;
- (4) Oil tank, liquefied gas carrier, chemical tank and ships carrying dangerous goods.

9.1.1.2 The maneuverability involved in this Section mainly includes course-changeability, turning ability and brake ability.

9.1.1.3 The ship is to have a good maneuverability.

9.1.1.4 Steering gear and reverse measures are to comply with the relevant provisions of Section 2 of CHAPTER 2.

9.1.1.5 The ship is to be provided with the maneuvering manual, which is compiled by the design department or shipyard according to the data from real ship maneuverability tests. The maneuvering manual is to at least include the followings:

- (1) Hydrostatic speeds with the main engine output power of 50%, 75%, 90%, 100% under fully loaded departure condition;
- (2) Turning tracks under fully loaded departure condition;
- (3) Brake abilities under fully loaded departure condition;
- (4) Course-changeabilities under fully loaded departure condition;
- (5) Precautions and recommendations for maneuvering ships under operation.

9.1.2 Definitions

9.1.2.1 Course-changeability refers to the reaction ability to rudder in the early period of ship rotation;

9.1.2.2 Turning ability refers to the ability of shifting the ship rudder to perform a circular motion;

9.1.2.3 Brake ability refers to the ability of responding to the inertia ship stopping and backing;

9.1.2.4 Turning test refers to the test of measuring the ship turning ability;

9.1.2.5 Z-shaped steering test refers to the test of determining the ship course-changeability by analyzing Z shape of steering angle changes;

9.1.2.6 Stopping test refers to the test of measuring relevant ship stopping distance and time by virtue of ship stopping and backing.

9.1.3 Maneuvering tests

9.1.3.1 Ship maneuverability is to be tested and evaluated through real ship maneuvering test. This test is to be performed upon the completion of newly built ship; for the same type ship built in the same shipyard (Series ship), the first one is to be performed with a real ship maneuvering test. If the subsequent ships don't have any modification or change influencing the maneuverability, the real ship maneuvering tests for them are not required to be performed, and their maneuvering manuals can take the data of the first ship. According to the provisions of 9.1.1.5 of this Chapter, ships with maneuvering manuals are to be performed with maneuverability tests and required to recompile the manuals in line with the real ship maneuvering test data in case of a large change occurs due to the modifications and repairs during ship operation.

9.1.3.2 The real ship maneuvering test is to be performed under the conditions with winds less than Beaufort grade 3, wide and calm waters of waves less than 0.2m and depth less than three times of ship draft. The aforesaid test conditions are to be recorded 30min before the testing; the measuring instruments are to be subject to prior verification.

9.1.3.3 The real ship maneuvering test is to be conducted under the fully loaded departure condition as much as possible. Providing that it is truly difficult to achieve a fully loaded departure condition, it may be solved with any of the following approach:

(1) In accordance with means of 9.1.4 of this section;

(2) The real ship maneuvering test may be performed under fully loaded departure condition before the 1st Annual Inspection after construction/conversion.

9.1.3.4 The real ship maneuvering test is to be conducted after confirming to the normal operation of steering gear and engine.

9.1.3.5 The real ship maneuvering test is to include Z-shape steering test, turning test, and ship stopping test.

9.1.4 Maneuvering parameter conversion under non-fully loaded departure conditions

9.1.4.1 When the real ship maneuvering test is performed under non-fully loaded departure condition, the maneuvering parameter may be converted according to the following formula:

$$[A_F]_s = [A_T]_s \frac{[A_F]_{m\&p}}{[A_T]_{m\&p}}$$

where: AF – Maneuvering parameter under non-fully loaded departure condition;

AT – Maneuvering parameter under testing condition;

s –subscript, indicates real ship value;

m –subscript, indicates predicted value of ship modeling test;

p –subscript, indicates predicted value of calculation.

9.1.4.2 In 9.1.4.2 of this Section, the predictions of ship modeling test and calculation are to be compliance with the provisions of ITTC standard processes or standards.

Section 2 NAVIGATION BRIDGE VISIBILITY

9.2.1 Application

9.2.1.1 This Section applies to the following ships:

- (1) Passenger ships (including ro-ro passenger ships of type 1 and type 2, vehicle-passenger ferries);
- (2) Oil tankers (including tank barge), liquefied gas carrier, chemical tank and ships carrying dangerous goods;
- (3) Cargo ships navigating in torrent sections and cargo ships with a tonnage of 1000 or more and navigating in waters other than torrent sections.,

9.2.2 Navigation bridge visibility

9.2.2.1 The navigation bridge visibility is to meet the following requirements:

- (1) The view of the water surface from the conning position is to be not obscured by more than 1.5 times the ships length (L_E) forward of the bow to 10° on either side under all conditions of draught, trim and deck cargo;
- (2) No blind sector, caused by cargo, vehicle, mast or other obstructions outside the wheelhouse forward of the beam which obstructs the view of the water surface as seen from the conning position, are to exceed 10° . The total arc of blind sectors is not to exceed 20° . The clear sectors between blind sectors are to be at least 5° . However, in the view described (1), each individual blind sector is not to exceed 5° ;
- (3) The horizontal field of vision from the conning position is to exceed over an arc of not less than 225° , that is from right ahead is to less than 22.5° abaft the beam on either side of the ship;
- (4) From each bridge wing, the horizontal field of vision is to extend over an arc of at least 225° , that is from at least 45° on the opposite bow through right ahead and then from right ahead to right astern through 180° on the same side of the ship;
- (5) From the main steering position, the horizontal field of vision is to extend over an arc from right ahead to at least 60° on each side of the ship;
- (6) The ship's side is to be visible from the bridge or bridge wing whenever the ship is sailing or berthed;
- (7) The bridge wing may directly lead to the navigation bridge by the side door of the navigation bridge, of which the fore end is to be flush with the fore bulkhead, and can be substituted by the bridge deck meeting the requirements for the bridge wing visibility;
- (8) When it is difficult to meet the visibility determined in (3) and (4) because of the loading, other measures may be used for substitution, but the measures are to ensure to meet the visibility determined in (3) and (4).

9.2.3 Windows of the navigation bridge

9.2.3.1 The windows of the bridge are to be fitted in accordance with the follows:

- (1) The height of the lower edge of the navigation bridge above the bridge deck is to be kept as low as possible. In no case is to the lower edge present an obstruction to the forward view as described above;

(2) The upper edge of the navigation bridge front without is to allow a forward view of the horizon, and the height of the forward view of the horizon is to be corresponding to a height of eye of a person, , in general, which is to be at least 1.8m;

(3) Framing between navigation bridge windows is to be kept to a minimum and not to be installed immediately forward of any work station;

(4) To help avoid reflections, the bridge front windows are to be inclined from the vertical plane top out;

(5) Polarized and tinted windows are to be not fitted;

(6) A clear view through at least two of the navigation bridge front windows and, depending on the bridge configuration, an additional number of clear-view windows is to be provided.

CHAPTER 10 ADDITIONAL REQUIREMENTS FOR SPECIAL SHIPS

Section 1 GENERAL PROVISIONS

10.1.1 General requirements

10.1.1.1 This Section applies to the fire-fighting ships navigating in inland waterways.

10.1.1.2 A fire-fighting ship is a ship having the ability to extinguish external fire and adequate to meet the fire-fighting task for ships, installations on water and facilities near the harbor's shore and berthing facilities etc.

10.1.1.3 The fire-fighting ships are divided into Grades 1, 2 and 3 according to the carriage requirements for fire-extinguishing appliances and their performance (see Table 10.1.9.1) :

Fire-fighting ships of Grade 1;

Fire-fighting ships of Grade 2;

Fire-fighting ships of Grade 3.

10.1.1.4 The fire-fighting ships are to comply with the requirements of this Section and in addition, the relevant requirements of CCSISC Rules for Construction of Inland Waterway Steel Ships.

10.1.1.5 Where it is necessary for fire-fighting ships to deviate from the requirements of this section due to their specific missions such as geographical limitations, equipment arrangement of the base or particular objects to be served, CCSISC may impose other requirements as appropriate on such ships. And individual requirements in this Section may also be relaxed subject to agreement of CCSISC.

10.1.2 Plans and documents to be submitted

10.1.2.1 In addition to those required in the relevant Chapters of CCSISC Regulations for Classification of Inland Waterway Ships, the following plans and documents are to be submitted in triplicate for approval:

(1) Arrangement and specification of water monitor system (including delivery of pumps and pressure, discharge and range of monitors);

(2) Plan of seating arrangements for water monitors;

(3) Plan of remote control system of monitors;

(4) Arrangement and specification of other fire-extinguishing systems (if fitted);

(5) Arrangement of water spray systems;

(6) Arrangement and specification of fire-fighter's outfits and standby aerators (if fitted)

(7) Arrangement and specification of searchlights;

(8) Arrangement of fire piping for external fire;

(9) Stability calculations for fire-fighting operations;

(10) Operation manual, including:

① detailed description of each fire-fighting system and equipment;

② instructions on use and maintenance of fire-fighting installations and equipment;

③ instructions on maneuvering of ship during fire-fighting;

④ stability information.

10.1.2.2 For fire-fighting ships of Grade 3, in addition to the plans and documents required in 10.1.2.1 above, the following plans and documents are to be submitted for approval:

(1) Arrangement and specification of foam systems;

(2) Plan of seating arrangements for foam monitors;

(3) Plan of remote control system of foam monitors.

10.1.2.3 The following plans and documents are to be submitted for information:

(1) Particulars of the means of keeping the ship in position during fire-fighting operations;

(2) Estimation of fuel consumption during fire-fighting operations.

10.1.2.4 Other plans and documents are to be additionally submitted for approval or for information where deemed necessary.

10.1.3 Hull structure

10.1.3.1 The hull structure, in way of the seating of any monitor, water tower and mast fitted with

monitors, is to be strengthened if necessary to withstand the forces imposed by the fire-fighting systems when operating at their maximum capacity.

10.1.4 Stability

10.1.4.1 When all monitors are in operation at full capacity in the most adverse direction for the stability, the ship is to have satisfactory stability corresponding to the load conditions.

10.1.5 Maneuverability

10.1.5.1 The ships are to have double main propulsion machinery or other main and auxiliary propulsion machinery, which are to be capable of keeping the ship in position in all condition.

10.1.5.2 Main propellers and side thrusters (if any) are to keep the ship at a standstill in calm waters at all combinations of capacity and direction of throw of the water monitors and foam monitors.

10.1.5.3 A simple control system is to be provided for operating the main propeller and side thrusters (if any).

10.1.6 Lighting

10.1.6.1 Two searchlights are to be provided to permit operations of the fire-fighting equipment at night.

10.1.6.2 The searchlights are to be capable of providing at a range of 250 m in clear atmospheric conditions a level of illumination of 50 lx within an area of not less than 11 m diameter. They are to be capable of being adjusted in the horizontal and vertical directions.

10.1.7 Fuel capacity

10.1.7.1 The quantity of fuel oil is to be provided to secure continuous fire-fighting operations and other fire-fight operations of all water monitors during the design duration and at the maximum capacity required in Table 10.1.9.1.

10.1.8 Operation manual

10.1.8.1 An approval operation manual, complying with 10.1.2.1 (10) of this Section, is to be kept on board.

10.1.9 Fire-fighting equipment

10.1.9.1 The carriage of fire-fighting equipment and their performance for all grades of fire-fighting ship is to at least meet the requirements in Table 10.1.9.1, having regard to particular objects to be served and navigable area conditions.

Table 10.1.9.1

Equipment	Grade of fire-fighting ships		
	1	2	3
Minimum number of fire pumps	1	2	2
Minimum total pump capacity, in m ³ /h	220	900	1200
Minimum number of water monitors	2	3	4
Minimum discharge rate per water monitor, in m ³ /h	100	280	280
Minimum range of water monitor jets, in m	55	80	80
Minimum fuel capacity for simultaneous working of all water monitors, in h	24	36	48
Minimum number of foam monitors	—	—	2
Minimum discharge rate of per foam monitor, in m ³ /h	—	—	230
Minimum range of foam monitor jets, in m	—	—	60
Minimum time of continuous foam production ,in min	—	—	30
Minimum number of hose connections and foam applicators	—	—	4
Minimum number of hydrants	4	8	8
Minimum number of fire-fighter’s outfits	2	6	8

10.1.10 Pumps and piping systems for water and foam

10.1.10.1 The pumping capacity for fire-fighting systems is to be determined according to the actual needs and not be less than that required in Table 10.1.9.1.

10.1.10.2 The pumps and piping systems are to be of a design and arrangement to secure an even and sufficient supply of water to the pumps.

10.1.10.3 The pumps for fire-fighting systems and their prime movers are to be located that they will be easily accessible during operation and maintenance.

10.1.10.4 Starting of fire-fighting pumps when water inlet valves are closed is to be prevented either by an interlock system or by an audible and visual alarm for fire-fighting ships of Grade 2 and 3.

10.1.10.5 The pumps for fire-fighting systems are to be fitted with an independent water inlet, the water

suctions are to be arranged as low as practicable to avoid being choked by impurities and ice-blocks and inhaling floating oil, and the location of the sea chests is to be such that the water supply is not impeded by the ship's motions or by the water flow to and from thrusters etc.

10.1.10.6 Openings in ship sides for water boxes are to be fitted with gratings or orifice plates, with bars arranged longitudinally along the hull and an effective flow area of at least three times that of water suction valves, and low pressure or compressed air blowpipes or other effective measures are to be provided to ensure cleaning of the gratings or orifice plates.

10.1.10.7 A strainer is to be fitted between the sea chest and the pump of which an effective flow area is to be at least two times that of the water suction valves, and efficient means are to be provided for cleaning the strainers.

10.1.10.8 The water suction valve, pressure valve and the pump motor are to be operable from the same position. Valves with nominal diameter exceeding 450 mm are to be power actuated as well as manually operable.

10.1.10.9 The pumps and piping systems for fire-fighting systems are to be not arranged for other purposes except for fire fighting and water spray.

10.1.10.10 Where the fire-fighting system is also used for a fixed drencher system, the fixed drencher is to be independent to the piping systems for monitors and be fitted with pressure protective equipment.

10.1.10.11 The service piping for water and/or foam monitors are to be provided with blowoff valves or other equivalent means. The service piping on deck are to be protected against freezing according to the needs.

10.1.10.12 The piping systems are to have arrangements to avoid overheating of the pumps at low delivery rates.

10.1.10.13 Suction lines are to be as short and straight as practicable. The design maximum water velocity in the suction lines is not to normally exceed 2 m/s.

10.1.10.14 Piping between pumps and water monitors are to have a maximum design water velocity normally not exceeding 4 m/s.

10.1.11 Water monitors

10.1.11.1 The capacity of each water monitor and range of each water monitor jet is to be not less than those required in Table 10.1.9.1 for simultaneous working of all water monitors (including foam/water monitors, combined monitors, multifunction and single function water monitors).

10.1.11.2 The water monitors are to have flexible operation and reliable action, of which the arrangement is to be such that the jet of water emanating from each monitor may reach the required direction and range when all water monitors act simultaneously, and isolating valves are to be fitted to separate the monitor from the fire-extinguishing system in the event of failure of any monitor.

10.1.11.3 The water monitors are to be capable of being adequately adjusted in the vertical and horizontal directions to achieve the best target point of the jet. An enough space is to be provided to operate the water monitor, protective means (e.g. railing, handrails) are to be provided to protect the operator, and the water monitors are to be so positioned that the jets will be unimpeded within the required range of operation.

10.1.11.4 The water monitors are to be fitted on fixed and robust seatings, and the water monitors together with their seatings are to have enough strength to withstand the imposed forces from all modes of operation.

10.1.11.5 At least one water monitor is to be equipped with a permanently fitted nozzle which can give solid or a spray jet as required.

10.1.11.6 The water monitors, of which the minimum number is required in Table 10.1.9.1, are to be capable of being activated and maneuvered by remote control from a protected position ensuring a good view of the monitors and of the area to be served.

10.1.11.7 The remote control systems for water monitors are to be capable of preventing outside interferences. Where an electrical control system is used, each control is to be protected against short circuit and against overload. The water monitors controlled by hydraulic or pneumatic pressure are to be provided with a spare source of power.

10.1.11.8 In addition to the remote control system, the water monitors are to be capable of local manual operation, and a safety interlock is to be fitted between the remote control system and the hand-operated equipment.

10.1.11.9 All valves and controls for water monitors are to be clearly marked.

10.1.12 Fixed foam monitor systems

10.1.12.1 For fire-fighting ships of Grade 3, a fixed foam monitor system is to be provided. where fire-fighting ships of Grade 1 and 2 are equipped with a fixed foam monitor system according to the actual needs, the fixed foam monitor system is to comply with the provisions of this paragraph.

10.1.12.2 The capacity of each foam monitor and range of each foam monitor jet is to comply with the

requirements specified in Table 10.1.9.1.

10.1.12.3 The foam monitors are to be fitted on fixed and robust seatings, and the foam monitors together with their seatings are to have enough strength to withstand the imposed forces from all modes of operation.

10.1.12.4 In addition to the local manual control, foam monitors are to be provided with remote control which is to include the operation of the valves necessary for the control of both water and foam. The remote control of foam monitors are to be located at the same remote-control station for water monitors.

10.1.12.5 The foam monitors are to have flexible operation and reliable action no matter by manual control or by remote control. An enough space is to be provided to operate the foam monitor, protective means (e.g. railing, handrails) are to be provided to protect the operator, and the foam monitors are to be so positioned that the jets will be unimpeded within the required range of operation.

10.1.12.6 The capacity of the foam applicators is to be not less than 400 L/min, the range not less than 15 m. The foam applicators are to be installed so as to ensure flexible action in the fire-fighting operation. The foam nose connections are to be arranged on both sides of the ship.

10.1.12.7 The foam generating system is to be of a fixed type, consisting of individual foam concentrate tank, foam-mixing unit and piping to the monitors. The system may be supplied by the pumps of water monitors. In such cases, the pump reasuring is to be adjustable to ensure producing the maximum capacity of foam.

10.1.12.8 The foam concentrate tanks, foam piping and valves are to be of erosion-resisting material or subject to the anticorrosion treatment.

10.1.12.9 Sufficient foam concentrate is to be available for at least 30 min of simultaneous operation of all foam monitors at the maximum capacity. A foam expansion ratio is to be not more than 12:1.

10.1.12.10 Where a dry powder fire-extinguishing system is fitted, the foam used are to be chosen considering its combinability with the dry powder, that is, the foam are to have the resistance to the dry powder.

10.1.12.11 All valves and controls for foam monitor systems are to be clearly marked.

10.1.13 Hydrants and fire hoses

10.1.13.1 The hydrants are to be arranged on each side of the exposed weather deck, of which the nominal diameter is to be 65 mm or 80 mm.

10.1.13.2 The position of the hydrants is to be such that they will not affect the personnel activity and the fire hoses may be easily coupled to them.

10.1.13.3 The types of the accessories such as fire hoses and nozzles are to meet the service requirements, and each hydrant is to be provided with a hose and a nozzle.

10.1.13.4 Where the hydrant is connected to the water monitor piping system, means are to be provided to adjust the hydrostatic pressure so that each nozzle are to be capable of being held by one person and the hydrostatic pressure is to be enough to project a jet of water reaching to at least 12 m.

10.1.13.5 Nozzles are to be of a dual-purpose type (i.e. spray/jet type).

10.1.14 Other fire-extinguishing systems and equipment

10.1.14.1 Fire-fighting ships are to be provided with at least two portable foam applicators, where, including an air aspirating foam applicator being capable of coupling the hose to the hydrant together with a portable vessel of a capacity of at least 20 L and a spare vessel. The foam applicators are to be capable of producing the foam with an effective capacity of 1.5 m³ per minster and for oil fire fighting, and a foam expansion ratio are to be not more than 12:1.

10.1.14.2 Other fire-extinguishing systems and equipment may be chosen according to the actual needs and design requirements, the fire-extinguishing systems chosen are to comply with the relevant provisions specified in 10.1.14.3 or 10.1.14.4 to 10.1.14.6.

10.1.14.3 Where a high or medium expansion foam fire-extinguishing system is provided, the number of the high or medium expansion foam generators are to be not less than 2, and the storage of the foam-forming liquid is to be capable of producing continuous foam for 30 minters.

10.1.14.4 For fire-fighting ships fitted with a dry powder fire-extinguishing system, the dry powder fire-extinguishing system is to consist of dry powder installation, permanent pipes of pressurized mediums, dry powder monitors or handheld hoses, and the dry powder are to be projected by special inert gas (e.g. nitrogen) which is used as a driving medium and stored in a pressure vessel adjacent to the dry powder vessel. The dry powder tanks and inert gas bottles driving the dry powder are to comply with the relevant provisions of **CCSIS** Rules for Construction of Inland Waterway Steel Ships.

10.1.14.5 The dry powder discharge rate is to be not less than 10 kg/s. The discharge rate of a handheld hose is to be not less than 3.5 kg/s, one nozzle, being capable of being opened and shut off, is to be provided for it, and the hose is to be operated by one person at the maximum discharge rate.

10.1.14.6 The dry powder storage is to be so sufficient that all dry powder monitors and handheld hoses of the dry powder unit can project for at least 45 seconds at the maximum discharge rate.

10.1.15 Fire towers

10.1.15.1 Where a lift unit such as a lifting platform, a aerial platform or a fire tower is fitted on fire-fighting ships, it is to be smooth without abnormal noise, vibration and leakage in the course of lifting up and down. The lift unit risen up is to be not dropped in the event of its failure.

10.1.15.2 For the lifting platform, aerial platform or fire tower fitted with water monitors or foam monitors, its strength and stiffness are to meet the requirements for projecting at the maximum discharge rate and at the maximum height.

10.1.15.3 Means are to be provided to recover the risen unit in the event of failure of the lifting system.

10.1.16 Fire-fighter's outfits and other personal equipment

10.1.16.1 Fire-fighting ships are to be provided with fire-fighter's outfits in accordance with Table 10.1.9.1.

10.1.16.2 The fire-fighter's outfits are to be kept in a special fire station that is to have an easy access from an open space, and the entrances to the fire station are to be clearly marked.

10.1.16.3 The fire station is to be so arranged that all fire equipment are readily available and in addition, a ventilation device and a heating device are to be provided.

10.1.16.4 Suitable spare aerators are to be provided to fill the air bottles of the breathing apparatus of the fire-fighter's outfit. The aerators are to be kept in a safe space, and the time for refilling the air bottles to the rated capacity is not to exceed 30 minutes. Alternatively, each fire-fighter's outfit is to be provided with spare air bottles having at least 6 breathing apparatus.

10.1.16.5 Suitable medical equipment and medicine are to be provided on board according to particular objects to be served.

10.1.16.6 In addition, fire-fighting ships are to be provided with rescue facilities and mobile pumping systems etc. for emergency.

10.1.16.7 Fire-fighting ships are to be provided with fire ladders to scale up the vessels in distress. The fire ladders are to be light and their capacity is to meet the service requirements.

10.1.17 Water spray systems

10.1.17.1 Fire-fighting ships are to be provided with means to protect the ship, in order to prevent radiant heat from a fire affecting the fire-fighting task. The protective means may be a water spray system covering the whole surface of the ship, alternatively a water spray system combined with a heat insulating apparatus.

10.1.17.2 The water spray system is to be an independent fixed unit that ensures a protection of all outside vertical areas above the lightest waterline, including superstructures, deckhouses, seatings for monitors and other fire-fighting equipment and fire-fighters etc., and will develop a protective water spray on the deck fitted with an engine room or other spaces containing combustible materials.

10.1.17.3 The pipes, valves and nozzles of the water spray system are to be suitably protected to avoid damage in the fire-fighting operation.

10.1.17.4 The water spray system is to have a capacity of at least 5L/min per m² of the protected area which is internally insulated to class A-60 and at least 10L/min per m² of the protected area of steel construction and without insulation.

10.1.17.5 The pumping capacity is to be sufficient to supply simultaneously at the required pressure the sections which serve the maximum area exposed to radiant heat from a fire. Where the pumps of the fire-extinguishing system are used for this purpose, they are to be capable of operating this system, the water monitors and the hose stations simultaneously at the required pressure. A connection with a shut-off valve is to be fitted between the piping system for the water monitors and the supply line for the water spray system.

10.1.17.6 The water spray system is to be divided into sections so that it will be possible to close down sections covering surfaces which are not exposed to radiant heat.

10.1.17.7 The nozzles of the water spray system are to be arranged to give an even distribution of water spray over the protected areas.

10.1.17.8 The water spray system is to be provided with anti-corrosion measures, the pipes are to be of galvanized pipes (or equivalent to galvanized pipes), and a plug is to be provided for the scupper to avoid damage by freezing.

10.1.17.9 Deck scuppers and freeing ports are to be of sufficient area to ensure efficient drainage of water from decks and horizontal surfaces in all conditions when the water spray system is in operation.

10.1.17.10 The arrangement of the water spray system is to ensure an observation of its operation from the navigation bridge and remote-control station, and means are to be taken to ensure that necessary visibility

from the navigation bridge and the remote-control station can be maintained during the water spray operation.

10.1.18 Protection

10.1.18.1 The superstructures and deckhouses are to be constructed of steel or other equivalent material, and the doors and window in their boundaries are to be of fixed or movable weathertight type.

10.1.18.2 All weather decks, accommodation ladders and handrails are to be painted with non-slip dressing.

Section 2 OIL RECOVERY SHIPS

10.2.1 General requirements

10.2.1.1 Unless expressly provided in this Section, oil recovery ships are to comply with the relevant requirements for the cargo ships with the same gross tonnage of the Guidelines.

10.2.1.2 Except as provided in 10.2.18 of this Section, this Section applies to steel ships engaged on recovery of oil floating on water with a flash point not exceeding 60°C (closed cup test) and a Reid vapor pressure below atmospheric pressure.

10.2.1.3 The provision of 10.2.18 of this Section applies to steel ships engaged on recovery of oil floating on water with a flash point exceeding 60°C (closed cup test) and a Reid vapor pressure below atmospheric pressure.

10.2.1.4 The ship is to be capable of the following operations at a safe distance from the source of oil spill:

- ① recovery of floating oil from the surface of the water;
- ② handling, storage and transportation of the recovered oil.

10.2.1.5 The other auxiliary ships associated with operations of oil recovery ships may be dealt with by referring to this Section.

10.2.2 Definitions

10.2.2.1 An *oil recovery ship* is a steel ship specially or also engaged in the recovery of oil floating on the water.

10.2.2.2 A *gas-hazardous zone* is an area in which flammable or explosive gas or vapor is liable to accumulate to a dangerous concentration. The gas-hazardous zones may be divided into the following categories:

(1) Hazardous zone of Category 0 is an area in which the mixture of flammable or explosive gas or vapor with air exists continuously or for long time;

(2) Hazardous zone of Category 2 is an area in which the mixture of flammable or explosive gas or vapor with air may occur during normal operation.

10.2.2.3 A *source of oil spill* is the source from which the oil floating on the water originates, e.g. from an oil tanker.

10.2.3 Division of gas-hazardous zones and safe areas

10.2.3.1 The following areas or spaces of oil recovery ships are to be regarded as gas-hazardous zones:

(1) Hazardous zones of Category 0:

- ① recovered oil tanks;
- ② the interiors of piping systems and containers of the containment system for recovered oil.

(2) Hazardous zones of Category 1:

① cofferdams or other spaces adjacent to any recovered oil tank;

② enclosed or semi-enclosed spaces in which pipe flanges, valves, hoses, pumps and other equipment for handling of recovered oil are located;

③ spaces including semi-enclosed spaces on open deck within a 3 m radius of the separator, the hoses and valves used for oil recovery, the openings of recovered oil tanks and the openings of spaces within the hazardous zones of Category 1 such as pump rooms or cofferdams;

④ spaces on open deck above recovered oil tanks, extending 3 m respectively fore and aft of this area to a height of 2.4 m;

⑤ any enclosed space outside a recovered oil tank, through which recovered oil piping passed or in which such piping terminates, may be excluded, provided that ventilation is fitted as specified in 10.2.12.4 of this Section;

⑥ enclosed or semi-enclosed spaces which can be entered directly from hazardous zones of Category 1 (without air lock) or which have openings into hazardous zones of Category 1 may be excluded, provided that ventilation is fitted as specified in 10.2.12.4 of this Section.

10.2.3.2 The areas outside the above-mentioned gas-hazardous zones are safe areas.

10.2.4 Plans and documents

10.2.4.1 The relevant plans and documents as required for oil tankers and in addition, the following plans and documents are to be submitted for approval:

- (1) General arrangement of equipment for oil recovery operations;

- (2) Details of access doors (including air locks) and openings used in normal recovery operations and not fitted with gastight sealing;
- (3) Details of access doors and openings closed gastight in oil recovery operations;
- (4) Details of arrangement and capacity of recovered oil tanks;
- (5) Stability and damage stability calculations for working operations;
- (6) Division of gas-hazardous zones;
- (7) Arrangement of venting system of recovered oil tanks;
- (8) Drawing of power system of the equipment used for oil recovery operations;
- (9) Details of arrangement of piping, pumping and handling systems for recovered oil;
- (10) Arrangement of electrical equipment in gas-hazardous zones;
- (11) Operating manual;
- (12) Other plans and documents as deemed necessary by [CCSISC](#).

10.2.5 Structure and arrangement of recovered oil tanks

10.2.5.1 The structures of oil recovery ships are to comply with the relevant requirements of CHAPTER 5, PART THREE of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

10.2.5.2 The tanks in accommodation spaces and machinery spaces are to be not used as an oil recovered tank.

10.2.5.3 Tanks intended for the storage of recovered oil are to be located forward or aft of the accommodation and machinery spaces, and are to be generally separated from accommodation and machinery spaces by cofferdams or by dry tanks outside accommodation spaces. Oil fuel tanks, settling tanks, tanks for ballast water or pump rooms may be considered as a cofferdam.

10.2.5.4 All openings (sounding pipes, hatches for the deployment of portable pumps and hoses) to tanks for recovered oil are to be located on open deck.

10.2.5.5 Tanks for recovered oil are to have suitable access from open deck for cleaning and gas-freeing, or small dedicated hatches for cleaning.

10.2.5.6 The construction of oil recovered oil tanks is to comply with the requirements of 2.1.5 of CHAPTER 2 of this PART.

10.2.5.7 Tanks for recovered oil are to be in general provided with wash bulkheads in one of the following cases:

- (1) $0.5B$ (B being breadth of the ship) is exceeded; or
- (2) $0.1L$ (L being length of the ship) or 10 m is exceeded, whichever is the greater.

10.2.6 Accesses and other openings

10.2.6.1 No ventilation opening of safe spaces, such as accommodation, service and machinery spaces, control stations and navigation bridges, is to be permitted in gas-hazardous zones.

10.2.6.2 In general, no access door or any opening not for access doors or ventilation are to be permitted between safe spaces (such as accommodation, service and machinery spaces, control stations and navigation bridges) and gas-hazardous zones.

(1) Access doors may be accepted between such spaces above and gas-hazardous zones of Category 1, provided that the following conditions are met:

- ① An air lock is to consist of two steel doors substantially gastight which is to be spaced not less than 1.5 m apart (watertight doors may be considered as gastight doors);
- ② Safe spaces are under positive pressure mechanical ventilation in relation to the gas-hazardous zones;
- ③ The doors are to be self-closing and without any holding back arrangements;
- ④ Signs are provided to warn that the doors are to be kept closed during oil recovery operations.

(2) Openings not for access or ventilation may be accepted between such spaces above and gas-hazardous zones of Category 1, provided that the following conditions are met:

- ① Their closing arrangements are to be of gastight type;
- ② Signs are provided to warn that the doors are to be kept closed during oil recovery operations or during cleaning and gas-freeing of oil recovered tanks, and a device is to be fitted which prevents unauthorized opening.

10.2.6.3 Access, ventilation openings (inlets and outlets) and other openings to safe spaces such as accommodation, service and machinery spaces, control stations and navigation bridges, which are in frequent use during oil recovery operations and not fitted with weathertight closing appliances, are to be located outside gas-hazardous zones. Where these openings are located inside gas-hazardous zones, they are to be fitted with air locks, and the height of their doorsills is to comply with the relevant provisions for load lines.

10.2.6.4 Oil handling spaces on deck are to be provided with a coaming around all pumps, transfer flanges and other connections. Each coaming is to have a height sufficient to prevent recovered oil from

entering accommodation, machinery, control and service spaces or passing overboard. The coaming are to have a height of at least 150 mm. Where drains are provided for the coaming, closing devices for these drains are to be permanently attached.

10.2.7 Fire protection and extinction

10.2.7.1 Exterior boundaries of superstructures and deckhouses enclosing accommodation, including any overhanging decks which support such accommodation, are to be insulated to A-60 standard for all parts which face gas-hazardous zones and for 3 m aft or forward thereof. The requirements is also applicable for access doors in such boundaries.

10.2.7.2 Portholes or windows in the exterior boundaries which are required to be insulated to A-60 standar, as referred to in 10.2.7.1 of this Section, are to be of fixed (non-opening) type and are to be insulated to A-60 standard, except for those in the navigation bridge.

10.2.7.3 As an alternative to compliance with 10.2.7.1 of this Section, a fixed water spraying system may be used to protect all boundaries, portholes or windows which may, in this case, be insulated to A-0 standard. The system is to be capable of delivering water at a rate of 10 L/min per m² at least and is to be readily available.

10.2.7.4 Working deck areas used for oil recovery operation, where there are arrangements for the collection, handling and transfer of recovered oil, are to be provided with the following fire-extinguishing equipment:

(1) two dry powder fire-extinguishers, each at least 50 kg capacity. The fire-extinguishers are to be located near the working deck and are to be fitted with discharge hoses having a length sufficient to reach the arrangements for the collection, handling and transfer of recovered oil;

(2) a large fire-extinguishing foam installation fitted with at least one portable foam applicator. The foam installation is to be so arranged that it is capable of applying foam to any part of the working deck. The capacity of any applicator is to be not less than 400 L/min of foam solution and the applicator throw in still air conditions isto be not less than 15 m. Sufficient foam concentrate is to be provided for at least 0.4 L/m² of the working deck area with a minimum quantity of 200 L. The foam expansion ratio is not to generally exceed 12 to 1.

10.2.7.5 Oil recovery ships are to be provided with at least two fire-fighter's outfits.

10.2.8 Intact stability

10.2.8.1 The stability of oil recovery ships is to be checked for navigation conditions and operation conditions.

10.2.8.2 The stability of oil recovery ships in navigation conditions is to comply with the relevant requirements for tankers specified in CHAPTER 8 of this Part.

10.2.8.3 The stability of oil recovery ships in operation conditions is to comply with the following requirements :

(1) loading conditions:

- ① recovered oil tanker fully loaded, with all fuel, water and stores;
- ② recovered oil tanker fully loaded, with 10% of fuel, water and stores;
- ③ recovered oil tanker half loaded, with 50% of fuel, water and stores;

(2) The static limiting heeling angle θ_r is to be taken as 0.8 times immersion angle of the deck edge, times emersion angle of bilge at its middlepoint or 8°, whichever is the smallest;

(3) The initial metacentric height is to be obtained from the following formula:

$$GM_1 \geq \frac{M_f + M_s}{0.172\theta_r \Delta}$$

where: GM_1 ---initial metacentric height as corrected for free surface in the loading condition under check, in m;

M_f ---heeling moment due to wind pressure, in kN·m, taken as half of the value obtained from 8.2.5.1 of CHAPTER 8 of this Part;

M_s ---heeling moment due to oil recovey operations, inkN·m, see 10.2.8.3 (4);

θ_r ---static limiting heeling angle in the loading condition under checking, in (°), see 10.2.8.3 (2);

Δ ---displacement in the loading condition under checking, in t.

(4) The heeling moment M_s due to oil recovey operations at one side of the ship is to be obtained from the following formula:

$$M_s = 9.81W_s b_s \quad \text{kN}\cdot\text{m}$$

where: W_S ---gross weight of oil and water in the oil recovery equipment, in t;

b_s ---horizontal distance from the gravity of the oil and water in the oil recovery equipment to the longitudinal centerline, in m.

10.2.9 Damage stability

10.2.9.1 The damage stability of the oil recovery ships with a gross tonnage for 500 or over is to comply with the relevant requirements for oil tankers specified in 2.1.9, CHAPTER 2 of this Part.

10.2.10 General requirements for machinery installations

10.2.10.1 All machinery equipment used in gas-hazardous zones during oil recovery operations are to be suitable for operation in gas contaminated atmosphere.

10.2.10.2 The exhaust lines of diesel engines, the flue ducts of boilers and the vents of diesel engine crankcases are to be led to a position outside the gas-hazardous zones.

10.2.10.3 The exhaust lines of diesel engines and the flue ducts of boilers are to be provided with effective spark arresters.

10.2.11 Arrangement of pumps and pipes

10.2.11.1 A fixed transfer system for recovered oil is to be provided. The transfer system is to be arranged so that simultaneous filling and discharge will be possible.

10.2.11.2 For coupling of portable skimming equipment, one or maximum two filling connections with branch pipes to all recovered oil tanks are to be arranged on deck.

10.2.11.3 Every tank for recovered oil is to be fitted with a vent pipe or other equivalent venting arrangement. The vent pipes are to be sized for 125% of the maximum of loading rate. However, the diameter of each vent pipe is to be not less than 60 mm. Venting outlets are to be led to open deck. Gas from the outlets are to be discharged directly upwards.

10.2.11.4 The outlets are to be have a minimum height of 2.4 m above deck and be located at a minimum horizontal distance of 5 m away from openings to accommodation and other gas-safe spaces, ventilation intakes for accommodation and machinery spaces and non-certified safe electrical equipment. For multi-purpose oil recovery ships, portable vent pipes intended for use during oil recovery operations only, may be accepted. The ends of vent pipes are to be fitted with a corrosion resistant flameproof wire gauze capable of being easily renewed.

10.2.11.5 The piping systems related to oil recovered are not to pass through machinery, accommodation and service spaces and other enclosed gas safe spaces.

10.2.11.6 A pump room fitted with an oil pump for oil recovery is to comply with the relevant requirements for cargo pump-rooms of oil tankers.

10.2.11.7 The pumps and piping systems for oil recovery are to be independent of other pumps and piping systems onboard.

10.2.11.8 Bilge drainage of the recovered oil transfer pump room and the cofferdam within the gas-hazardous zones are to be effected by powered pumps or bilge ejector suction independent of the bilge drainage system of safe spaces. The pump room bilge is to be drained into the tanks for recovered oil.

For oil recovery ships of less than 500 gross tonnage, the pump room bilge may be drained by a hand pump having at least a 50 mm bore suction.

10.2.11.9 The recovered oil tank is to be provided with a high-level audible and visual alarm that is to be of an approved type, and the alarm signal is to be affected in the navigation bridge and control station.

10.2.11.10 Where an oil heating system is fitted in the recovered oil tank, its design and arrangement are to comply with the relevant requirements of Section 5, CHAPTER 10, PART FOUR of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

10.2.11.11 The ballast piping system serving gas-hazardous zones are to be independent of that serving safe spaces. The ballast pump is to be located in the recovered oil pump room or other suitable gas-hazardous spaces.

10.2.12 Mechanical ventilation

10.2.12.1 The design, type and structure of mechanical ventilation systems may be dealt with in accordance with the relevant requirements for oil tanker of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

10.2.12.2 Spaces with access to hazardous zones of Category 1 are to be kept under positive pressure mechanical ventilation during oil recovery operations, with the air intake located inside a safe area.

10.2.12.3 Spaces in hazardous zones of Categories 0 and 1 that are not frequently used during oil recovery operations are to be not ventilated, provided that the equipment therein is provided with the required

explosion protection. For safety reasons, spaces in hazardous zones of Category 0 and 1 that must be accessible at all times are to be equipped with a ventilation system of the extraction type, ensuring at least 8 air changes per hour.

10.2.12.4 Hazardous zones of Category 1 as specified in 10.2.3.1 (2) ⑤ and ⑥ of this Section may be accepted as safe areas, provided that the following special ventilation requirements are complied with and positive pressure mechanical ventilation is maintained:

(1) The ventilation airflow is to be at least 20 air changes per hour;

(2) The arrangement of ventilation inlet and outlet openings in a space is to be such that the entire space is efficiently ventilated, taking special consideration to locations where gas may be released or may accumulate;

(3) The air intake is to be located in a safe area.

10.2.12.5 For the spaces required to be under positive pressure ventilation, audible and visual alarms are to be initiated at the navigation bridge or other suitable positions in case of loss of positive pressure ventilation.

10.2.13 Gas detection and alarm systems

10.2.13.1 For the purpose of explosion protection, the ship is to be equipped with a permanently installed gas detection system, which will actuate an audible and visual alarm at the navigation bridge or other suitable positions. Detection points may be arranged according to specific circumstances, generally close to ventilation air intakes, in air locks and on the main deck (at least one at the fore end and one at the aft end of the ship).

10.2.13.2 In addition to the above gas detection system, at least one portable instrument is to be available on board for gas detection.

10.2.14 Machinery equipment and systems in gas-hazardous zones

10.2.14.1 The oil recovery equipment and hoses are to be electrically bonded into the ship’s hull. The cross-sectional area of the metallic bonding strap is to be not less than 10 mm².

10.2.14.2 Hoses are to be electrically well conductive.

10.2.14.3 No spark is to be allowed during operation of the oil recovery equipment.

10.2.14.4 Surface temperature of the equipment is not to exceed 200°C.

10.2.15 General requirements for electrical installations

10.2.15.1 Unless specified otherwise in this Section, electrical equipment, cables and distribution systems are to comply with the relevant requirements of CHAPTER 13 of PART FIVE of CCSISC Rules for Construction of Inland Waterway Steel Ships.

10.2.15.2 The oil recovery operation areas and the deck areas used for storing hoses are to have adequate lighting.

10.2.16 Electrical equipment in gas-hazardous zones

10.2.16.1 The use of electrical appliances in gas-hazardous zones as specified in 10.2.3 of this Section are to be restricted to operationally essential equipment and are to comply with Table 10.2.6.1.

Table 10.2.16.1

Category of hazardous zones	Type of electrical equipment	Cable
0	Intrinsically safe Ex"ia"	Cables associated with intrinsically safe equipment in such zones
1	Intrinsically safe Ex"ia" , Ex"ib"	Cables associated with the equipment in such zones; Through runs of cables
	Flameproof Ex"d"	
	Increased safety Ex"e"	
	Pressurized enclosure Ex"p"	
	Powder filled Ex"q" Encapsulated Ex"m"	

10.2.16.2 The explosion-proof electrical equipment listed in Table 10.2.16.1 are to meet at least the following requirements:

Temperature T3;□

Equipment group II A.

10.2.16.3 All equipment not complying with 10.2.16.1 of this Section and located in the gas-hazardous zones as specified in 10.2.2 of this Section are to be disconnected during oil recovery operation. The switches for such disconnection are to be safeguarded against unintentional re-connection and appropriately marked to that effect.

10.2.16.4 The flexible cables without armor or metal braid may be applied in zones of Category 1,

provided that the construction and installation of such cables are to comply with acceptable standards⁹, as appropriate.

10.2.16.5 Portable oil recovery equipment and recovered oil pumps are to comply with the following requirements:

(1) Portable oil recovery equipment and recovered oil pumps are to be supplied from a permanently installed distribution box of socket outlet;

(2) Socket outlets for power circuits are to be interlocked in such a way that the plug can be neither inserted nor withdrawn when the socket contacts are live;

(3) The socket outlet as the separate final sub-circuit are to be provided with a circuit breaker capable of over current and short-circuit protection in each insulated phase. The supply to the socket-outlet are to be permanently installed;

(4) Socket outlets are to be located at easily accessible places and in such a way that flexible cables are not carried through doors or port lights leading from working deck to machinery or accommodation space.

10.2.17 Operating manual

10.2.17.1 The ship is to be provided with an approved operating manual. In general, the operating manual is to contain a description of the safety precautions needed when preparing for and carrying out oil recovery operation.

10.2.17.2 The operating manual for oil recovery ships is to include:

(1) equipment and arrangement

① arrangement of recovered oil tanks;

② transfer system for recovered oil;

③ gas-measuring instrument;

④ other associated units of equipment.

(2) preparation for operation

① checking all equipment on board to determine compliance with 10.2.10.1 and 10.2.16.1 of this Section;

② mounting and fastening of non-permanent equipment;

③ blanking off particular pipes;

④ assembling air pipes;

⑤ disconnecting power supply to those electrical installations not complying with 10.2.16.1 of this Section;

⑥ closing openings between safe areas and gas-hazardous zones;

⑦ starting up additional ventilation equipment;

⑧ changeover to low suction for cooling water pumps;

⑨ displaying signs to the effect that open flame, non-certified explosion-proof electrical equipment, etc.

are prohibited;

(3) oil recovery operation

① guidance on safe distance from an oil spill source and relevant notes;

② gas measurements during operation (on open deck and in spaces where gas may accumulate). If gas is traced on open deck, the ship is to move away immediately;

③ actions to be taken for cleaning, ventilation, emptying adjacent tanks, etc. if gas is traced in any enclosed space;

④ emergency measures to be taken in case of failure of positive pressure ventilation;

⑤ precautions against overfilling of recovered oil tanks;

⑥ discharging.

(4) cleaning and gas-freeing of recovered oil tanks and pipes.

10.2.18 Oil recovery ships carrying recovered oil having a flash point exceeding 60°C

10.2.18.1 Ships engaged exclusively in the recovery of oil having a flash point exceeding 60°C are to comply with the relevant requirements of 10.2.1, 10.2.2 10.2.4 and 10.2.17 of this Section, and the following additional requirements.

10.2.18.2 Construction and fire safety

(1) Ships engaged exclusively in the recovery of oil having a flash point exceeding 60°C are to comply with the requirements of CHAPTER 2 of PART THREE of **CECIS** Rules for Construction of Inland

⁹ Refer to IC publication 60079-14: Explosive atmospheres – Part 14: Electrical installations design, selection and erection.

Waterway Steel Ships;

(2) The fire safety of ships engaged exclusively in the recovery of oil having a flash point exceeding 60°C is to comply with the relevant requirements for cargo ships and the following additional requirements:

- ① In working deck areas, fire-extinguishing equipment required in 10.2.7.4 of this Section are to be provided in lieu of the fixed fire-extinguishing system required for cargo spaces of cargo ships;
- ② All openings of tanks for recovered oil are to be located in accordance with the requirements of 10.2.5.4 of this Section;
- ③ Spill coamings and drains are to be provided in accordance with the requirements of 10.2.6.3 of this Section;
- ④ Fire-fighter's outfits are to be provided in accordance with the requirements of 10.2.7.5 of this Section;
- ⑤ At least one portable instrument is to be available on board for gas detection.

10.2.18.3 Machinery installation

(1) For ships engaged exclusively in the recovery of oil having a flash point exceeding 60°C, 10.2.11.1, 10.2.11.2, 10.2.11.3, 10.2.11.7, 10.2.11.9 and 10.2.11.10 of this Section are applicable;

(2) Piping systems related to oil recovery are not to pass through machinery and accommodation spaces as far as practicable; where this is unavoidable, the arrangement of such piping systems within machinery spaces is to comply with the requirements for fuel oil piping systems;

(3) The outlets of vent pipes of recovered oil tanks are to have a minimum height of 500 mm above weather deck and located at a minimum horizontal distance of 2 m away from inlets or openings of enclosed spaces containing ignition sources and deck machinery and equipment with ignition hazards, and the ends of vent pipes are to be fitted with a wire gauze required.

10.2.18.4 Electrical installations

(1) For ships engaged exclusively in the recovery of oil having a flash point exceeding 60°C, the additional requirements for electrical installations are to comply with the requirements of Section 2, CHAPTER 13 of PART FIVE of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

Section 3 SELF-UNLOADING SAND SHIPS

10.3.1 General requirements

10.3.1.1 Unless expressly provided in this Section, self-unloading sand ships are to comply with the relevant requirements for cargo ships with the same gross tonnage of the Guidelines and in addition, the relevant requirements of CCSISC Rules for Construction of Inland Waterway Steel Ships.

10.3.1.2 The self-unloading sand ships with a length of 40 m or over are to be provided with a safe loading manual that is to be prepared by the designer or shipyard according to the final data of the ship and are to be submitted to CCSISC for approval.

10.3.1.3 A permanent ruler or range pole is to be fitted at the fore and aft ends of the cargo tank and amid the cargo tank (if possible) for ready observation of the actual height of the stack by personnel. A notice plate is to be placed at suitable positions to alert the crew to operate properly and avoid inadvertent operation.

10.3.1.4 In generally, the self-unloading sand ships are to be not provided with a sand pump system or other similar equipment for evacuating sand. Special consideration are to be given to usage of such a system onboard and agreement is to be given by CCSISC.

10.3.1.5 The ships with a gross tonnage of 1000 or over are to comply with the requirements of 9.2.2 and 9.2.3 of CHAPTER 9 of this Part. Where the ships do not complying with the requirements for the navigation bridge visibility specified in 9.2.2.1 (1) and (2) of CHAPTER 9 of this Part, means, such as a visual surveillance with night-vision capability, may be adopted as an alternative.

10.3.1.6 The water trapped in a water collection tank are to be timely drained in the navigation condition and during the loading process.

10.3.1.7 Trim by bow is not to occur in the navigation condition.

10.3.2 Definitions

10.3.2.1 A *cargo conveyor* is a gravity type conveyor that consists of transmissions, gears, belt storage devices and booms for lifting the cargo from the bottom of the cargo tank to the outboard.

10.3.2.2 A *water collection tank* is a tank formed by bottom shell, longitudinal bulkheads and sloped plates of the cargo tank etc. for draining trapped water, supporting the cargo tank and delivering cargoes, which also known as a conveyor belt tank.

10.3.2.3 A *flap channel* is a watertight U-shaped structure that is fitted in the water collection tank and formed by bottom shell and longitudinal flappers for drainage of trapped water.

10.3.2.4 A *conveyor belt channel* is a watertight U-shaped channel that is formed by watertight bottom plates and watertight longitudinal plates from the fore collision bulkhead to the freeboard deck or the fore raised quarter deck for drainage of trapped water and passing of the cargo conveyor.

10.3.3 Hull structures

10.3.3.1 The ships with a length of 40m or over but less than 60 m are to be provided with side tanks between the fore bulkhead of the cargo tank and the fore bulkhead of the engine room. The ships with a length of 60 m or over are to be provided with side tanks between the fore collision bulkhead and the fore bulkhead of the engine room.

The longitudinal side bulkhead (inner side bulkhead) of the side tank is to be watertight and extended to the freeboard deck.

10.3.3.2 The ships are to be fitted with water collection tanks, flap channels (if required) or other similar structures and drainage wells, which are to be so constructed that the water in the cargo tank may be easily collected and drained to reduce the influence of free surface to the stability and to prevent the water flowing into other tanks.

The longitudinal bulkheads of a water collection tanks are to be watertight as far as possible, or are to be watertight to a certain depth above the bottom shell. Where a flap channel is fitted, its flappers are to be watertight to a certain depth above the bottom shell.

10.3.3.3 Where the cargo conveyor passes through the fore collision bulkhead, a conveyor belt channel is to be provided and is to be effectively connected to the longitudinal plates of the water collection tank or to the longitudinal flappers of the flap channel, in order to collect the sand water or rainwater to the drainage well. The bottom plates and longitudinal plates of the conveyor belt channel are to be watertightly connected to the adjacent structures, such as the collision bulkhead, the freeboard deck or the fore raised quarter deck. The openings cut on the freeboard deck or fore raised quarter deck for the conveyor belt channel are to be kept as small as possible to reduce the chances of rainwater ingress.

10.3.3.4 A hatchcoaming is to be fitted in way of the exit on the freeboard deck (or raised quarter deck) for cargo conveyors (conveyor belt channels), and the fore end of the exit (excluding the hatchcoaming)

is to be not below the freeboard deck (or the raised quarter deck if it is fitted).

10.3.3.5 The arrangement and structural scantlings of the side tanks, water collection tanks, flap channels (if required) and conveyor belt channels are to comply with the relevant provisions of CCSISC Rules for Construction of Inland Waterway Steel Ships.

10.3.4 Machinery and electrical installations

10.3.4.1 The ships are to be provided with drainage piping special for cargo tanks, independent bilge piping and bilge level monitoring devices.

10.3.4.2 The drainage pumps of cargo tanks are to be self-priming mud pumps, consisting of at least two pumps or two groups of pumps. The total capacity of the pumps is to be determined according to the requirements of (1), (2) and (3) as follows, whichever is the greatest:

(1) an amount equal to rainfall of 100 mm/hour, with the water-collecting area taken as the total area in horizontal projection (vertical view) of the cargo area of the wagon, the opening of the freeboard deck (or raised quarter deck) for the cargo conveyor and the belt of the cargo conveyor over the freeboard deck (or raised quarter deck) ;

(2) the quantity of the collecting water, calculated at the rate of loading and the moisture content of the sand in loading operation which are determined according to the loading capacity of the ship and the sand conditions ;

(3) the total capacity of the pumps is to be greater than 100 m³/h for the ships with a length of less than 50 m; greater than 150 m³/h for the ships with a length of 50 m or over.

10.3.4.3 The calculation and material of discharge piping of cargo tanks and the arrangement of suctions, bilge fittings, bilge level monitoring devices and drainage arrangements are to comply with the relevant requirement of CCSISC Rules for Construction of Inland Waterway Steel Ships.

10.3.5 Intact stability

10.3.5.1 Where the lightweight and gravity of the ship corresponding to the loading, navigation and unloading condition are different, the inclining test is to be carried out for the cargo conveyor and other movable equipment, and the lightweight and gravity of the ship in the loading and unloading condition are to be calculated according to the test results.

10.3.5.2 For the ships requiring permanent ballast, water ballast are to be not regarded as permanent ballast. In checking the stability for loading conditions, water ballast are to be not permitted, except for the lightweight or lightweight plus ballast (departure, arrival).

10.3.5.3 In checking the stability of the ship, the exit of the freeboard deck (or raised quarter deck) for the cargo conveyor is to be considered as the location of down flooding to calculate flooding angles.

10.3.5.4 The basic loading conditions under consideration and the calculation of bulk shift and so on are to comply with the relevant requirements of 8.3.3.2 and 8.3.3.3 of CHAPTER 8 of this Part.

10.3.5.5 The density under consideration of the sand is to be taken as 1.5t/m³.

10.3.5.6 The calculation of the distribution, weight and gravity of the sand is to comply with the relevant requirements of 8.3.3.4 of CHAPTER 8 of this Part.

10.3.5.7 In checking the stability of the ship, the effects of free surface of the liquid in the water collection tank or flap channel on the initial metacentric height and righting lever curves are to be calculated according to the following methods:

(1) The length under consideration is to be taken as the horizontal distance from the aft end of the conveyor belt channel to the after bulkhead of the cargo tank;

(2) The breadth under consideration is to be taken as that of the water collection tank (or that of the flap channel if a flap channel is fitted). When the watertight height of the longitudinal plates of the water collection tank, longitudinal flappers of the flap channel or the structures forming the boundaries of the water collection tank is less than that obtained from the following formula, the breadth under consideration is to be taken as the horizontal distance between the adjacent longitudinal watertight bulkheads or between the adjacent side shell plates. When the breadth of the water collection tank or flap channel (including drainage wells) are different at fore and aft, the breadth under consideration is to be taken as an equivalent breadth:

$$h = H_0 + 125W + 100 \quad \text{mm}$$

where: H_0 ---alarm level of the bilge level monitoring device (measured from the top of the bottom plate of the drainage well), in mm;

W ---breadth of the water collection tank, in m.

(3) the height under consideration is to be taken as the watertight height of the longitudinal plates or flappers specified in (2) above;

(4) The liquid loading rate of the water collection tank or flap channel is to be calculated at the height corresponding to the alarm level of the bilge level monitoring device;

(5) The cargo weight loaded onboard is to include the weight of the water trapped in the water collection tank or the flap channel, and the trapped water in the water collection tank or the flap channel are to be not considered as an individual weight under consideration.

10.3.5.8 The initial metacentric height righting lever curves, stability criterion numeral due to wind pressure and due to torrent current (if applicable) and stability in full speed return voyage are to comply with the relevant requirements of CHAPTER 8 of this Part.

10.3.5.9 For the ships provided with a rotational conveyor, the stability under the full-loaded arrival condition is to be also checked as the conveyor rotates, which are to comply with the requirements for that under the operation condition for slewing floating cranes specified in CHAPTER 8 of this Part, and the heeling moment due to the conveyor outboard is to be obtained from the following formula:

$$M_h = 9.81W_x b_x - M_i$$

where: W_x ---weight of the rotational conveyor, in t;

b_x ---horizontal distance from the gravity of the rotational conveyor to the longitudinal centerline, in m;

M_i ---equilibrant moment from the mechanical balance part of the rotational conveyor, in kN·m.

10.3.6 Cargo conveyors

10.3.6.1 The part of a cargo conveyor above the freeboard deck is to be designed to be of telescopic, rotational or twist-up types or other equivalent types and are to be efficiently secured. The arrangement and structural scantlings are to comply with the relevant requirements of [CCSISC](#) Rules for Construction of Inland Waterway Steel Ships.

10.3.6.2 The cargo conveyor is to be not in generally permitted to extend beyond the bow; if so in the navigation condition, the length of the part extending beyond the bow in the fore and aft direction (measured from the fore perpendicular) is to be not in generally more than 10 m, and its fore end is to be fitted with a white all-round light.

10.3.6.3 The prime mover space for the cargo conveyor is to be protected against fire in accordance with the following requirements:

(1) The fixed water fire-extinguishing system is to cover this space;

(2) Two portable fire extinguishers are to be provided. Where the total capacity of the prime mover is equal to or more than 735 kW, an additional portable foam applicator are to be provided;

(3) an access from the open deck is to be provided, and hydrants are to be fitted near the exit of the access;

(4) Where the total capacity of the prime mover is equal to or more than 735 kW, the oil fuel tank for the prime mover is to be separated from the prime mover by a bulkhead or deck or other steel structures.

10.3.6.4 The control position for the cargo conveyor is to be provided with lighting provisions, and an operating instruction is to be posted therein.