MERCHANT SHIPPING (CONSTRUCTION & SURVEY OF PASSENGER SHIPS) RULES, 2025

G.S.R. ---)- whereas, draft of the Merchant Shipping (Construction and Survey of Passenger Ships) Rules, 2025 were published, as required by sub-section (1) of section 130 of the Merchant Shipping Act, 2025 (24 of 2025) vide G.S.R. _____ dated _____, inviting objections and suggestions from all persons likely to be affected thereby till the expiry of thirty days from the date of publication of the said notification in the Official Gazette;

And, whereas the copies of the said Gazette were made available to the public on the _____

And whereas ____ objection or suggestion has been received and considered on the said draft;

Now, therefore, in exercise of the powers conferred by section 130 of the Merchant Shipping Act, 2025 the Central Government hereby make the following rules, namely:-

PART I

PRELIMINARY

1. Short title, commencement and application-

(1) These rules may be called the Merchant Shipping (Construction and Survey of Passenger Ships) Rules, 2025

(2) They shall come into force on the date of their publication in the Official Gazette.

(3) (a) Save as otherwise provided in clause (b), they shall apply to-

(i) every sea going passenger ship, being a new ship of Classes I and II registered in India, wherever it is; and

(ii) every special trade passenger ship being a new ship of Class III to VII, both inclusive registered in India wherever it is;

(iii) every sea going passenger ship of Classes I and II, registered in any country outside India while such ship is at a port or place in India or within the territorial waters of India; and

(iv) every special trade passenger ship of Classes III and IV registered in any country outside India while such ship is at a port or place in India or within the territorial waters of India;

Provided that nothing in these rules shall apply to any ship by reason of its being at a port or place in India or within territorial waters of India if it would not have been at any such port or place or within territorial waters but for the stress of weather or any other circumstance that neither the master nor the owner nor the charterer, if any, of the ship could have prevented or forestalled.

(b) Nothing in these rules shall apply to any passenger ship, being an existing ship, if it complies with any of the following requirements, namely:-

(i) in the case of a ship of Classes I or II, the keel of which was laid or which was at a similar stage of construction before the 19th day of November, 1952, the requirements of the International Convention on Safety of Life at Sea, 1929;

(ii) in the case of a ship of Classes III or IV, the keel of which was laid or which was at a similar stage of construction before the 19th day of November, 1952, the requirements of the International Convention on Safety of Life at Sea, 1929 read with the requirements of the Simla Rules, 1931;

(iii) in the case of a ship of Classes I, II, III or IV, the keel of which was laid or which was at a similar stage of construction on or after the 19th day of November 1952 but before the 26th May, 1965, the requirements of the Indian Merchant Shipping (Construction & Survey of Passenger Steamers) Rules, 1956.

(iv) in the case of a ship of Classes I or II, the keel of which was laid or which was at a similar stage of construction on or after the 25th May, 1965 but before 25th May 1980 the requirements of the International Convention on Safety of Life at Sea, 1960;

(v) in the case of a ship of Classes III or IV, the keel of which was laid or which was at a similar stage of construction on or after the 25th May, 1965 but before 25th May 1980 , ... the requirements of the International Convention on Safety of Life at Sea, 1960 read with the requirements of Special Trade Passenger Ships Agreement, 1971 (from 1st December 1976), Protocol on Space Requirements for Special Trade Passenger Ships, 1973 (from 2nd June 1977) and the Simla Rules, 1931.

(vi) in the case of a ship of Classes V, VI or VII, the requirements of the Indian Merchant Shipping (Construction and Survey of Passenger Steamers) Rules, 1956 read with such exemptions as the Central Government may have granted from time to time.

(vii) in the case of ship of Classes I to VII, the keel of which was laid on or which was at a similar stage of construction after the 21st July,1981 but before this Rules comes into effect, the requirements of Merchant Shipping (Construction and Survey of Passenger ships) Rules,1981 along with the applicable amendments to related SOLAS requirements made by resolutions MSC.1(XLV), MSC.6(48), MSC.11(55), MSC.12(56), MSC.13(57), MSC.22(59), MSC.24(60), MSC 26(60), MSC.27(61), MSC.31(63), 1994 and 1995 SOLAS Conference, MSC.47(66), MSC.57(67), MSC 69(69), MSC.91(72), MSC.99(73), MSC.142(77), MSC.170(79), MSC.194(80), MSC.201(81), MSC.202(81), MSC.216(82) are to be complied with.

(4) These rules incorporate the applicable SOLAS 1974 regulations, as amended related to construction, subdivision and stability, surveys and navigation equipment, as covered by Chapters I, II and V of SOLAS.

(5) These rules are subject to any future amendments to the SOLAS regulations (adopted after May 2005 and coming in to force on or after 1st January 2008) for ships of Classes I, II, III and IV. Director General may extend these amended requirements to ships of other Classes as deemed necessary.–The Director General may issue Merchant Shipping Notices for the purpose of clarification or for the application of the amendments to the SOLAS Convention.

(6) Not withstanding anything contained in these rules High Speed Passenger Crafts shall be surveyed and certified under the provisions of :

1) Code of Safety for dynamically supported craft adopted by IMO by resolution A 373(X), as amended, for crafts constructed on or after 1 January 1980, but before 1 January 1996.

2) The International Code of safety for High Speed Craft 1994 (1994 HSC Code), adopted by the IMO by Resolution MSC.36(63), as amended, for crafts constructed on or after1 January 1996 but before 1 July 2002.

3) The International Code of safety for High Speed Craft 2000 (2000 HSC Code), adopted by IMO by Resolution MSC.97(73), as amended, for crafts constructed on or after 1 July 2002.

2. Definitions

In these rules, unless the context otherwise requires-

(1) " 'A' Class Division" means a bulkhead or a part of a deck in either case complying with the applicable requirements of Part II, Chapter 2, of these rules;

(2) "accommodation space" means any space used for accommodation purposes and includes-

(a) passenger space,

(b) crew space,

(c) offices,

(d) pantries, and

(e) space similar to any of the foregoing spaces not being service spaces or open spaces on deck;

(3) "Act" means the Merchant Shipping Act, 1958 (44 of 1958);

(4) "Aft terminal" is the aft limit of the subdivision length.

(5) "Amidships" is at the middle of length (L).

(6)"auxiliary stairway" means a stairway made of steel or other suitable material which does not form part of a means of escape and which serves only two decks;

(7) "Auxiliary steering gear" is the equipment other than any part of the main steering gear necessary to steer the ship in the event of failure of the main steering gear but not including the tiller, quadrant or components serving the same purpose.

(8) " 'B' Class Division" means a bulkhead complying with the applicable requirements of Part II, Chapter 2, of these rules;

(9) "breadth (B)" is the greatest moulded breadth of the ship at or below the deepest subdivision draught;

(10) "Bulkhead deck" in a passenger ship means the uppermost deck at any point in the subdivision length (Ls) to which the main bulkheads and the ship's shell are carried watertight and the lowermost deck from which passenger and crew evacuation will not be impeded by water in any stage of flooding for damage cases defined in the first schedule. The bulkhead deck may be a stepped deck. In a cargo ship the freeboard deck may be taken as the bulkhead deck.

(11)"cargo spaces" means spaces appropriated for cargoes other than mail and bullion and trunks leading to such spaces;

(12) "combustible material" means any material which is not "incombustible";

(13) "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 recording or fire control equipment is centralized.

(14) "crew space" means accommodation provided exclusively for the use of the crew;

(15) "criterion numeral" in relation to any ship means criterion numeral of the ship determined in accordance with applicable provisions of the First Schedule;

(16) "Dead ship condition" is the condition under which the main propulsion plant, boilers and auxiliaries are not in operation due to the absence of power.

(17) "deepest subdivision draught" is the water line which corresponds to the summer load line draught of the ship.

(18) "Design pressure" means the hydrostatic pressure for which each structure or appliance assumed watertight in the intact and damage stability calculations is designed to withstand.

(19) "draught" means the vertical distance from the keel line at mid-length to the water line in question;

(20) "Emergency condition" is a condition under which any services needed for normal operational and habitable conditions are not in working order due to failure of the main source of electrical power.

(21)"equivalent material" when used in the expression "steel or other equivalent material" means any material which by itself or by reason of insulation provided possesses structural and integrity properties equivalent to steel and proves such properties when subjected to an appropriate fire test;

(22) "existing ship" means a ship the keel of which was laid or which was at a similar stage of construction before the date of coming into force of these rules;

(23) "Emergency switchboard" is a switchboard which in the event of failure of the main electrical power supply system is directly supplied by the emergency source of electrical power or the transitional source of emergency power and is intended to distribute electrical energy to the emergency services.

(24) "Emergency source of electrical power" is a source of electrical power, intended to supply the emergency switchboard in the event of a failure of the supply from the main source of electrical power.

(25) "factor of sub-division" in relation to any ship or a portion thereof means the factor of sub-division determined in accordance with the applicable provisions of the First Schedule;

(26) "floodable length" in relation to any portion of a ship at any draught means the maximum length of that portion having its centre at a given point in a ship which at that draught and under such assumption of permeability set forth in the First Schedule as are applicable in the circumstances, can be flooded without submerging any part of the ship's margin line when the ship has no list;

(27) "Forward terminal" is the forward limit of the sub division length

(28) "Forward Perpendicular" is as defined in the Merchant Shipping (Load Line) Rules in force.

(29) "Freeboard deck" is the deck as defined in the Merchant Shipping (Load Line) Rules in force.

(30) "incombustible material" means any material which when heated to a temperature of 750^{O}C neither burns nor gives off inflammable vapour in quantity sufficient to ignite a pilot flame;

(31)"independent power pump" means a pump operated by power otherwise than by power generated from ship's main engine;

(32) Keel line is a line parallel to the slope of the keel passing amidships through:

i) the top of the keel at centreline or line of intersection of the inside of shell plating with the keel if a bar keel extends below that line, on a ship with a metal shell; or

ii) in wood and composite ships, the distance is measured from the lower edge of the keel rabbet. When the form at the lower part of the midship section is of a hollow character, or where thick garboards are fitted, the distance is measured from the point where the line of the flat of the bottom continued inward intersects the centreline amidships.

(33) Subdivision length (L_s) of the ship is the greatest projected moulded length of that part of the ship at or below deck or decks limiting the vertical extent of flooding with the ship at the deepest subdivision draught.

"length (L) " for any other purpose means the length on the summer load water line measured between the foreside of the stem and after side of the rudder post or to the centre of the rudder stock if there is no rudder post, or 96 per cent of the summer load water line, whichever is the greater;

(34) "Light service draught (d_l)" is the service draught corresponding to the lightest anticipated loading and associated tankage, including, however, such ballast as may be necessary for stability and/or immersion. The full complement of passengers and crew are to be considered on board.

(35) "low flame spread" means the surface that adequately restricts the spread of flame having regard to the risk of fire in the space concerned;

(36) " machinery spaces" for the purpose of subdivision and stability are spaces between the watertight boundaries of a space containing the main and auxiliary propulsion machinery, including boilers, generators and electric motors primarily intended for propulsion. In the case of unusual arrangements, the Director General may define the limits of the machinery spaces.

"machinery spaces" for other purposes are all machinery spaces of category A and all other spaces containing propelling machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces.

"machinery spaces of category A" are those spaces and trunks to such spaces which contain:

i) internal combustion machinery used for main propulsion;

ii) internal combustion machinery used for purposes other than main

propulsion where such machinery has in the aggregate a total power output of not less than 375 kW; or
iii) any oil-fired boiler or oil fuel unit.

(37) "main circulating pump" means the pump installed for circulating water through the main condenser;

(38) "Main generating station" is the space in which the main source of electrical power is situated.

(39) "Emergency condition" is a condition under which any services needed for normal operational and habitable conditions are not in working order due to failure of the main source of electrical power.

(40) "Main source of electrical power" is a source intended to supply electrical power to the main switchboard for distribution to all services necessary for maintaining the ship in normal operational and habitable conditions.

(41) "Main steering gear" is the machinery, rudder actuators, steering gear, power units, if any, and ancillary equipment and the means of applying torque to the rudder stock (e.g. tiller or quadrant) necessary for effecting movement of the rudder for the purpose of steering the ship under normal service conditions.

(42) "main vertical zone" means the vertical zone in which the hull superstructures and deck houses are divided by `A' class divisions;

(43) "maximum ahead service speed" means the greatest speed the ship is designed to maintain in service at sea at the deepest seagoing draught;

(44) "Maximum astern speed" is the speed which it is estimated the ship can attain at the designed maximum astern power at the deepest sea-going draught.

(45) "Main switchboard" is a switchboard which is directly supplied by the main sourceof electrical power and is intended to distribute electrical energy to the ship's services...

(46) "Merchant Shipping Notice" means a Notice described as such and issued by the Directorate.

(47) "mid-length" is the mid point of the subdivision length of the ship;

(47) "mile" means a nautical mile of 1852 metres;

(48) "motor ship" means a ship propelled by internal combustion engines;

(49) "navigable speed" means the minimum speed at which the ship can be effectively steered in the ahead direction;

(50) "new ship" means a ship the keel of which is laid or which is at a similar stage of construction on or after the date of coming into force of these rules;

(51) "Normal operational and habitable condition" is a condition under which the ship as a whole, the machinery, services, means and aids ensuring propulsion,

ability to steer, safe navigation, fire and flooding safety, internal and external communications and signals, means of escape, and emergency boat winches, as well as the designed comfortable conditions of habitability are in working order and functioning normally.

(52) Partial subdivision draught (d_p) is the light service draught plus 60% of the difference between the light service draught and the deepest subdivision draught.

(53) "passenger space" means space provided for the use of passengers and does not include any space appropriated for baggage, stores, provisions and mail;

(54) "Permeability" (μ) of a space is the proportion of the immersed volume of that space which can be occupied by water.

(55) "Power actuating system" is the hydraulic equipment provided for supplying power to turn the rudder stock, comprising a steering gear power unit or units, together with the associated pipes and fittings, and a rudder actuator. The power actuating systems may share common mechanical components (i.e. tiller, quadrant and rudder stock) or components serving the same purpose.

(56)"public spaces" includes halls, dining rooms, bars, smoke rooms, lounges, recreation rooms, nurseries and libraries;

(57) "Ro-ro passenger ship" means a passenger ship with ro-ro spaces or special category spaces as defined in Part II Chapter 2.

(58) "service space" includes galleys, main pantries, laundries, store rooms, paint rooms, baggage rooms, mail rooms, bullion rooms, carpenter and plumber workshops and trunkways leading to such spaces;

(59) "settling tank" means an oil storage tank having a heating surface of not less than $0.18m^2$ per tonne of oil capacity;

(60)"ship" includes any vessel propelled by electricity, steam, or other mechanical means;

(61) "short international voyage" means an international voyage in the course of which a ship is not more than 200 miles from a port or place in which the passengers and crew could be placed in safety and which does not exceed 600 miles in length between the last port of the call in the country to which the voyage begins and the first port of destination;

(62) "Steering gear control system" is the equipment by which orders are transmitted from the navigating bridge to the steering gear power units. Steering gear control systems comprise transmitters, receivers, hydraulic

control pumps and their associated motors, motor controllers, piping and cables.

(63) "steering gear power unit" means-

(a) in the case of electric steering gear, the electric motor and its associated electrical equipment;

(b) in the case of electro-hydraulic steering gear, the electric motor, its associated electrical equipment and connected pumps; and

(c) in the case of steam hydraulic or pneumatic-hydraulic steering gear, the driving engine and connected pump;

(64) "sub-division load line" means the load line indicating the depth to which a ship can be loaded having regard to the extent to which she is sub-divided and to the space for the time being allotted to passengers;

(65) "sub-division load water line" means the water line used or assumed in determining the sub-division of the ship;

(66) "suitable" in relation to material means any material approved by the Director General as suitable for the purpose for which it is intended or approved by Indian Register of Shipping or any Classification society(only a member of International Association of Classification Societies(IACS));

(67) "Trim" is the difference between the draught forward and the draught aft, where the draughts are measured at the forward and aft terminals respectively, disregarding any rake of keel.

(68) "Watertight" means having scantlings and arrangements capable of preventing the passage of water in any direction under the head of water likely to occur in intact and damaged conditions. In the damaged condition, the head of water is to be considered in the worst situation at equilibrium, including intermediate stages of flooding.

(69) "weather tight" in relation to a structure means a structure which is capable of preventing the passage of sea water through it in any sea conditions.

(70) "Special trade passenger" means a passenger carried in special trades in spaces on the weather deck, upper deck and / or between decks which accommodate more than eight passengers

(71) " Weather deck" means the uppermost continuous deck fully or partially exposed to weather which may be wholly or partially used by passengers.

(72) " Upper deck" in ships with side openings means the deck below the weather deck.

(73) "SOLAS" means International Convention for the Safety of Life at Sea

(74) "MSC" means Maritime Safety Committee formulated by International Maritime Organization(IMO).

words and expressions used in these rules and not defined but defined in the Act, shall have the meanings, respectively assigned to them in the Act.

3. Classification of ships

For the purpose of these rules, passenger ships shall be arranged in the following classes, namely:-

Class I -	Passenger ships engaged on international voyages other than ships of Class III.
Class II -	Passenger ships engaged on short international voyages other than ships of Class IV.
Class III -	Special Trade Passenger Ships engaged on international voyages.
Class IV -	Special Trade Passenger Ships engaged on short international voyages.
Class V -	Special Trade Passenger Ships (other than ships of Class VI and VII) engaged on voyages other than international voyages.
Class VI -	Special Trade Passenger Ships engaged on voyages in the coasting trade of India during the course of which they do not go more than 20 miles from the nearest land. Provided that such ships shall not cease to be ships of Class VI merely by reason of the fact that they cross during their voyage the Gulf of Kutch, Cambay or Mannar.
Class VII -	Special Trade Passenger Ships engaged on voyages in fair season between ports in India during the course of which they do not go more than 5 miles from the nearest land.

"Special Trade" means the conveyance of large numbers of special trade passengers by sea on international voyages within the area specified below as well as coastal voyages (the voyages along coast of India).

- on the south bounded by the parallel of latitude 20° S from the east coast of Africa to the west coast of Madagascar, thence the west and north coasts of Madagascar to longitude 50° E, thence the meridian of longitude 50° E to latitude 10° S, thence the rhumb line to the point latitude 3° S, longitude 75° E, thence the rhumb line to the point latitude 11° S, longitude 120° E, thence the parallel of latitude 11°S to longitude 141°03'E;
- on the east bounded by the meridian of longitude 141°03'E from latitude 11°S to the south coast of New Guinea, thence the south, west and north coasts of New Guinea to the point longitude 141°03'E, thence the rhumb line from the north coast of New Guinea at the point 141°03'E to the point latitude 10°N at the north-east coast of Mindanao, thence the west coasts of the islands of Leyte, Samar and Luzon to the port of Sual (Luzon Island), thence the rhumb line from the Port of Sual to Hong Kong;
- on the north bounded by the south coast of Asia from Hong Kong to Suez;

- on the west bounded by the east coast of Africa from Suez to the point latitude 20ºS.

PART II

CHAPTER I :

CONSTRUCTION OF HULLS

4. General

(1) The structural strength of every ship to which these rules apply shall be sufficient for the service for which the ship is intended.

(2) For the purposes of sub-rule (1), the builders shall submit detailed strength calculations of the bending moment and shear forces on the structure. Such calculations shall take into account particular features in ballasting and loading arrangements of the ship.

(3) Unless expressly provided otherwise, for ships constructed before 1 January, 2026 the Central Government shall ensure that the requirements which are applicable under chapter II-1 of the International Convention for the Safety of Life at Sea, 1974, as amended by resolutions MSC.1 (XLV), MSC.6 (48), MSC.11 (55), MSC. 12(56), MSC 13(57), MSC. 26(60), MSC. 27(61), Resolution 1 of the 1995 SOLAS Conference, MSC. 47(66), MSC. 57(67), MSC. 65(68), MSC. 69(69), MSC. 99(73) and MSC.170 (79) , ……. are complied with.

5. Structural plans

(1) Before the construction of any ship commences or, as the case may be, before any ship is commissioned into service for the first time, plans with respect to the following items of the ship's structure shall be submitted to the Director General for approval, namely:-

(a) Midship section;

(b) Longitudinal section;

(c) Shell plating;

(d) Decks, watertight bulkheads;

(e) Pillars and girders;

(f) Deep tanks;

(g) Oil fuel bunkers and settling tanks forming part of the ship's structure;

(h) Arrangement of fore and aft body;

(i) Stem and stern frame construction;

(j) Rudder;

(k) Propeller brackets;

(l) Main engine and thrust seatings;

(m) Superstructure and deck houses;

(n) Hatchways and other openings on deck; and

(o) Such other plans as the Director general or any other officer authorised by him in this behalf may require.

(2) Every plan submitted for approval in pursuance of sub-rule (1) shall clearly indicate the particulars of welding and riveting used in the respective part of the ship and their relative sequences.

(3) A set of as built construction drawings and other plans showing any subsequent structural alterations are to be kept on board. The set of plans are to include the following:

a) Main plans

i) General arrangement
ii) Capacity plan
iii) Hydrostatic curves
iv) Loading manual, where required

b) Structural plans

i) Midship section
ii) Scantling profile
iii) Decks
iv) Shell expansion
v) Transverse bulkheads
vi) Rudder and rudder stock
vii) Cargo hatch covers, when applicable

c) Bilge and ballast piping diagrams.

An additional set of such drawings are to be kept ashore by the company responsible for the operation of the ship.

6. Watertight subdivision - passenger ships

Every ship of Classes I, II, III, IV, V, VI or VII shall be sub-divided into compartments so as to comply with the provisions of the First schedule.

7. Peak and machinery space, bulkheads, etc.

(1) A forepeak or collision bulkhead shall be fitted which is to be watertight up to the bulkhead deck. The bulkhead shall be located at a distance from the forward perpendicular of not less than 0.05 L or 10 m, whichever is less, and not more than s 0.08 L or 0.05 L + 3 m ,, whichever is the greater..

(2) Where any part of the ship below the waterline extends forward of the forward perpendicular, e.g. a bulbous bow, the distances stipulated in sub-rule (1) shall be measured from a point either:

(a) at the mid-length of such extension; or

(b) at a distance 0.015 L forward of the forward perpendicular; or

(c) at a distance 3 m forward of the forward perpendicular; whichever gives the smallest measurement.

(3) Where a long forward superstructure is fitted, the forepeak or collision bulkhead on all passenger ships shall be extended weathertight to the next full deck above bulkhead deck. The extension shall be so arranged as to preclude the possibility of the bow door causing damage to it in the case of damage to, or detachment of, a bow door.

(4) The extension required in sub-rule (3) need not be fitted directly above the bulkhead below, provided that all parts of the extension are not located forward of the forward limit specified in sub-rule (1) or sub-rule (2).

(5) Where bow doors are fitted and a sloping loading ramp forms part of the extension of the collision bulkhead above the bulkhead deck the ramp shall be weathertight over its complete length. Ramps not meeting above requirement shall be disregarded as an extension of the collision bulkhead.

(6) The number of openings in the extension of the collision bulkhead above the freeboard deck shall be restricted to the minimum compatible with the design and normal operation of the ship. All such openings shall be capable of being closed weathertight.

(7) Bulkheads shall be fitted separating the machinery space from cargo and accommodation spaces forward and aft and made watertight up to the bulkhead deck. An afterpeak bulkhead shall also be fitted and made watertight up to the bulkhead deck. The after peak bulkhead may, however, be stepped below the bulkhead deck, provided the degree of safety of the ship as regards subdivision is not thereby diminished.

(8) In all cases, the stern tubes shall be enclosed in watertight spaces of moderate volume. The stern gland shall be situated in a watertight shaft tunnel or other watertight space separate from the stern tube compartment and of such volume that, if flooded by leakage through the stern gland, the bulkhead deck will not be immersed.

8. Double bottom tanks

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

(2) Where a double bottom is required to be fitted,,the inner bottom shall be continued out to the ship's side in such manner as to protect the bottom to the turn of the bilge. Such protection will be deemed satisfactory if the inner bottom is not lower at any part than a plane parallel with the keel line and which is located not less than a vertical distance *h* measured from the keel line, as calculated by the formula: *h=B/20.*

However, in no case is the value of *h* to be less than 760 mm and need not be taken as more than 2000 mm.

(3) Small wells constructed in the double bottom in connection with drainage arrangement of holds, etc., shall not extend downwards more than necessary. A well extending to the outer bottom is, however, permitted at the after end of the shaft tunnel. Other wells (e.g., for lubricating oil under main engines) may be permitted by if the Director General is satisfied that the arrangements give protection equivalent to that afforded by a double bottom complying with rule (2). In no case shall the vertical distance from the bottom of such a well to a plane coinciding with the keel line be less than 500 mm.

(4) Nothing in this rule shall require a double bottom to be fitted in way of watertight tanks, including dry tanks of moderate size if the safety of the ship is not likely to be impaired by reason of the absence of a double bottom in that position in the event of bottom or side damage.

(5) In the case of passenger ships of class IV, VI and VII , the Director General may permit a double bottom to be dispensed with if satisfied that the fitting of a double bottom in that part would not be compatible with the design and proper working of the ship.

(6) Any part of a passenger ship that is not fitted with a double bottom in accordance with paragraphs 1, 4 or 5 shall be capable of withstanding bottom damages, as specified in paragraph 8, in that part of the ship.

(7) In the case of unusual bottom arrangements in a passenger ship, it shall be demonstrated that the ship is capable of withstanding bottom damages as specified in paragraph 8.

(8) Compliance with paragraphs 6 or 7 is to be achieved by demonstrating that s_i, when calculated in accordance with Schedule -1, is not less than 1 for all service conditions when subject to a bottom damage assumed at any position along the ship's bottom and with an extent specified in subparagraph .2 below for the affected part of the ship:

i) Flooding of such spaces shall not render emergency power and lighting, internal communication, signals or other emergency devices inoperable in other parts of the ship.

ii) Assumed extent of damage shall be as follows:

	For 0.3 L from the forward perpendicular of the ship	Any other part of the ship
Longitudinal extent	1/3 $L^{2/3}$ or 14.5 m, whichever is less	1/3 $L^{2/3}$ or 14.5 m, whichever is less
Transverse extent	*B*/6 or 10 m, whichever is less	*B*/6 or 5 m, whichever is less
Vertical extent, measured from the keel line	*B*/20 or 2 m, whichever is less	*B*/20 or 2 m, whichever is less

iii) If any damage of a lesser extent than the maximum damage specified in subparagraph .2 would result in a more severe condition, such damage should be considered.

(9) In case of large lower holds in passenger ships, the Director General may require an increased double bottom height of not more than *B*/10 or 3 m, whichever is less, measured from the keel line. Alternatively, bottom damages may be calculated for these areas, in accordance with paragraph 8, but assuming an increased vertical extent.

9. Manholes and Lightening holes in double bottoms

(1) Manholes and lightening holes shall be provided in all non-watertight members of the double bottom tank to ensure ventilation and easy access to the various parts of the double bottom. The number of manholes in tank tops shall be reduced to the minimum compatible with securing free ventilation and ready access. Care shall be taken in locating manholes so as to avoid the possibility of interconnection of main sub-division compartments to the double bottom.

(2) Covers of manholes in tank tops shall be of steel and where no ceiling is provided in cargo spaces the covers and their fittings shall be effectively protected against damage.

(3) Ample air and drainage holes shall be provided in all non-watertight members of the structure.

(4) Oiltight cofferdams shall be provided in the double bottom so as to separate the compartments for carrying fuel or lubricating oil from each other and for separating all such oil tanks from tanks carrying fresh water.

(5) Striking plates of adequate thickness or other suitable arrangements shall be provided under sounding pipes to prevent damage to the ship's bottom plating by striking of the sounding rod.

10. Construction of watertight bulkheads, etc.

(1) Every bulkhead and other portion of the internal structure forming part of the watertight sub-division of a ship shall be of such strength and so constructed as to be capable of supporting with an adequate margin of resistance, the pressure due to the maximum head of water which it may have to sustain in the event of damage to the ship. Such head of water shall be not less than the head upto the bulkhead deck, or such maximum head as may result from flooding or heeling if that be higher.

(2) Every such bulkhead and portion of the internal structure shall be constructed of steel or equivalent and shall be constructed to the requirements of the 2nd Schedule..

11. Watertight decks, steps and flats

(1) The horizontal plating of decks, steps and flats required by these rules to be watertight shall be as strong as the bulkhead at the place where each occurs.

(2) Adequate supports for beams shall be provided by bulkheads or by girders, pillared where necessary, and the connection of the pillars shall be sufficient to withstand the load due to water pressure.

(3) Where frames pass through a deck, a step or flat required to be watertight, such deck, step or flat shall be made watertight without the use of wood or cement.

12. Fore peak, deep and other tanks

(1) Where fore peak bulkhead, deep tank bulkhead and bulkhead of any other tank intended for holding liquids form boundaries of watertight sub-divisions such bulkheads shall be adequate having regard to their intended purpose.

(2) Deep tanks extending from side to side shall have a centre line oil tight or as the case may be watertight bulkhead. Such bulkheads shall have scantlings in the same manner as in the case of boundary bulkheads.

(3) Girders fitted on tank bulkheads shall form a continuous line of support on bulkheads and ship's side.

13. Watertight recesses and trunkways

(1) Every recess and trunkway required by these rules to be watertight shall be so constructed as to provide strength and stiffness to all the parts not less than that required for watertight bulkheads at corresponding level.

(2) Watertight ventilators and trunks shall be carried at least up to the bulkhead deck in passenger ships.

(3) Where a ventilation trunk passing through a structure penetrates the bulkhead deck, the trunk shall be capable of withstanding the water pressure that may be present within the trunk, after having taken into account the maximum heel angle allowable during intermediate stages of flooding, in accordance with the First schedule.

(4) Where all or part of the penetration of the bulkhead deck is on the main ro-ro deck, the trunk shall be capable of withstanding impact pressure due to internal water motions (sloshing) of water trapped on the ro-ro deck.

14. Watertight tunnels

(1) Every tunnel required by these rules to be watertight shall be constructed with plating

and stiffeners of adequate strength having regard to their intended purpose. ..

(2) Every inner skin required by these rules to be watertight shall be of such strength and construction as will enable it to withstand a head of water upto the bulkhead deck.

15. Testing of watertight bulkheads, watertight decks, trunks, ventilators etc.

(1) Testing of main compartments by filling them with water shall not be compulsory. When testing by filling with water is not carried out, a hose test is compulsory, this test shall be carried out in the most advanced stage of the fitting out of the ship. In any case a thorough inspection of the watertight bulkheads shall be carried out.

(2) The forepeak, double bottoms, duct keels and inner skins shall be tested by flooding with water to the head prescribed in rule 10(1).

(3) Tanks which are intended to hold liquids and which form part of the subdivision of the ship shall be tested for tightness and structural strength with water to a head corresponding to its design pressure. . In no case shall the test head be less than the top of the air pipes or to a level of 2.4 metres above the top of the tank, whichever is greater.

(4) The tests prescribed in (2) and (3) of this rule are for the purpose of ensuring that the subdivision structural arrangements are watertight and are not to be regarded as a test of the fitness of any compartment for the storage of oil fuel or for other special purposes for which a test of a superior character may be required depending on the height to which the liquid has access in the tank or its connections.

(5) After completion, a hose or flooding test shall be applied to watertight decks and a hose test to watertight trunks, tunnels and ventilators.

16. Openings and means of closing openings in watertight bulkheads

(1) The number of openings in watertight bulkheads shall be reduced to the minimum compatible with the design and proper working of the ship ; satisfactory means shall be provided for closing these openings.

(2)(a) Where pipes, scuppers, electric cables, etc., are carried through watertight subdivision bulkheads, arrangements shall be made to ensure the watertight integrity of the bulkheads.

(b) Valves not forming part of a piping system shall not be permitted in watertight subdivision bulkheads.

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

(3)(a) No doors, manholes, or access openings are permitted :

i. in the collision bulkhead below the bulkhead deck ;

ii. in watertight transverse bulkheads dividing a cargo space from an adjoining cargo space or from a permanent or reserve bunker, except as provided in sub-rule 9(a) and in rule 18.

(b) Except as provided in sub-rule 3(c), the collision bulkhead may be pierced below the bulkhead deck by not more than one pipe for dealing with fluid in the forepeak tank, provided that the pipe is fitted with a screwdown valve capable of being operated from above the bulkhead deck, the valve chest being secured inside the forepeak to the collision bulkhead. The Director general may, however, authorize the fitting of this valve on the after side of the collision bulkhead provided that the valve is readily accessible under all service conditions and the space in which it is located is not a cargo space.

(c) If the forepeak is divided to hold two different kinds of liquids the Director general may allow the collision bulkhead to be pierced below the bulkhead deck by two pipes, each of which is fitted as required by sub-rule 3(b), provided the Director general is satisfied that there is no practical alternative to the fitting of such a second pipe and that, having regard to the additional subdivision provided in the forepeak, the safety of the ship is maintained.

(4) Subject to sub-rule 10, not more than one door, apart from the doors to shaft tunnels, may be fitted in each main transverse bulkhead within spaces containing the main and auxiliary propulsion machinery including boilers serving the needs of propulsion. . Where two or more shafts are fitted, the tunnels shall be connected by an intercommunicating passage. There shall be only one door between the machinery space and the tunnel spaces where two shafts are fitted and only two doors where there are more than two shafts. All these doors shall be of the sliding type and shall be so located as to have their sills as high as practicable. The hand gear for operating these doors from above the bulkhead deck shall be situated outside the spaces containing the machinery.

(5) (a) Watertight doors, except as provided in sub-rule 9(a), (c) or rule 18, shall be power-operated sliding doors complying with the requirements of sub-rule 6 capable of being closed simultaneously from the central operating console at the navigation bridge in not more than 60 s with the ship in the upright position.

(b) The means of operation whether by power or by hand of any power-operated sliding watertight door shall be capable of closing the door with the ship listed to 15° either way. Consideration shall also be given to the forces which may act on either side of the

door as may be experienced when water is flowing through the opening applying a static head equivalent to a water height of at least 1 m above the sill on the centreline of the door.

(c) Watertight door controls, including hydraulic piping and electric cables, shall be kept as close as practicable to the bulkhead in which the doors are fitted, in order to minimize the likelihood of them being involved in any damage which the ship may sustain. The positioning of watertight doors and their controls shall be such that if the ship sustains damage within one fifth of the breadth of the ship, as defined in rule 2, such distance being measured at right angles to the centreline at the level of the deepest subdivision load line, the operation of the watertight doors clear of the damaged portion of the ship is not impaired.

(d) All power-operated sliding watertight doors shall be provided with means of indication which will show at all remote operating positions whether the doors are open or closed. Remote operating positions shall only be at the navigation bridge as required by sub-rule 6(a)(ee) and at the location where hand operation above the bulkhead deck is required by sub-rule 6(a)(dd).

(6)(a) Each power-operated sliding watertight door :

aa. shall have a vertical or horizontal motion ;

bb. shall, subject to sub-rule 10, be normally limited to a maximum clear opening width of 1.2 m. The Director general may permit larger doors only to the extent considered necessary for the effective operation of the ship provided that other safety measures, including the following, are taken into consideration :

(i) special consideration shall be given to the strength of the door and its closing appliances in order to prevent leakages ;

(ii) the door shall be located outside the damage zone B/5 ;

(iii) the door shall be kept closed when the ship is at sea, except for limited periods when absolutely necessary as determined by the Director general;

cc. shall be fitted with the necessary equipment to open and close the door using electric power, hydraulic power, or any other form of power that is acceptable to the Director general;

dd. shall be provided with an individual hand-operated mechanism. It shall be possible to open and close the door by hand at the door itself from either side, and in addition, close the door from an accessible position above the bulkhead deck with an all round crank motion or some other movement providing the same degree of safety acceptable to the Director general. Direction of rotation or other movement is to be clearly indicated at all operating positions. The time necessary for the complete closure of the door, when operating by hand gear, shall not exceed 90 s with the ship in the upright position ;

ee. shall be provided with controls for opening and closing the door by power from both sides of the door and also for closing the door by power from the central operating console at the navigation bridge ;

ff. shall be provided with an audible alarm, distinct from any other alarm in the area, which will sound whenever the door is closed remotely by power and which shall sound for at least 5 s but no more than 10 s before the door begins to move and shall continue sounding until the door is completely closed. In the case of remote hand operation it is sufficient for the audible alarm to sound only when the door is moving. Additionally, in passenger areas and areas of high ambient noise the Director General may require the audible alarm to be supplemented by an intermittent visual signal at the door ; and

gg. shall have an approximately uniform rate of closure under power. The closure time, from the time the door begins to move to the time it reaches the completely closed position, shall in no case be less than 20 s or more than 40 s with the ship in the upright position.

(b) The electrical power required for power-operated sliding watertight doors shall be supplied from the emergency switchboard either directly or by a dedicated distribution board situated above the bulkhead deck. The associated control, indication and alarm circuits shall be supplied from the emergency switchboard either directly or by a dedicated distribution board situated above the bulkhead deck and be capable of being automatically supplied by the transitional source of emergency electrical power required by rule 140(3)(a)(iii) in the event of failure of either the main or emergency source of electrical power.

(c) Power-operated sliding watertight doors shall have either :

aa. a centralized hydraulic system with two independent power sources each consisting of a motor and pump capable of simultaneously closing all doors. In addition, there shall be for the whole installation hydraulic accumulators of sufficient capacity to operate all the doors at least three times, i.e. closed-open-closed, against an adverse list of 15°. This operating cycle shall be capable of being carried out when the accumulator is at the pump cut-in pressure. The fluid used shall be chosen considering the temperatures liable to be encountered by the installation during its service. The power operating system shall be designed to minimize the possibility of having a single failure in the hydraulic piping adversely affect the operation of more than one door. The hydraulic system shall be provided with a low-level alarm for hydraulic fluid reservoirs serving the power-operated system and a low gas pressure alarm or other effective means of monitoring loss of stored energy in hydraulic accumulators. These alarms are to be audible and visual and shall be situated on the central operating console at the navigation bridge ; or

bb. an independent hydraulic system for each door with each power source consisting of a motor and pump capable of opening and closing the door. In addition, there shall be a hydraulic accumulator of sufficient capacity to operate the door at least three times, i.e. closed-open-closed, against an adverse list of 15°. This operating cycle shall be capable of being carried out when the

accumulator is at the pump cut-in pressure. The fluid used shall be chosen considering the temperatures liable to be encountered by the installation during its service. A low gas pressure group alarm or other effective means of monitoring loss of stored energy in hydraulic accumulators shall be provided at the central operating console on the navigation bridge. Loss of stored energy indication at each local operating position shall also be provided ; or

cc. an independent electrical system and motor for each door with each power source consisting of a motor capable of opening and closing the door. The power source shall be capable of being automatically supplied by the transitional source of emergency electrical power as required by rule 140(4)(b) in the event of failure of either the main or emergency source of electrical power and with sufficient capacity to operate the door at least three times, i.e. closed-open-closed, against an adverse list of 15°.

For the systems specified in sub-rules 6(c)(aa), 6(c)(bb), and 6(c)(cc), provision should be made as follows :

Power systems for power-operated watertight sliding doors shall be separate from any other power system. A single failure in the electric or hydraulic power-operated systems excluding the hydraulic actuator shall not prevent the hand operation of any door.

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

(e) As far as practicable, electrical equipment and components for watertight doors shall be situated above the bulkhead deck and outside hazardous areas and spaces.

(f) The enclosures of electrical components necessarily situated below the bulkhead deck shall provide suitable protection against the ingress of water..

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

(h) A single electrical failure in the power operating or control system of a power-operated sliding watertight door shall not result in a closed door opening. Availability of the power supply should be continuously monitored at a point in the electrical circuit as near as practicable to each of the motors required by sub-rule 6(c). Loss of any such power supply should activate an audible and visual alarm at the central operating console at the navigation bridge.

(7).(a) The central operating console at the navigation bridge shall have a “master mode” switch with two modes of control : a “local control” mode which shall allow any door to be locally opened and locally closed after use without automatic closure, and a “doors closed” mode which shall automatically close any door that is open. The “doors closed” mode shall automatically close any door that is open. The “doors closed” mode shall permit doors to be opened locally and shall automatically reclose the doors upon release of the local control mechanism. The “master mode” switch shall normally be in the “local control” mode. The “doors closed” mode shall only be used in an emergency or for testing purposes. Special consideration shall be given to the reliability of the “master mode” switch.

(b) The central operating console at the navigation bridge shall be provided with a diagram showing the location of each door, with visual indicators to show whether each door is open or closed. A red light shall indicate a door is fully open and a green light shall indicate a door is fully closed. When the door is closed remotely the red light shall indicate the intermediate position by flashing. The indicating circuit shall be independent of the control circuit for each door.

(c) It shall not be possible to remotely open any door from the central operating console.

(8)(a) All watertight doors shall be kept closed during navigation except that they may be opened during navigation as specified in sub-rules 8(b) and 8(c) . Watertight doors of width of more than 1.2 m permitted by sub-rule 11 may only be opened in the circumstances detailed in that sub-rule. Any door which is opened in accordance with this sub-rule shall be ready to be immediately closed.

(b) A watertight door may be opened during navigation to permit the passage of passengers or crew, or when work in the immediate vicinity of the door necessitates it being opened. The door must be immediately closed when transit through the door is complete or when the task which necessitated it being open is finished.

(c) Certain watertight doors may be permitted to remain open during navigation only if considered absolutely necessary ; that is, being open is determined essential to the safe and effective operation of the ship's machinery or to permit passengers normally unrestricted access throughout the passenger area. Such determination shall be made by the Director General only after careful consideration of the impact on ship operations and survivability. A watertight door permitted to remain thus open shall be clearly indicated in the ship's stability information and shall always be ready to be immediately closed.

(9).(a) If the Director General is satisfied that such doors are essential, watertight doors of satisfactory construction may be fitted in watertight bulkheads dividing cargo between deck spaces. Such doors may be hinged, rolling or sliding doors but shall not be remotely controlled. They shall be fitted at the highest level and as far from the shell plating as practicable, but in no case shall the outboard vertical edges be situated at a distance from the shell plating which is less than one fifth of the breadth of the ship, as defined in rule 2, such distance being measured at right angles to the centreline at the level of the deepest subdivision load line.

(b) Such doors shall be closed before the voyage commences and shall be kept closed during navigation ; the time of opening such doors in port and of closing them before the ship leaves port shall be entered in the log-book. Should any of the doors be accessible during the voyage, they shall be fitted with a device which prevents unauthorized opening. When it is proposed to fit such doors, the number and arrangements shall receive the special consideration of the Director general.

(c) Vessels of Class VI, VII can be given exemption by the Director General considering size of vessel & no. of passengers for provision of hand operated (remotely controlled) sliding doors when no. of doors is not more than one.

(10) Portable plates on bulkheads shall not be permitted except in machinery spaces. Such plates shall always be in place before the ship leaves port, and shall not be removed during navigation except in case of urgent necessity at the discretion of the master. The times of removal and replacement of any such portable plates shall be recorded in the log-book, and the necessary precautions shall be taken in replacing them to ensure that the joints are watertight. The Director General may permit not more than one power-operated sliding watertight door in each main transverse bulkhead larger than those specified in sub-rule 6(a)(bb) to be substituted for these portable plates, provided these doors are closed before the ship leaves port and remain closed during navigation except in case of urgent necessity at the discretion of the master. These doors need not meet the requirements of sub-rule 6(a)(dd) regarding complete closure by hand-operated gear in 90 s. The time of opening and closing these doors, whether the ship is at sea or in port, shall be recorded in the log-book.

(11)(a) Where trunkways or tunnels for access from crew accommodation to the stokehold, for piping, or for any other purpose are carried through main transverse watertight bulkheads, they shall be watertight and in accordance with the requirements of rule 15. The access to at least one end of each such tunnel or trunkway, if used as a passage at sea, shall be through a trunk extending watertight to a height sufficient to permit access above the bulkhead deck. The access to the other end of the trunkway or tunnel may be through a watertight door of the type required by its location in the ship. Such trunkways or tunnels shall not extend through the first subdivision bulkhead abaft the collision bulkhead.

(b) Where it is proposed to fit tunnels piercing main transverse watertight bulkheads, these shall receive the special consideration of the Director General

(c) Where trunkways in connection with refrigerated cargo and ventilation or forced draught trunks are carried through more than one watertight bulkhead, the means of closure at such openings shall be operated by power and be capable of being closed from a central position situated above the bulkhead deck.

17. Construction of watertight doors

(1) Every door required by these rules to be watertight shall be of such design, material and construction as will maintain the watertight integrity of the bulkhead in which it is fitted. . Any such door in any other position shall, together with its frame, be made of mild steel or cast iron.

(2) Every sliding watertight door shall be fitted with rubbing face of brass or similar metal which may be fitted either on the door itself or on the door frame, and if they are less than 25 millimeters in width shall be fitted in recesses.

(3) The screw for operating the screw gear of such door shall work in a nut of suitable material which is resistant to corrosion.

(4) The frame of every vertical sliding watertight door shall have no groove on the door in which dirt may lodge. The door of any such frame if it is of skeleton form shall be so arranged that dirt cannot lodge therein. The bottom edge of such doors shall be tapered or bevelled.

(5) Every vertical watertight door which is operated by power shall be so designed and fitted that if the power supply ceases, there shall be no danger of the door dropping.

(6) Every horizontal sliding watertight door shall be so installed as to prevent it from movement if in the event of rolling of the ship and a clip or other suitable device shall be provided for that purpose. The device shall not interfere with the closing of the door when the door is required to be closed.

(7) The frame of every watertight door shall be properly fitted to the bulkhead in which the door is situated and the joining material between the frame and bulkhead shall be of such type as will not deteriorate or be damaged by heat.

(8) Every completed watertight door shall be tested by hydraulic pressure equivalent to a head of water they might sustain in a final or intermediate stage of flooding. The frame work to which the door frame is secured for the purpose of testing should not give greater stiffening than the bulkhead to which it is to be fitted.

(9) Where testing of individual doors is not carried out because of possible damage to insulation or outfitting items, testing of individual doors may be replaced by a prototype pressure test of each type and size of door. The prototype test shall be carried out before the door is fitted. The installation method and procedure for fitting the door on board shall correspond to that of the prototype test. When fitted on board, each door shall be checked for proper seating between the bulkhead, the frame and the door.

18. Passenger ships carrying goods vehicles and accompanying personnel

(1) This rule applies to passenger ships regardless of the date of construction designed or adapted for the carriage of goods vehicles and accompanying personnel where the total number of persons on board (excluding crew) exceeds 12.

(2) If in such a ship the total number of passengers which include personnel accompanying vehicles does not exceed $N = 12 + A/25$, where A = total deck area (square metres) of spaces available for the stowage of goods vehicles and where the clear height at the stowage position and at the entrance to such spaces is not less than 4 m, the provisions of rule 16.9 in respect of watertight doors apply except that the doors may be fitted at any level in watertight bulkheads dividing cargo spaces. Additionally, indicators are

required on the navigation bridge to show automatically when each door is closed and all door fastenings are secured.

(3) When applying the provisions of this chapter to such a ship, N shall be taken as the maximum number of passengers for which the ship may be certified in accordance with this rule.

19. Opening in shell-plating below the bulkhead deck of passenger ships

(1) The number of openings in the shell plating shall be reduced to the minimum compatible with the design and proper working of the ship.

(2) The arrangement and efficiency of the means for closing any opening in the shell plating shall be consistent with its intended purpose and the position in which it is fitted and generally to the satisfaction of the Director General

(3)In every ship of Classes I, II, III, IV or V, the number of side scuttle shall be the minimum compatible with the requirements of the proper operation of the ship.

(a) Subject to the requirements of the IMS rules on Load Lines in force, no sidescuttle shall be fitted in such a position that its sill is below a line drawn parallel to the bulkhead deck at side and having its lowest point 2.5% of the breadth of the ship above the deepest subdivision load line, or 500 mm, whichever is the greater.

(b) All sidescuttles the sills of which are below the bulkhead deck, as permitted by sub-rule 3(a) shall be of such construction as will effectively prevent any person opening them without the consent of the master of the ship.

(c)(i) Where in a between-decks, the sills of any of the sidescuttles referred to in sub-rule 3(b) are below a line drawn parallel to the bulkhead deck at side and having its lowest point 1.4 m plus 2.5% of the breadth of the ship above the water when the ship departs from any port, all the sidescuttles in that between-decks shall be closed watertight and locked before the ship leaves port, and they shall not be opened before the ship arrives at the next port. In the application of this sub-rule the appropriate allowance for fresh water may be made when applicable.

(ii) The time of opening such sidescuttles in port and of closing and locking them before the ship leaves port shall be entered in such log-book as may be prescribed by the Director general.

(iii) For any ship that has one or more sidescuttles so placed that the requirements of sub-rule 3(c)(i) would apply when it was floating at its deepest subdivision load line, the Director general may indicate the limiting mean draught at which these sidescuttles will have their sills above the line drawn parallel to the bulkhead deck at side, and having its lowest point 1.4 m plus 25% of the breadth of the ship above the waterline corresponding to the limiting mean draught, and at which it will therefore be permissible to depart from port without previously closing and locking them and to open them at sea on the responsibility of the master during the voyage to the next

port. In tropical zones as defined in the IMS rules on Load Lines in force, this limiting draught may be increased by 0.3 m.

(d) In every ship of Class VI and VII side scuttles below the bulkhead deck shall be of a non-opening type.

(4) Efficient hinged inside deadlights so arranged that they can be easily and effectively closed and secured watertight, shall be fitted to all sidescuttles except that abaft one eighth of the ship's length from the forward perpendicular and above a line drawn parallel to the bulkhead deck at side and having its lowest point at a height of 3.7 m plus 2.5% of the breadth of the ship above the deepest subdivision load line, the deadlights may be portable in passenger accommodation other than that for steerage passengers, unless the deadlights are required by the IMS rules on Load Lines in force to be permanently attached in their proper positions. Such portable deadlights shall be stowed adjacent to the sidescuttles they serve.

(5) Sidescuttles and their deadlights which will not be accessible during navigation shall be closed and secured before the ship leaves port.

(6)(a) No sidescuttles shall be fitted in any spaces which are appropriated exclusively to the carriage of cargo or coal.

(b) Sidescuttles may, however, be fitted in spaces appropriated alternatively to the carriage of cargo or passengers, but they shall be of such construction as will effectively prevent any person opening them or their deadlights without the consent of the master.

(c) If cargo is carried in such spaces, the sidescuttles and their deadlights shall be closed watertight and locked before the cargo is shipped and such closing and locking shall be recorded in the official log-book.

(7) Automatic ventilating sidescuttles shall not be fitted in the shell plating below the bulkhead deck without the special sanction of the Director general

20. Scuppers, sanitary discharges and similar openings

(1) The number of scuppers, sanitary discharges and other similar openings in the shell plating shall be reduced to the minimum either by making each discharge serve for as many as possible of the sanitary and other pipes, or in any other satisfactory manner.

(2) All inlets and discharges in the shell plating shall be fitted with efficient and accessible arrangements for preventing the accidental admission of water into the ship.

Lead or other heat sensitive material shall not be used for pipes fitted outboard of shell valves in inlets or discharges or in any other place where the deterioration of such pipes in the event of fire would give rise to danger of flooding.

(aa) Subject to the requirements of the IMS rules on Load Lines in force, and except as provided in sub-rule (6), each separate discharge led through the shell plating from spaces below the bulkhead deck shall be provided with either one automatic non-return valve fitted with a positive means of closing it from above the bulkhead deck

or with two automatic non-return valves without positive means of closing, provided that the inboard valve is situated above the deepest subdivision load line and is always accessible for examination under service conditions and is of a horizontal balanced type which is normally closed. Where a valve with positive means of closing is fitted, the operating position above the bulkhead deck shall always be readily accessible and means shall be provided for indicating whether the valve is open or closed.

(bb) The requirements of the IMS rules on Load Lines in force shall apply to discharges led through the shell plating from spaces above the bulkhead deck.

(3) Discharge pipes led through the shell-plating from within superstructure and deck houses fitted with hinged steel doors and gaskets and permanently attached to the bulkhead shall be fitted with an automatic non-return valve with a positive means of closing it from above the free board deck. Where the inboard end of the discharge pipe is more than 0.02L distance from the Summer Load Water Line the Director general may exempt any ship from the provision of the positive means of closing.

(4) Scuppers and discharges originating at any level and penetrating the shell more than 450 mm below the freeboard deck or less than 600 mm above the Summer Load Water Line shall be provided with a non-return valve at the shell. Such valve unless required by sub-rule (2) and (3) may not be provided if the piping is of substantial thickness.

(5) Any valve fitted in compliance with the requirements of this rule, if it is a geared valve or the lower of two non-geared valves, shall be secured to the ship's shell-plating.

(6) Machinery space main and auxiliary sea inlets and discharges in connection with the operation of machinery shall be fitted with readily accessible valves between the pipes and the shell plating or between the pipes and fabricated boxes attached to the shell plating. The valves may be controlled locally and shall be provided with indicators showing whether they are open or closed.

(7) All shell fittings and valves required by this rule shall be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable. All pipes to which this rule refers shall be of steel or other equivalent material to the satisfaction of the Director general. If made of steel, such cocks and valves shall be protected against corrosion.

(8) Discharge pipes led through the shell-plating below the bulkhead deck of any ship of Classes I, II, III, IV, V, VI or VII shall not be fitted in direct line between the outboard opening and the connection with the deck, water closets or other similar fitting, but shall be arranged with bends or elbows of substantial metal other than cast iron or lead.

(9) All discharge pipes led through the shell-plating below the bulkhead deck and the valve relating thereto shall be protected from damage.

(10) Valves, cocks, discharge pipes and other similar fittings connected to the shell-plating below the bulkhead deck shall be fitted on to doublers welded on the inside of the

shell-plating. Studs for securing these fittings shall be screwed through the doubler but not through the shell-plating.

(11) Efficient means shall be provided for the drainage of all watertight decks below the bulkhead deck and any drainage pipe shall be so fitted with valves or arranged otherwise as to avoid the danger of water passing from a damaged to an undamaged compartment.

(12).(a) The inboard opening of each ash-chute, rubbish-chute, etc., shall be fitted with an efficient cover.

(b) If the inboard opening is situated below the bulkhead deck, the cover shall be watertight, and in addition an automatic non-return valve shall be fitted in the chute in an easily accessible position above the deepest subdivision load line. When the chute is not in use both the cover and the valve shall be kept closed and secured.

(13) The valve shall be of a horizontal balanced type normally closed and provided with a local means for securing it in a closed position. The requirement of this sub-rule shall not apply to ash ejectors and expellers, the inboard openings of which are in the ship's stokehold and necessarily below the deepest sub-division load water line. Such ejectors and expellers shall be fitted with means which shall be capable of preventing water entering the ship.

(a) Gangway, cargo and coaling ports fitted below the bulkhead deck shall be of sufficient strength. They shall be effectively closed and secured watertight before the ship leaves port, and shall be kept closed during navigation.

(b) Such ports shall in no case be so fitted as to have their lowest point below the deepest subdivision load line.

21. Side and other openings above the bulkhead deck

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

(2) All openings in the exposed weather deck shall have coamings of ample height and strength and shall be provided with efficient means for expeditiously closing them weathertight. Freeing ports, open rails and scuppers shall be fitted as necessary for rapidly clearing the weather deck of water under all weather conditions.

(3) The open end of air pipes terminating within a superstructure shall be at least 1 m above the waterline when the ship heels to an angle of 15°, or the maximum angle of heel during intermediate stages of flooding, as determined by direct calculation, whichever is the greater. Alternatively, air pipes from tanks other than oil tanks may discharge through the side of the superstructure. The provisions of this sub-rule are without prejudice to the provisions of the IMS rules on Load Lines in force.

(4) Sidescuttles, gangway, cargo and coaling ports and other means for closing openings in the shell plating above the bulkhead deck shall be of efficient design and construction and of sufficient strength having regard to the spaces in which they are fitted and their positions relative to the deepest subdivision load line.

(5) Efficient inside deadlights, so arranged that they can be easily and effectively closed and secured watertight, shall be provided for all sidescuttles to spaces below the first deck above the bulkhead deck.

22. Weather decks

(1) The bulkhead deck or a deck above the bulkhead deck shall be weathertight. All openings in the exposed weathertight deck shall have coamings of adequate height and strength and shall be provided with efficient and rapid means of closing so as to make the openings weather-tight. Corners of openings in weather decks shall be well rounded. Radius of any such corner shall not be less than 150 mm. Except in the case of elliptical or parabolic corners, insert plates shall be provided at corners of hatch openings. Edges of all circular holes cut in the deck shall be reinforced by a flat bar welded to them. Edges of coamings of access openings shall be suitably reinforced.

(2) Freeing ports, open rails and scuppers shall be fitted as necessary for rapidly clearing the weather deck of water under all weather conditions.

(3) All reasonable and practicable measures shall be taken to limit the entry and spread of water above the bulkhead deck. Such measures may include fitting of partial bulkheads or webs. Where partial water tight bulkheads or webs are fitted on the bulkhead deck above or in the vicinity of main sub-division bulkheads they shall have watertight shell and bulkhead deck connections so as to restrict the flow of water along the deck when the ship is heeled in a damaged condition. Where the partial watertight bulkhead dows not line up with the bulkhead below, the bulkhead deck between shall be made effectively watertight.

23. Closure of cargo loading doors

(1) The following doors, located above the bulkhead deck, shall be closed and locked before the ship proceeds on any voyage and shall remain closed and locked until the ship is at its next berth :

(a) cargo loading doors in the shell or the boundaries of enclosed superstructures ;

(b) bow visors fitted in positions, as indicated in sub-rule (1(a)) ;

(c) cargo loading doors in the collision bulkhead ;

(d) weathertight ramps forming an alternative closure to those defined in sub-rules (1(a))to(1(c))inclusive.

Provided that where a door cannot be opened or closed while the ship is at the berth, such a door may be opened or left open while the ship approaches or draws away from the berth, but only so far as may be necessary to enable the door to be immediately operated. In any case, the inner bow door must be kept closed.

(2) Notwithstanding the requirements of sub-rule (1(a)) and (1(d)), the Director general may authorize that particular doors can be opened at the discretion of the master, if necessary for the operation of the ship or the embarking and disembarking of passengers, when the ship is at safe anchorage and provided that the safety of the ship is not impaired.

(3) The master shall ensure that an effective system of supervision and reporting of the closing and opening of the doors referred to in sub-rule (1) is implemented.

(4) The master shall ensure, before the ship proceeds on any voyage, that an entry in the log-book is made of the time of the last closing of the doors specified in sub-rule (1) and the time of any opening of particular doors in accordance with sub-rule (2).

24. Watertight integrity from the ro-ro deck (bulkhead deck) to spaces below

In ro-ro passenger ships :

(1) subject to the provisions of subsub-rules (2) and (3), all accesses that lead to spaces below the bulkhead deck shall have a lowest point which is not less than 2.5 m above the bulkhead deck ;

(2) where vehicle ramps are installed to give access to spaces below the bulkhead deck, their openings shall be able to be closed weathertight to prevent ingress of water below, alarmed and indicated to the navigation bridge ;

(3) the Director general may permit the fitting of particular accesses to spaces below the bulkhead deck provided they are necessary for the essential working of the ship, e.g. the movement of machinery and stores, subject to such accesses being made watertight, alarmed and indicated to the navigation bridge ;

(4) the accesses referred to in sub-rules (2) and (3) shall be closed before the ship leaves the berth on any voyage and shall remain closed until the ship is at its next berth ;

(5) the master shall ensure that an effective system of supervision and reporting of the closing and opening of such accesses referred to in sub-rules (2) and (3) is implemented ; and

(6) the master shall ensure, before the ship leaves the berth on any voyage, that an entry in the log-book, as required by rule 33, is made of the time of the last closing of the accesses referred to in sub-rules (2) and (3).

25. Access to ro-ro decks

In all ro-ro passenger ships, the master or the designated officer shall ensure that, without the expressed consent of the master or the designated officer, no passengers are allowed access to an enclosed ro-ro deck when the ship is underway.

26. Closure of bulkheads on the ro-ro deck

(1) All transverse or longitudinal bulkheads which are taken into account as effective to confine the seawater accumulated on the ro-ro deck shall be in place and secured before the ship leaves the berth and remain in place and secured until the ship is at its next berth.

(2) Notwithstanding the requirements of sub-rule 1, the Director general may permit some accesses within such bulkheads to be opened during the voyage but only for sufficient time to permit through passage and, if required, for the essential working of the ship.

27. Sub-division load lines

(1) Every ship shall be marked on its side amidships with the sub-division load lines assigned to it by the Director general. The mark shall consist of horizontal lines 25 millimetres in breadth and 230 millimetres in length. The marks shall be painted in white or yellow on a dark ground or in black on a light ground and shall also be cut in or centre punched or indicated by welded bead on iron or steel ships and cut into the planking on wood ships.

(2) The subdivision load lines assigned and marked shall be recorded in the Passenger Ship Safety Certificate, and shall be distinguished by the notation P1 for the principal passenger service configuration, and P2, P3, etc., for the alternative configurations. The principal passenger configuration shall be taken as the mode of operation in which the required subdivision index *R* (see rule …) will have the highest value.

(3) For ships of Classes III, IV, V, VI and VII carrying Special Trade Passengers, the respective sub-division load lines corresponding to the deepest sub-division draught shall be ‘D1’ and the alternative conditions denoted by ‘D2’, ‘D3’, etc.

(4) The freeboard corresponding to each sub-division load line shall be measured at the same position and from the same deck line as the freeboard determined by IMS rules on Load Lines in force.

(5) The freeboard corresponding to each approved subdivision load line and the service configuration, for which it is approved, will be clearly indicated on the Passenger Ship Safety Certificate.

(6) In no case may any sub-division Load Line be assigned and marked on the ship’s side above the deepest load line in salt water determined by IMS rules on Load Lines in force.

(7) A ship shall not be so loaded as to submerge in salt water, when the ship has no list, a sub-division load line mark appropriate to the particular voyage and condition of service.

28. Stability of passenger ships

(1) Every passenger ship regardless of size shall be inclined upon its completion and the elements of its stability determined. The master shall be supplied with such information satisfactory to the Director general as is necessary to enable him by rapid and simple processes to obtain accurate guidance as to the stability of the ship under varying conditions of service. A copy of the stability information shall be furnished to the Director general.

(2) Where any alterations are made to a ship so as to materially affect the stability information supplied to the master, amended stability information shall be provided. If necessary the ship shall be re-inclined.

(3) At periodical intervals not exceeding five years, a lightweight survey shall be carried out on all passenger ships to verify any changes in lightship displacement and longitudinal centre of gravity. The ship shall be re-inclined whenever, in comparison with the approved stability information, a deviation from the lightship displacement exceeding 2% or a deviation of the longitudinal centre of gravity exceeding 1% of L is found or anticipated.

(4) Every ship shall have scales of draughts marked clearly at the bow and stern. In the case where the draught marks are not located where they are easily readable, or operational constraints for a particular trade make it difficult to read the draught marks, then the ship shall also be fitted with a reliable draught indicating system by which the bow and stern draughts can be determined.

29. Stability data

(1) The owner of every ship shall provide for the guidance of the master of the ship information relating to the stability, loading and ballasting of the ship.

(2) The information shall be in the form of a booklet and shall comply with the requirements laid down in the Third Schedule.

30. Exhibition of damage control plans

There shall be permanently exhibited, for the guidance of the officer in charge of the ship, plans showing clearly for each deck and hold the boundaries of the watertight compartments, the openings therein with the means of closure and position of any controls thereof, and the arrangements for the correction of any list due to flooding. In addition, booklets containing the aforementioned information shall be made available to the officers of the ship.

31. Integrity of the hull and superstructure, damage prevention and control

(1) Indicators shall be provided on the navigation bridge for all shell doors, loading doors and other closing appliances which, if left open or not properly secured, could, in the opinion of the Director general , lead to flooding of a special category space or ro-ro cargo space. The indicator system shall be designed on the fail-safe principle and shall show by visual alarms if the door is not fully closed or if any of the securing arrangements are not in place and fully locked and by audible alarms if such door or closing appliances become open or the securing arrangements become unsecured. The indicator panel on the navigation bridge shall be equipped with a mode selection function "harbour/sea voyage" so arranged that an audible alarm is given on the navigation bridge if the ship leaves harbour with the bow doors, inner doors, stern ramp or any other side shell doors not closed or any closing device not in the correct position. The power supply for the indicator system shall be independent of the power supply for operating and securing the doors.

(2) Television surveillance and a water leakage detection system shall be arranged to provide an indication to the navigation bridge and to the engine control station of any leakage through inner and outer bow doors, stern doors or any other shell doors which could lead to flooding of special category spaces or ro-ro cargo spaces.

(3) Special category spaces and ro-ro cargo spaces shall be continuously patrolled or monitored by effective means, such as television surveillance, so that any movement of vehicles in adverse weather conditions and unauthorized access by passengers thereto can be detected whilst the ship is underway.

(4) Documented operating procedures for closing and securing all shell doors, loading doors and other closing appliances which, if left open or not properly secured, could, in the opinion of the Director general , lead to flooding of a special category space or ro-ro cargo space, shall be kept on board and posted at an appropriate place.

(5) Hinged doors, portable plates, sidescuttles, gangway, cargo and coaling ports and other openings, which are required by these rules to be kept closed during navigation, shall be closed before the ship leaves port. The time of closing and the time of opening (if permissible under these rules) shall be recorded in such log-book as may be prescribed by the Director general.

32. Marking, periodical operation and inspection of watertight doors, etc., in passenger ships

(1) This rule applies to all Classes of ships.

(2) (a) Drills for the operating of watertight doors, sidescuttles, valves and closing mechanisms of scuppers, ash-chutes and rubbish-chutes shall take place weekly. In ships in which the voyage exceeds one week in duration a complete drill shall be held before leaving port, and others thereafter at least once a week during the voyage.

(b) All watertight doors, both hinged and power operated, in main transverse bulkheads, in use at sea, shall be operated daily.

(3) (a) The watertight doors and all mechanisms and indicators connected therewith, all valves, the closing of which is necessary to make a compartment watertight, and all valves the operation of which is necessary for damage control cross-connections shall be periodically inspected at sea at least once a week.

(b) Such valves, doors and mechanisms shall be suitably marked to ensure that they may be properly used to provide maximum safety.

(4) A record of all drills and inspections required by sub rule (2) and (3) shall be entered in the log-book with an explicit record of any defects which may be disclosed.

33. Towing and Mooring equipment

(1) This rule applies to all ships.

(2) Ships shall be provided with arrangements, equipment and fittings of sufficient safe working load to enable the safe conduct of all towing and mooring operations associated with the normal operation of the ship.

(3) Each fitting or item of equipment provided under this regulation shall be clearly marked with any restrictions associated with its safe operation, taking into account the strength of its attachment to the ship's structure.

34. Corrosion prevention of seawater ballast tanks

(1) All dedicated seawater ballast tanks shall be coated during construction in accordance with the Performance Standard for protective coatings adopted by IMO by resolution MSC.215(82), as amended.

(2) Maintenance of the protective coating system shall be included in the overall ship's maintenance scheme.

CHAPTER 2

FIRE PROTECTION

SHIPS OF CLASSES I TO V

Section A. General

Application

34. General

(1) Unless expressly provided otherwise, this chapter shall apply to ships constructed on or after the coming into force of these rules.

(2) For the purpose of this chapter:
- (a) The expression 'ships constructed' means ships the keels of which are laid or which are at a similar stage of construction;
- (b) The expression ' all ships' means ships, irrespective of type, constructed before, on or after the coming into force of these rules; and
- (c) A cargo ship, whenever built, which is converted into a passenger ship shall be treated as a passenger ship constructed on the date on which such a conversion commences.

(3) For the purpose of this chapter, the expression 'a similar stage of construction' means the stage at which:
- (a) Construction identifiable with a specific ship begins; and
- (b) Assembly of that ship has commenced comprising at least 50 tonnes or 1% of the estimated mass of all structural material, whichever is less.

35. Requirements applicable to existing ships

(1) Unless expressly provided otherwise, for ships constructed before 1 July 2002 the requirements given in the Merchant Shipping (Construction and Survey of Passenger Ships) Rules, 1981 and the applicable requirements of Chapter II-2 of the International Convention for the Safety of Life at Sea, 1974, as amended by resolutions MSC.1(XLV), MSC.6(48), MSC.13(57), MSC.22(59), MSC.24(60), MSC.27(61), MSC.31(63) and MSC.57(67) shall be complied with.

(2) Ships constructed before the coming into force of these rules are also to comply with:

(a) Rule 36, as appropriate, and

(b) Paragraphs (b) to (d) of sub rule (12) of rule 88, sub rule (5) of rule 89 and Section E as appropriate. (regarding emergency escape breathing devices and operational requirements for fire safety)

36. Repairs, alterations, modifications and outfitting

(1) All ships which undergo repairs, alterations, modifications and outfitting related thereto shall

continue to comply with at least the requirements previously applicable to these ships. Such ships, if constructed before the coming into force of these rules shall, as a rule, comply with the requirements for ships constructed on or after that date to at least the same extent as they did before undergoing such repairs, alterations, modifications or outfitting.

(2) Repairs, alterations and modifications which substantially alter the dimensions of a ship or the passenger accommodation spaces, or substantially increase a ship's service life and outfitting related thereto, shall meet the requirements for ships constructed on or after the coming into force of these rules in so far as the Director-General deems reasonable and practicable.

Fire Safety Objectives and Functional Requirements

37. Fire safety objectives. - The fire safety objectives of this chapter are to:

(a) prevent the occurrence of fire and explosion;

(b) reduce the risk to life caused by fire;

(c) reduce the risk of damage caused by fire to the ship, its cargo and the environment;

(d) contain, control and suppress fire and explosion in the compartment of origin; and

(e) provide adequate and readily accessible means of escape for passengers and crew.

38. Functional requirements. - In order to achieve the fire safety objectives set out in rule 37 above, the following functional requirements are embodied in the requirements of this chapter and in the M.S (Fire fighting appliances) rules applicable to passenger vessels as appropriate:

(a) division of the ship into main vertical and horizontal zones by thermal and structural boundaries;

(b) separation of accommodation spaces from the remainder of the ship by thermal and structural boundaries;

(c) restricted use of combustible materials;

(d) detection of any fire in the zone of origin;

(e) containment and extinction of any fire in the space of origin;

(f) identification and protection of means of escape

(g) access for fire-fighting;

(h) ready availability of fire-extinguishing appliances; and

(i) minimization of possibility of ignition of flammable cargo vapour.

39. Achievement of the fire safety objectives. - The fire safety objectives set out in rule 37 above shall be achieved by ensuring compliance with the prescriptive requirements specified in sections B, C,D, E and G of this chapter and in the M.S (Fire fighting appliances) rules applicable to passenger vessels or by alternative design and arrangements which comply with section F. A ship will be considered to meet the functional requirements set out in rule 38 and to achieve the fire safety objectives set out in rule 37 when either:

(a) the ship's designs and arrangements, as a whole complies with the relevant prescriptive requirements in sections B, C,D,E and G of this chapter and in the M.S (Fire fighting appliances) rules applicable to passenger vessels;

(b) the ship's designs and arrangements, as a whole, have been reviewed and approved in accordance with section F;

(c) part(s) of the ship's design and arrangements have been reviewed and approved in accordance with section F and the remaining parts of the ship comply with the relevant prescriptive requirements in rules B, C,D,E and G of this chapter and in the M.S (Fire fighting appliances) rules applicable to passenger vessels.

40.Definitions

For the purpose of this chapter, unless expressly provided otherwise, the following definitions shall apply:

(1) **"**Accommodation spaces" are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobbies rooms, barber shops, pantries containing no cooking appliances and similar spaces.

(2) " 'A' class divisions" are those divisions formed by bulkheads and decks, which comply with the following criteria:

(a) they are constructed of steel or other equivalent material;

(b) they are suitably stiffened;

(c) they are so constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test;

(d) they are 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 minutes

Class 'A-30' 30 minutes

Class 'A-15' 15 minutes

Class 'A-0' 0 minutes

(e) a test of prototype bulkhead or deck will be required to ensure that it meets the above requirements for integrity and temperature rise.

(3) “Atriums” are public spaces within a single main vertical zone spanning three or more open decks.

(4) “ 'B' class divisions” are those divisions formed by bulkheads, decks, ceilings or linings, which comply with the following criteria:

(a) they are 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;

(b) they 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 point, including any joint, rise more than 225°C above the original temperature, within the time listed below:

Class 'B-15' 15 minutes

Class 'B-0' 0 minutes

(c) they are constructed of approved non-combustible materials and all materials entering into the construction and erection of 'B' class divisions shall be non-combustible. A division consisting of a non-combustible core and combustible veneers may be accepted as a B class division, provided that the non combustible core and veneers are tested in accordance with relevant parts of Fire Test Procedure Code described in (17).

(d) a test of a prototype division will be required to ensure that it meets the above requirements for integrity and temperature rise.

(5) “Bulkhead deck” is the uppermost deck upto which the transverse watertight bulkheads are carried.

(6) “Cabin balcony” is an open deck space which is provided for the exclusive use of the occupants of a single cabin and has direct access from such a cabin.

(7) “Cargo spaces” are spaces used for cargo, cargo oil tanks, tanks for other liquid cargo and trunks to such spaces.

(8) “Central Control station” is a control station in which the following control and indicator functions are centralized:

(a) fixed fire detection and alarm systems;

(b) automatic sprinklers, fire detection and alarm systems;

(c) fire door indicator panels;

(d) fire door closures;

(e) watertight door indicator panels;

(f) watertight door closures;

(g) ventilation fans;

(h) general/fire alarms;

(i) communication systems including telephones; and

(j) microphones to public address system.

(9) " '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. A division consisting of a non-combustible core and combustible veneers may be accepted as a C class division, provided that the non-combustible core and veneers are tested in accordance with relevant parts of Fire Test Procedure Code.

(10) "Closed ro/ro spaces" are Ro/Ro spaces which are neither open Ro/Ro spaces nor weather decks.

(11) "Closed vehicle spaces" are vehicle spaces which are neither open vehicle spaces or weather decks.

(12) "Combustible material" is any material other than a non-combustible material.

(13) "Continuous 'B' class ceilings or linings" are those 'B' class ceilings or linings which terminate only at an 'A' or 'B' class division.

(14)"Continuously manned central control station" is a central control station which is continuously manned by a responsible member of the crew.

(15)"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 recording or fire control equipment is centralized. Spaces where the fire recording or fire control equipment is centralized are also considered to be a "Fire Control Station".

(16)"Deadweight" is the difference in tonnes between the displacement of a ship in water of a specific gravity of 1.025 at the load water-line corresponding to the assigned summer freeboard and the lightweight of the ship.

(17) "Fire safety systems code" means the International Code for Fire Safety Systems as adopted by the Maritime Safety Committee of the IMO by resolution MSC.98(73) and as may be

amended by IMO.

(18) “Fire test procedures code” means the International Code for Application of Fire Test Procedures, as adopted by the Maritime Safety Committee of IMO by resolution MSC.61(67), and as may be amended by IMO.

(19) “Flashpoint” is the temperature in degrees Celsius (closed cup test) at which a product will give off enough flammable vapour to be ignited, as determined by an approved flashpoint apparatus.

(20) “Helideck” is a purpose-built helicopter landing area located on a ship including all structure, fire-fighting appliances and other equipment necessary for the safe operation of helicopters.

(21) “Helicopter facility” is a helideck including any refueling and hangar facilities.

(22) “Lightweight” is the displacement of a ship in tonnes without cargo, fuel, lubricating oil, ballast water, fresh water and feed water in tanks, consumable stores, and passengers and crew and their effects.

(23) “Low flame spread” means that the surface thus described will adequately restrict the spread of flame, this being determined in accordance with Fire Test Procedures Code.

(24) “Machinery spaces” are all machinery spaces of category 'A' and all other spaces containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces.

(25) “Machinery spaces of category 'A'” are those spaces and trunks to such spaces, which contain:

(a) internal combustion machinery used for main propulsion; or

(b) internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 [kW]; or

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

(26) “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 40 [m].

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

(28) “Oil fuel unit” is the equipment used for the preparation of oil fuel heated or not, for delivery to an oil fired boiler (including inert gas generators, incinerator, waste disposal

unit, etc.) or to an internal combustion engine (including gas turbines) and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0.18 [N/mm^2].

(29) "Open ro/ro spaces" are those ro/ro spaces that 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 deckhead or from above, having a total area of at least 10% of the total area of the spaces sides.

(30) "Open vehicle spaces" are those vehicle spaces 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 deckhead or from above, having a total area of at least 10% of the total area of the space sides.

(31) "A passenger ship" is a ship which carries more than twelve passengers, a passenger being every person other than :

(a) the master and members of the crew or other persons employed or engaged in any capacity on board a ship on the business of the ship; or

(b) a child under one year of age.

(32) "Prescriptive requirements" means the construction characteristics, limiting dimensions or fire safety systems specified in sections B, C,D,E and G of this chapter and in the M.S (Fire fighting appliances) rules applicable to passenger vessels.

(33) "Public spaces" are those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

(34) "Rooms containing furniture and furnishings of restricted fire risk" are those rooms containing furniture and furnishing of restricted fire risk (whether cabins, public spaces, offices or other types of accommodation) in which :

(a) case furniture such as desks, wardrobes, dressing tables, bureaux, dressers, are constructed entirely of approved non-combustible materials, except that a combustible veneer not exceeding 2 [mm] may be used on the working surface of such articles;

(b) free-standing furniture such as chairs, sofas, tables, is constructed with frames of non-combustible materials;

(c) draperies, curtains and other suspended textile materials have qualities of resistance to the propagation of flame not inferior to those of wool of mass 0.8 [kg/m^2], this being determined in accordance with the Fire Test Procedures Code;

(d) floor coverings have low flame spread characteristics;

(e) exposed surfaces of bulkheads, linings and ceilings have low flame- spread characteristics;

(f) upholstered furniture has qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the Fire Test Procedures Code; and

(g) bedding components have qualities of resistance to the ignition and propagation of flame, this being determined in accordance with the Fire Test Procedures Code.

(35) "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 on 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 horizontal direction.

(36) **"**Ro-ro passenger ship" means a passenger ship with ro-ro cargo spaces or special category spaces.

(37) "Steel or other equivalent material". Where the words "steel or other equivalent material" occur, 'equivalent material' means any non- combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable fire exposure to the standard fire test (e.g. Aluminium alloy with appropriate insulation).

(38) " Sauna" is a hot room with temperatures normally varying between 80°C - 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.

(39) "Service spaces" are those spaces used for galleys, pantries containing cooking appliances, lockers, mail and specie rooms, store rooms, workshops other than those forming part of machinery spaces, and similar spaces and trunks to such spaces.

(40) "Special category spaces" are those enclosed vehicle spaces above and below the bulkhead deck, into and from which vehicles can be driven and to which passengers have access. Special category spaces may be accommodated on more than one deck provided that the total overall clear height for vehicles does not exceed 10 [m].

(41) "A standard fire test" is one 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. The test method is to be in accordance with the Fire Test Procedures Code.

(42) "Vehicle spaces" are cargo spaces intended for carriage of motor vehicles with fuel in their tanks for their own propulsion.

(43) "Weather deck" is a deck which is completely exposed to the weather from above and from at least two sides.

Section B. Prevention of Fire and Explosion

Probability of Ignition

41. Purpose of requirements:

The purpose of rules 42 to 44 is to prevent the ignition of combustible materials or flammable liquids. For this purpose the following functional requirements shall be met:

(a) means shall be provided to control leaks of flammable liquids;

(b) means shall be provided to limit the accumulation of flammable vapours;

(c) the ignitability of combustible materials is to be restricted;

(d) ignition sources shall be restricted; and

(e) ignition sources shall be separated from combustible materials and flammable liquids.

42. Arrangements for oil fuel, lubrication oil and other flammable oils.

(1) Limitations in the use of oils as fuel: The following limitations shall apply to the use of oil as fuel:

(a) except as otherwise permitted by this rule, no oil fuel with a flashpoint of less than 60°C is to be used;

(b) in emergency generators oil fuel with a flashpoint of not less than 43°C may be used;

(c) the use of oil fuel having 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 auxiliary machines which are not located in the machinery spaces of category A) subject to the following:

(i) fuel oil tanks except those arranged in double bottom compartments shall be located outside the machinery spaces of category A;

(ii) provisions for the measurement of oil temperature are provided on the suction pipe of the oil fuel pump;

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

(iv) pipe joints of welded construction or of circular cone type or spherical type union joint are applied as much as possible;

(2) Arrangements for oil fuel:

In a ship in which oil fuel is used, the arrangements for the storage, distribution and utilization of the oil fuel shall be such as to ensure the safety of the ship and persons on board and shall at least comply with the following provisions.

(a) Location of oil fuel systems: As far as practicable, parts of the oil fuel system containing heated oil under pressure exceeding 0.18 [N/mm^2] shall not be placed in a concealed position such that defects and leakage cannot readily be observed. The machinery spaces in way of such parts of the oil fuel system shall be adequately illuminated.

(b) Ventilation of machinery spaces: The ventilation of machinery spaces is to be sufficient under normal conditions to prevent accumulation of oil vapour.

(c) Oil fuel tanks:

(i) Fuel oil, lubrication oil and other flammable oils shall not be carried in forepeak tanks.

(ii) As far as practicable, oil fuel tanks shall be part of the ship's structure and shall be located outside machinery spaces of category A. Where oil fuel tanks, other than double bottom tanks, are necessarily located adjacent to or within machinery spaces of category A, at least one of their vertical sides is to be contiguous to the machinery space boundaries and they are preferably to have a common boundary with the double bottom tanks and the area of the tank boundary common with the machinery spaces shall be kept to a minimum. Where such tanks are situated within the boundaries of machinery spaces of category A they are not to contain oil fuel having a flashpoint of less than 60°C. In general, the use of free-standing oil fuel tanks is to be avoided. When such tanks are employed their use is prohibited in category A machinery spaces. Where permitted, they shall be placed in an oil-tight spill tray of ample size having a suitable drain pipe leading to a suitably sized spill oil tank.

(iii) No oil fuel tank is to be situated where spillage or leakage therefrom can constitute a fire or explosion hazard by falling on heated surfaces.

(iv) Oil fuel pipes, which, if damaged, would allow oil to escape from a storage, settling or daily service tank having a capacity of 500 *l* and above situated above the double bottom, shall be fitted with a cock or valve directly on the tank capable of being closed from a safe position outside the space concerned in the event of a fire occurring in the space in which such tanks are situated. In the special case of deep tanks situated in any shaft or pipe tunnel or similar space, valves on the tank shall be fitted, but control in the event of fire may be effected by means of an additional valve on the pipe or pipes outside the tunnel or similar space. If such an additional valve is fitted in the machinery space it shall be operated from a position outside this space. The controls for remote operation of the valve for the emergency generator fuel tank shall be in a separate location from the controls for remote operation of other valves for tanks located in machinery spaces.

(v) Safe and efficient means of ascertaining the amount of oil fuel contained in any oil fuel tank shall be provided. 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 the Director General considers that these latter requirements are impracticable, sounding pipes may be permitted to terminate in machinery spaces subject to following requirements being met:

(aa) an oil-level gauge is provided meeting the requirements of (vi) below;

(bb) the sounding pipes terminate in locations remote from ignition hazards unless precautions are taken, such as the fitting of effective screens, to prevent the oil fuel in the case of spillage through the terminations of the sounding pipes from coming into contact with a source of ignition; and

(cc) 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 oil fuel is not present. Provisions shall be made so as to ensure that any spillage of oil fuel through the control cock involves no ignition hazard.

(vi) Other oil-level gauges may be used in place of sounding pipes provided that such gauges shall not require penetration below the top of the tank and their failure or overfilling of the tanks shall not permit release of fuel.

(vii) The means prescribed in (vi) above shall be maintained in the proper condition to ensure their continued accurate functioning in service.

(d) Prevention of overpressure:

Provisions shall be made to prevent overpressure in any oil tank or in any part of the oil fuel system, including the filling pipes served by pumps on board. Air and overflow pipes and relief valves shall discharge to a position where there is no risk of fire or explosion from the emergence of oils and vapour and are not to lead into crew spaces, passenger spaces nor into special category spaces, closed ro-ro cargo spaces, machinery spaces or similar spaces.

(e) Oil fuel piping:

(i) Oil fuel pipes and their valves and fittings shall be of steel or other approved material, except that restricted use of flexible pipes are permissible in positions where the Director General, is satisfied that they are necessary. Such flexible pipes and end attachments shall be of approved fire-resisting materials of adequate strength and shall be constructed to the satisfaction of the Director General, . For valves, fitted to oil fuel tanks and which are under static pressure, steel or spheroidal-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.

(ii) External high-pressure fuel delivery lines between the high-pressure fuel pumps and fuel injectors shall be protected with a jacketed piping system capable of containing fuel from a high-pressure line failure. A jacketed pipe incorporates an outer pipe into which the high-pressure fuel pipe is place d, forming a permanent assembly. The

jacketed piping system shall include a means for collection of leakages and arrangements shall be provided with an alarm in case of a fuel line failure.

(iii) Oil fuel lines shall not be located immediately above or near units of high temperature including boilers, steam pipelines, exhaust manifolds, silencers or other equipment required to be insulated by (f) below. As far as practicable, oil fuel lines shall be arranged far away from hot surfaces, electrical installations or other sources of ignition and shall be screened or otherwise suitably protected to avoid oil spray or oil leakage onto the sources of ignition. The number of joints in such piping systems shall be kept to a minimum.

(iv) Components of a diesel engine fuel system shall be designed considering the maximum peak pressure which will be experienced in service, including any high pressure pulses which are generated and transmitted back into the fuel supply and spill lines by the action of fuel injection pumps. Connections within the fuel supply and spill lines shall be constructed having regard to their ability to prevent pressurized oil fuel leaks while in service and after maintenance.

(v) In multi-engine installations which are supplied from the same fuel source, means of isolating the fuel supply and spill piping to individual engines, shall be provided. The means of isolation shall not affect the operation of the other engines and shall be operable from a position not rendered inaccessible by a fire on any of the engines.

(vi) Where the Director General, may permit the conveying of oil and combustible liquids through accommodation and service spaces, the pipes conveying oil or combustible liquids shall be of a material approved by the Director General, having regard to the fire risk..

(f) Protection of high temperature surfaces:

(i) Surfaces with temperatures above 220°C which may be impinged as a result of a fuel system failure shall be properly insulated.

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

(3) Arrangements for lubricating oil:

(a) The arrangements for the storage, distribution and utilization of oil used in pressure lubrication systems shall be such as to ensure the safety of the ship and persons onboard. The arrangements made in machinery spaces of category A and whenever practicable in other machinery spaces are at least to comply with the provisions of paragraphs (a), (c)-(iii), (c)-(iv), (c)-(v), (c)-(vi), (c)-(vii), (d), (e)-(i), (e)-(iii) and (f) of sub rule (2) of this rule except that:

(i) this does not preclude the use of sight-flow glasses in lubricating systems provided that they are shown by testing to have a suitable degree of fire resistance; and

(ii) sounding pipes may terminate in machinery spaces; however, the requirements of sub paragraphs (c)-(v)-(aa) and (c)-(v)-(cc) of sub rule (2) of this rule need not be applied on condition that the sounding pipes are fitted with appropriate means of closure.

(b) The provisions of paragraph (c)-(iv) of sub rule (2) shall also apply to lubricating oil tanks except those having a capacity less than 500 *l*, storage tanks on which valves are closed during the normal operation mode of the ship, or where it is determined that an unintended operation of a quick closing valve on the oil lubricating tank would endanger the safe operation of the main propulsion and essential auxiliary machinery.

(4) Arrangements for other flammable oils:

The arrangements for the storage, distribution and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heating systems shall be such as to ensure the safety of the ship and persons onboard. Suitable oil collecting arrangements for leaks shall be fitted below hydraulic valves and comply with the provisions of paragraph (c)-(iii), (c)-(v), (c)-(vi), (c)-(vii), (e)-(iii) and (f) and with the provisions of paragraph (d) and (e)-(i) of sub-rule (2) of this rule in respect of strength and construction.

(5) Arrangements for oil fuel in periodically unattended machinery spaces

In addition to the requirements of sub-rules (1) to (4) of this rule, the oil fuel and lubricating oil systems in a periodically unattended machinery space shall comply with the following:

(a) where daily service oil fuel tanks are filled automatically, or by remote control, means shall be provided to prevent overflow spillages. Other equipment which treat flammable liquids automatically (e.g. oil fuel purifiers) which, whenever practicable, shall be installed in a special space reserved for purifiers and their heaters shall have arrangements to prevent overflow spillages;
and
(b) where daily service oil fuel tanks or settling tanks are fitted with heating arrangements, a high temperature alarm is to be provided if the flashpoint of the oil fuel can be exceeded.

43. Arrangements for gaseous fuel for domestic purpose:

(1) Gaseous fuel systems used for domestic purposes shall be approved by the Director General, . Storage of gas bottles shall be located on the open deck or in a well-ventilated space, which opens only to the open deck.

44. Miscellaneous items of ignition sources and ignitability:

(1) Electric radiators:

Electric radiators, if used shall be fixed in position and so constructed as to reduce fire risks to a minimum. No such radiators shall 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.

(2) Waste receptacles:

Waste receptacles shall be constructed of non-combustible materials with no openings in the sides or bottom.

(3) Insulation surfaces protected against oil penetration:

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

(4) Primary deck coverings:

Primary deck coverings, if applied within accommodation and service spaces and control stations or if applied on cabin balconies of passenger ships constructed on or after 01 July 2008, shall be of an approved material which will not readily ignite, or give rise to toxic or explosive hazards at elevated temperatures, this being determined in accordance with the Fire Test Procedures Code.

(5) Films: Cellulose nitrate based films shall not be used for cinematograph installations.

Fire Growth Potential

45. Purpose of the requirements:

The purpose of the rules 46 and 47 is to limit the fire growth potential in every space of the ship. For this purpose, the following functional requirements shall be met:

(a) means of control for the air supply to the space shall be provided;

(b) means of control for flammable liquids in the space shall be provided; and

(c) the use of combustible materials is to be restricted.

46. Control of air supply and flammable liquid to the space:

(1) Closing appliances and stopping devices of ventilation:

(a) The main inlets and outlets of all ventilation system shall be capable of being closed from outside the spaces being ventilated. The means of closing shall be easily accessible as well as prominently and permanently marked and shall indicate whether the shut-off is open or closed.

(b) Power ventilation of accommodation spaces, service spaces, cargo spaces, control stations and machinery spaces shall be capable of being stopped from an easily accessible position outside the space being served. This position shall not be readily cut off in the event of a fire in the spaces served.

(c) In passenger ships carrying more than 36 passengers, power ventilation, except machinery space and cargo space ventilation and any alternative system which may be required by rule 61 is to be fitted with controls so grouped that all fans may be stopped from either of two separate positions which shall be situated as far apart as practicable. Fans serving power

ventilation systems to cargo spaces shall be capable of being stopped from a safe position outside such spaces.

(2) Means of control in machinery spaces

(a) Means of control shall be provided for opening and closure of skylights, closure of openings in funnels which normally allow exhaust ventilation and closure of ventilator dampers.

(b) Means of control shall be provided for stopping ventilating fans. Controls provided for the power ventilation serving machinery spaces shall be grouped so as to be operable from two positions, one of which shall be outside such spaces. The means provided for stopping the power ventilation of the machinery spaces shall be entirely separate from the means provided for stopping ventilation of other spaces.

(c) Means of control shall be provided for stopping forced and induced draught fans, oil fuel transfer pumps, oil fuel unit pumps, lubricating oil service pumps, thermal oil circulating pumps and oil separators (purifiers). However, paragraphs (d) and (e) of this sub-rule need not apply to oily water separators.

(d) The controls required in (a) to (c) of this sub-rule and in paragraph (c)-(iv) of sub-rule (2) of rule 42 shall be located outside the space concerned so they will not be cut off in the event of fire in the space they serve.

(e) The controls required in (a) to (d) of this sub-rule in sub rule (3) of rule 62 and sub rule (4) of rule 75 and the controls for any required fire-extinguishing system be situated at one control position or grouped in as few positions as possible to the satisfaction of the Director General, . Such positions shall have a safe access from the open deck.

(3) Additional requirements for means of control in periodically unattended machinery spaces:

(a) For periodically unattended machinery spaces, special consideration will be given to maintaining the fire integrity of the machinery spaces, the location and centralization of the fire-extinguishing system controls, the required shutdown arrangements (e.g. ventilation, fuel pumps, etc.) and that additional fire-extinguishing appliances and other fire-fighting equipment and breathing apparatus may be required.

(b) The requirements in paragraph (a) of this sub-rule shall be at least equivalent to those of machinery spaces normally attended.

47. Fire protection materials:

(1) Use of non-combustible materials:

(a) Insulating materials:

Insulating materials shall be non-combustible, except in cargo spaces, mail rooms, baggage rooms and refrigerated compartments of service spaces. Vapour barriers and adhesives used in conjunction with insulation, as well as the insulation of pipe fittings for cold service systems,

need not be of non-combustible materials, but they shall be kept to the minimum quantity practicable and their exposed surfaces shall have low flame-spread characteristics.

New installation of materials which contain asbestos shall be prohibited except for those items permitted by Rule 169(8) of Part II Chapter 5.

(b) Ceilings and linings :

All linings, grounds, draught stops and ceilings shall be of non-combustible material in the following under mentioned spaces except in mailrooms, baggage rooms, saunas, open deck areas not constituting embarkation area or muster station and refrigerated compartments of service spaces:

(i) accommodation spaces, service spaces and control stations

(ii) stairways, open deck spaces not constituting embarkation area or muster station.

(iii) machinery spaces.

(c) Partial bulkheads and decks in passenger ships

(i) Partial bulkheads or decks used to subdivide a space for utility or artistic treatment are also to be of non-combustible materials.

(ii) Linings, ceilings and partial bulkheads or decks used to screen or to separate adjacent cabin balconies shall be of non-combustible materials.

(2) Use of combustible materials:

(a) General:

"A", "B" or "C" class divisions in accommodation and services spaces and cabin balconies which are faced with combustible materials, facings, mouldings, decorations and veneers shall comply with the provisions of paragraphs (b) to (d) of this sub-rule and rules 48 to 50. However, traditional wooden benches and wooden linings on bulkheads and ceilings are permitted in saunas and such materials need not be subject to the calculations prescribed in paragraphs (b) and (c) of this sub-rule.

(b) Maximum calorific value of combustible materials:

Combustible materials used on the surfaces and linings specified in paragraph (a) of this sub-rule shall have a calorific value not exceeding 45 [MJ/m^2] of the area for the thickness used. The requirements of this paragraph are not applicable to the surfaces of furniture fixed to linings or bulkheads.

(c) Total volume of combustible materials:

Where combustible materials are used in accordance with paragraph (a) of this sub-rule, they shall comply with the following requirements:

(i) The total volume of combustible facings mouldings, decorations and veneers in accommodation and service spaces are not to exceed a volume equivalent to 2.5 [mm] veneer on the combined area of the walls and ceiling linings. Furniture fixed to linings, bulkheads or decks need not be included in the calculation of the total volume of combustible materials; and
(ii) In the case of ships fitted with an automatic sprinkler system complying with the provisions of the fourth Schedule, the above volume may include some combustible material used for erection of "C" class divisions.

(d) Low flame-spread characteristics of exposed surfaces:

The following surfaces shall have low flame-spread characteristics in accordance with the Fire Test Procedures Code:

(i) exposed surfaces in corridors and stairway enclosures and of bulkhead and ceiling linings in accommodation and service spaces (except saunas) and control stations; and
(ii) surfaces and grounds in concealed or inaccessible spaces in accommodation and service spaces and control stations.
(iii) exposed surfaces of cabin balconies, except for natural hardwood decking systems.

(3) Furniture in stairway enclosures:

Furniture in stairway enclosures shall be limited to seating. It is to be fixed, limited to six seats on each deck in each stairway enclosure, be of restricted fire risk determined in accordance with the Fire Test Procedure Code, and is not to restrict the passenger escape route. Additional seating may be permitted in the main reception area within a stairway enclosure if it is fixed, non-combustible and does not restrict the passenger escape route. Furniture shall not be fixed in passenger and crew corridors forming escape routes in cabin areas. In addition to the above, lockers of non-combustible material, providing storage for non-hazardous safety equipment required by these rules, may be permitted. Drinking water dispensers and ice cube machines may be fixed in corridors provided they are fixed and do not restrict the width of the escape routes. This applies as well to decorative flower or plant arrangements, statues or other objects of art such as paintings and tapestries in corridors and stairways.

(4) Furniture and furnishings on cabin balconies of passenger ships

Furniture and furnishings on cabin balconies shall comply with sub rules (a), (b), (c), (f) and (g) of Rule 34 unless such balconies are protected by a fixed water-spraying and fixed fire detection and fire alarm systems complying with Rules 54(5).

Smoke Generation Potential and Toxicity

48. Purpose of requirements:

(1) The purpose of rules 49 and 50 is to reduce the hazard to life from smoke and toxic products generated during a fire in spaces where persons normally work or live. For this purpose, the

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

49. Paints, varnishes and other finishes:

(1) Paints, varnishes and other finishes used on exposed interior surfaces are not be capable of producing excessive quantities of smoke and toxic products, this being determined in accordance with the Fire Test Procedures Code.

50. Primary deck coverings:

(1) Primary deck coverings, if applied within accommodation and service spaces and control stations shall be of approved material which will not give rise to smoke or toxic or explosive hazards at elevated temperatures, this being determined in accordance with the Fire Test Procedures Code.

Section C. Suppression of Fire

Detection and Alarm

51. Purpose of requirements:

(1) The purpose of rules 52 to 58 is to detect a fire in the space of origin and to provide for alarm for safe escape and fire-fighting activity. For this purpose, the following functional requirements shall be met:

(a) fixed fire detection and fire alarm system installations shall be suitable for the nature of the space, fire growth potential and potential generation of smoke and gases;

(b) manually operated call points shall be placed effectively to ensure a readily accessible means of notification; and

(c) fire patrols shall provide an effective means of detecting and locating fires and alerting the navigation bridge and fire teams.

52. General requirements:

(1) A fixed fire detection and fire alarm system is to be provided in accordance with the provisions of rules 52 to 58.

(2) A fixed fire detection and fire alarm system and a sample extraction smoke detection system required in this section and other sections in this chapter shall be of an approved type and comply with the fifth and the ninth Schedules.

(3) Where a fixed fire detection and fire alarm system is required for the protection of spaces other than those specified in sub rule (1) of rule 55, at least one detector complying with the fifth Schedule is to be installed in each such space.

53. Initial and periodical tests:

(1) The function of fixed fire detection and fire alarm systems required by the relevant sections of this part shall be tested under varying conditions of ventilation after installation.

(2) The function of fixed fire detection and fire alarm systems is to be periodically tested to the satisfaction of the Director General, by means of equipment producing hot air at the appropriate temperature, or smoke or aerosol particles having the appropriate range of density or particle size, or other characteristics associated with incipient fires to which the detector is designed to respond.

54. Protection of machinery spaces:

(1) Installation:

A fixed fire detection and fire alarm system is to be installed in:

(a) periodically unattended machinery spaces; and

(b) machinery spaces where:

(i) the installation of automatic and remote control systems and equipment has been approved in lieu of continuous manning of the space; and

(ii) the main propulsion and associated machinery including sources of the main sources of electrical power are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room.

(2) Design:

(a) The fire detection system is to be so designed and the detectors 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 specially appropriate, detection systems using only thermal detectors will not be permitted. The detection system is to initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the navigating bridge and by a responsible engineer officer. When the navigating bridge is unmanned, the alarm is to sound in a place where a responsible member of the crew is on duty.

55. Protection of accommodation and service spaces and control stations:

(1) Smoke detectors in accommodation spaces:

Smoke detectors shall be installed in all stairways, corridors and escape routes within accommodation spaces as provided in sub rules (2), (3) and (4). Consideration will be given to the installation of special purpose smoke detectors within ventilation ducting.

(2) Requirements for passenger ships carrying more than 36 passengers:

(a) A fixed fire detection and fire alarm system is to be installed and arranged as to provide smoke detection in service spaces, control stations and accommodation spaces, including corridors, stairways and escape routes within accommodation spaces. Smoke detectors need not be fitted in private bathrooms and galleys. Spaces having little or no fire risk such as voids, public toilets, carbon dioxide rooms and similar spaces need not be fitted with a fixed fire detection and alarm system.

(3) Requirements for passenger ships carrying not more than 36 passengers:

There is to be installed throughout each separate zone, whether vertical or horizontal, in all accommodation and service spaces and where it is considered necessary by the Director General, , in control stations, except spaces which afford no substantial fire risk such as void spaces, sanitary spaces, etc., either:

(a) a fixed fire detection and fire alarm system so installed and arranged as to detect the presence of fire in such spaces and providing smoke detection in corridors, stairways and escape routes within accommodation spaces; or

(b) an automatic sprinkler, fire detection and fire alarm system of an approved type complying with the relevant requirements of the fourth Schedule and so installed and arranged as to protect such spaces and, in addition, a fixed fire detection and fire alarm system and so installed and arranged as to provide smoke detection in corridors, stairways and escape routes within accommodation spaces.

(4) Protection of atriums:

The entire main vertical zone containing the atrium is to be protected throughout with a smoke detection system.

(5) Protection of cabin balconies

A fixed fire detection and fire alarm system complying with the provisions of the Fifth Schedule shall be installed on cabin balconies of ships to which Rule 47 (4) applies, when furniture and furnishings on such balconies are not as defined in sub-rules (a), (b), (c), (f) and (g) of Rule 34.

56. Protection of cargo spaces:

(1) A fixed fire detection and fire alarm system or a sample extraction smoke detection system is to be provided in any cargo space which is not accessible, except where it is shown to the satisfaction of the Director General, that the ship is engaged on voyages of such short duration that it would be unreasonable to apply this requirement.

57. Manually operated call points

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

58. Fire patrols

(1) For ships carrying more than 36 passengers an efficient patrol system is to be maintained so that an outbreak of fire may be promptly detected. Each member of the fire patrol is to be trained to be familiar with the arrangements of the ship as well as the location and operation of any equipment he may be called upon to use.

(2) Inspection hatches:

The construction of ceiling and bulkheads is to be such that it will be possible, without impairing the efficiency of the fire protection, for the fire patrols to detect any smoke originating in concealed and inaccessible places, except where there is no risk of fire originating in such places.

(3) Two-way portable radiotelephone apparatus:

Each member of the fire patrol is to be provided with a two-way portable radiotelephone apparatus.

59. Fire alarm signaling systems:

(1) Ships are at all times when at sea, or in port (except when out of service), to be so manned or equipped as to ensure that any initial fire alarm is immediately received by a responsible member of the crew.

(2) The control panel of fixed fire detection and fire alarm systems is to be designed on the fail-safe principle (e.g. an open detector circuit is to cause an alarm condition).

(3) Ships carrying more than 36 passengers shall have the fire detection alarms for the systems required by sub rule (2) of rule 55 centralized in a continuously manned central control station. In addition, controls for remote closing of the fire doors and shutting down the ventilation fans shall be centralized in the same location. The ventilation fans shall be capable of reactivation by the crew at the continuously manned control station. The control panels in the central control station shall be capable of indicating open or closed positions of fire doors and closed or off status of the detectors, alarms and fans. The control panels shall be continuously powered and shall have an automatic change-over to standby power supply in case of loss of normal power supply. The control panels shall be powered from the main source of electrical power and the emergency source of electrical power unless other arrangements are permitted by applicable requirements.

(4) A special alarm, operated from the navigation bridge or fire control station, is to be fitted to summon the crew. This alarm may be part of the ship's general alarm system and is to be capable of being sounded independently of the alarm to the passenger spaces.

Control of Smoke Spread

60. Purpose of the requirements:

(1) The purpose of the rules 61 to 64 is to control the spread of smoke in order to minimize the hazards from smoke. For this purpose, means for controlling smoke in atriums, control stations, machinery spaces and concealed spaces shall be provided.

61. Protection of control stations outside machinery spaces:

(1) Such measures as practicable shall be taken in respect of control stations outside machinery spaces in order to ensure that ventilation, visibility and freedom from smoke are maintained, so that in the event of fire the machinery and equipment contained therein may be supervised and continue to function effectively. Alternative and separate means of air supply shall be provided; air inlets of the two sources of supply shall be so disposed that the risk of both inlets drawing in smoke simultaneously in minimized. Such requirements need not apply to control station situated on, and opening on to, an open deck, or where local closing arrangements would be equally effective.

62. Release of smoke from machinery spaces:

(1) The following requirements are applicable to machinery spaces of category A and, where the Director General, considers desirable, to other machinery spaces.

(2) Suitable arrangements shall be made to permit the release of smoke, in the event of fire, from the space to be protected, subject to the provisions of sub rule (2) of rule 75. The normal ventilation systems may be acceptable for this purpose.

(3) Means of control shall be provided for permitting the release of smoke and such controls shall be located outside the space concerned so that, in the event of fire, they will not be cut off from the space they serve. The controls shall be situated at one control position or grouped in as few positions as possible to the satisfaction of the Director General, . Such positions shall have a safe access from the open deck.

63. Draught stops:

(1) Air spaces enclosed behind ceilings, pannelling or linings shall be divided by close-fitting draught stops spaced not more than 14 [m] apart. In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., shall be closed at each deck.

64. Smoke extraction systems in atriums:

(1) Atriums shall be equipped with a smoke extraction system. The smoke extraction system is to be activated by the required smoke detection system and be capable of manual control. The fans shall be sized such that the entire volume within space can be exhausted in 10 min or less.

Containment of Fire

65. Purpose of requirements:

(1) The purpose of the rules 66 to 77 is to contain a fire in the space of origin. For this purpose, the following functional requirements shall be met:

(a) the ship is to be subdivided by thermal and structural boundaries;

(b) thermal insulation of boundaries shall have due regard to the fire risk of the space and adjacent spaces; and

(c) the fire integrity of the divisions is to be maintained at openings and penetrations.

66. Main vertical zones and horizontal zones:

(1) In ships carrying more than 36 passengers, the hull, superstructure and deckhouses shall be subdivided into main vertical zones by 'A-60' class divisions. Steps and recesses shall be kept to a minimum, but where they are necessary, they are also to be 'A-60' class divisions. These standard may be reduced to 'A-0' where one side of the division belong to any of the following categories or where fuel oil tanks are on both sides of the division:

(a) open deck spaces as per category (5) in sub rule (b) of rule 68.

(b) sanitary and similar spaces as per category (9) in sub rule (b) of rule 68.

(c) tanks, voids and auxiliary machinery space having little or no fire risk as per category (10) in sub rule (b) of rule 68.

(2) In ships carrying not more than 36 passengers, the hull, superstructure and deckhouses in way of accommodation and service spaces shall be subdivided into main vertical zones by "A" class divisions. These divisions shall have insulation values in accordance with Tables II and IV.

(3) As far as practicable, the bulkheads forming the boundaries of the main vertical zones above the bulkhead deck shall be in line with watertight subdivision bulkheads situated immediately below the bulkhead deck. The length and width of main vertical zones may be extended to a maximum of 48 [m] in order to bring the ends of main vertical zones to coincide with watertight subdivision bulkheads or in order to accommodate a large public space extending for the whole length of the main vertical zone. The total area of the main vertical zone however, shall not be greater than 1600 [m^2] on any deck. The length and width of a main vertical zone is to be taken as the maximum distance between the furthermost points of the bulkheads bounding it.

(4) Such bulkheads shall extend from deck to deck and to the shell or other boundaries.

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

(6) On ships designed for special purposes, such as automobile or railroad car ferries, where the provision of main vertical zone bulkheads would defeat the purpose for which the ship is intended, equivalent means for controlling and limiting a fire will be specially considered. Service spaces and ship stores shall not be located on ro-ro decks unless protected in accordance with the applicable requirements.

(7) However, in a ship with special category spaces, such spaces shall comply with the applicable provisions of rules 117 to 123 and where such compliance would be inconsistent with other requirements specified in this chapter, the requirements of rules 117 to 123 shall prevail.

67. Bulkheads within a main vertical zone:

(1) For ships carrying more than 36 passengers, bulkheads which are not required to be "A" class divisions shall be at least "B" class or "C" class divisions as prescribed in the Tables in rule 68.

(2) For ships carrying not more than 36 passengers, bulkheads within accommodation and service spaces which are not required to be "A" class divisions shall be at least "B" class or "C" class divisions as prescribed in the Tables in rule 69. In addition, corridor bulkheads, where not required to be "A" class shall be "B" class divisions which shall extend from deck to deck except:

(a) when continuous "B" class ceilings or linings are fitted on both sides of the bulkhead, the portion of the bulkhead behind the continuous ceiling or lining is to be of material

which, in thickness and composition, is acceptable in the construction of "B" class divisions, but which will be required to meet "B" class integrity standards only in so far as is reasonable and practicable; and

(b) in the case of a ship protected by an automatic sprinkler system complying with the provisions of the fourth Schedule, the corridor bulkheads may terminate at a ceiling in the corridor provided such bulkheads and ceilings are of “B” class standard in compliance with rule 69. All doors and frames in such bulkheads shall be of non-combustible materials and shall have the same fire integrity as the bulkhead in which they are fitted.

(3) Bulkheads required to be "B" class divisions, except corridor bulkheads as prescribed in sub rule (2) of this rule, shall extend from deck to deck and to the shell or other boundaries. However, where 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.

68. Fire integrity of bulkheads and decks in ships carrying more than 36 passengers:

(a) In addition to complying with the specific provisions for fire integrity of bulkheads and decks, the minimum fire integrity of all bulkheads and decks shall be as prescribed in Tables I and II. Where, due to any particular structural arrangements in the ship, difficulty is experienced in determining from the tables the minimum fire integrity value of any divisions, such values shall be determined to the satisfaction of the Director General, .

(b) The following requirements shall govern application of the tables:

(i) Table I shall apply to bulkheads not bounding either main vertical zones or horizontal zones. Table II shall apply to decks not forming steps in main vertical zones nor bounding horizontal zones;

(ii) For determining the appropriate fire integrity standards to be applied to boundaries between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (1) to (14) below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this regulation, or where it is possible to assign two or more classifications to a space, it is to be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed rooms within a space that have less than 30% communicating openings to that space are considered separate spaces. The fire integrity of the boundary bulkheads and decks of such smaller rooms is to be as prescribed in Tables I and II. The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables.

(1) *Control stations*

Spaces containing emergency sources of power and lighting.
Wheelhouse and chartroom.
Spaces containing the ship’s radio equipment.
Fire control stations
Control room for propulsion machinery when located outside the propulsion machinery space.

Spaces containing centralized fire alarm equipment.
Spaces containing centralized emergency public address system stations and equipment.

(2) *Stairways*

Interior stairways, lifts, totally enclosed emergency escape trunks, and escalators (other than those wholly contained within the machinery spaces) for passengers and crew and enclosures thereto.
In this connection a stairway, which is enclosed at only one level, shall be regarded as part of the space from which it is not separated by a fire door.

(3) *Corridors*

Passenger and crew corridors and lobbies.

(4) *Evacuation stations and external escape routes*

Survival craft stowage area.

Open deck spaces and enclosed promenades forming lifeboat and life raft embarkation and lowering stations.

Assembly stations, internal and external.

External stairs and open decks used for escape routes.

The ship's side to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to the life raft and evacuation slide embarkation areas.

(5) *Open deck spaces*

Open deck spaces and enclosed promenades clear of lifeboat and life raft embarkation and lowering stations. To be considered in this category, enclosed promenades shall have no significant fire risk, meaning that furnishings shall be restricted to deck furniture. In addition, such spaces shall be naturally ventilated by permanent openings.

Air spaces (the space outside superstructures and deckhouses).

(6) *Accommodation spaces of minor fire risk*

Cabins containing furniture and furnishings of restricted fire risk.

Offices and dispensaries containing furniture and furnishings of restricted fire risk.

Public spaces containing furniture and furnishings of restricted fire risk and having a deck area of less than 50 [m^2].

(7) *Accommodation spaces of moderate fire risk*

Spaces as in category (6) above but containing furniture and furnishings of other than restricted fire risk.

Public spaces containing furniture and furnishings of restricted fire risk and having a deck area of 50 [m^2] or more.
Isolated lockers and small store-rooms in accommodation spaces having areas less than 4 [m^2] (in which flammable liquids are not stowed).

Sale shops. Motion picture projection and film stowage rooms. Diet kitchens (containing no open flame).

Cleaning gear lockers (in which flammable liquids are not stowed).

Laboratories (in which flammable liquids are not stowed).

Pharmacies.

Small drying rooms (having a deck area of 4 [m^2] or less).

Specie rooms.

Operating rooms.

(8) *Accommodation spaces of greater fire risk*

Public spaces containing furniture and furnishings of other than restricted fire risk and having a deck area of 50 [m^2] or more.
Barber shops and beauty parlours.

Saunas.

(9) *Sanitary and similar spaces*

Communal sanitary facilities, showers, baths, water closets, etc.

Small laundry rooms.

Indoor swimming pool area.

Isolated pantries containing no cooking appliances in accommodation spaces.

Private sanitary facilities shall be considered a portion of the space in which they are located.

(10) *Tanks, voids and auxiliary machinery spaces having little or no fire risk*

Water tanks forming part of the ship's structure.

Voids and cofferdams.

Auxiliary machinery spaces which do not contain machinery having a pressure lubrication system and where storage of combustibles is prohibited, such as:

- ventilation and air-conditioning rooms;
- windlass room;
- steering gear room;
- stabilizer equipment room;
- electrical propulsion motor room;

- rooms containing section switchboards and purely electrical equipment other than oil-filled electrical transformers (above 10 kVA);
- shaft alleys and pipe tunnels;
- spaces for pumps and refrigeration machinery (not handling or using flammable liquids).

Closed trunks serving the spaces listed above.

Other closed trunks such as pipe and cable trunks.

(11) *Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk*

Cargo oil tanks.

Cargo holds, trunk ways and hatchways.

Refrigerated chambers.

Oil fuel tanks (where installed in a separate space with no machinery).

Shaft alleys and pipe tunnels allowing storage of combustibles.

Auxiliary machinery spaces as in category (10) which contain machinery having a pressure lubrication system or where storage of combustibles is permitted.

Oil fuel filling stations.

Spaces containing oil-filled electrical transformers (above 10 kVA).

Spaces containing turbine and reciprocating steam engine driven auxiliary generators and small internal combustion engines of power output up to 110 kW driving generators, sprinkler, drencher or fire pumps, bilge pumps, etc.

Closed trunks serving the spaces listed above.

(12) *Machinery spaces and main galleys*

Main propulsion machinery rooms (other than electric propulsion motor rooms) and boiler rooms.

Auxiliary machinery spaces other than those in categories (10) and (11) which contain internal combustion machinery or other oil burning, heating or pumping units.

Main galleys and annexes.

Trunks and casings to the spaces listed above.

(13) *Storerooms, workshops, pantries, et*c.

Main pantries not annexed to galleys.

Main laundry.

Large drying rooms (having a deck area of more than 4 [m^2])

Miscellaneous stores.

Mail and baggage rooms.

Garbage rooms.

Workshops (not part of machinery spaces, galleys, etc.).

Lockers and storerooms having areas greater than 4 [m^2], other than those spaces that have provisions for the storage of flammable liquids.

(14) *Other spaces in which flammable liquids are stowed*

Paint lockers.

Storerooms containing flammable liquids (including dyes, medicines, etc.).

Laboratories (in which flammable liquids are stowed);

(iii) Where a single value is shown for the fire integrity of a boundary between two spaces, that value will apply in all cases;

(iv) Notwithstanding the provision of rule 67, there are no special requirements for material or integrity of boundaries where only a dash appears in the tables, and

(v) In respect of category (5) spaces the insulation values in Table I apply to ends of deckhouses and superstructures, and the insulation values in Table II apply to weather decks. In no case will the requirements of category (5) of Table I or II necessitate enclosure of spaces, which need not be enclosed.

(c) Continuous "B" class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as contributing wholly or in part, to the required insulation and integrity of a division.

(d) Construction and arrangement of saunas:

(i) 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 (5), (9) and (10).

(ii) 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.

(iii) 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 30 [mm]. The distance from the hot surfaces to combustible materials shall be at least 500 [mm] or the combustible materials shall be protected (e.g. non-combustible plate with an air gap of at least 30 [mm]).

(iv) The traditional wooden benches are permitted to be used in the sauna.

(v) The sauna door is to open outwards by pushing.

(vi) Electrically heated ovens shall be provided with a timer.

(e) Arrangement of cabin balconies

Non-load bearing partial bulkheads which separate adjacent cabin balconies shall be capable of being opened by the crew from each side for the purpose of fighting fires

Table I: Bulkheads not bounding either main vertical zones or horizontal zones (Ships with more than 36 passengers)

Spaces		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Control stations	(1)	B-0[a]	A-0	A-0	A-0	A-0	A-60	A-60	A-60	A-0	A-0	A-60	A-60	A-60	A-60
Stairways	(2)		A-0[a]	A-0	A-0	A-0	A-0	A-15	A-15	A-0[c]	A-0	A-15	A-30	A-15	A-30
Corridors	(3)			B-15	A-60	A-0	B-15	B-15	B-15	B-15	A-0	A-15	A-30	A-0	A-30
Evacuation stations and external escape routes	(4)					A-0	A-60[b,d]	A-60[b,d]	A-60[b,d]	A-0[d]	A-0	A-60[b]	A-60[b]	A-60[b]	A-60[b]
Open deck spaces	(5)						A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Accommodation spaces of minor fire risk	(6)						B-0	B-0	B-0	C	A-0	A-0	A-30	A-0	A-30
Accommodation spaces of moderate fire risk	(7)							B-0	B-0	C	A-0	A-15	A-60	A-15	A-60
Accommodation spaces of greater fire risk	(8)								B-0	C	A-0	A-30	A-60	A-15	A-60
Sanitary and similar spaces	(9)									C	A-0	A-0	A-0	A-0	A-0
Tanks, voids and auxiliary machinery spaces having little or no fire risk	(10)										A-0[a]	A-0	A-0	A-0	A-0
Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk	(11)											A-0[a]	A-0	A-0	A-15
Machinery spaces and main galleys	(12)												A-0[a]	A-0	A-60
Store-rooms, workshops, pantries, etc.	(13)													A-0[a]	A-0
Other spaces in which flammable liquids are stowed	(14)														A-30

See notes following Table 3.2.

Table II : Decks not forming steps in main vertical zones nor bounding horizontal zones

(Ships with more than 36 passengers)

Space		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Control stations	(1)	A-30	A-30	A-15	A-0	A-0	A-0	A-15	A-30	A-0	A-0	A-0	A-60	A-0	A-60
Stairways	(2)	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-30	A-0	A-30
Corridors	(3)	A-15	A-0	A-0[a]	A-60	A-0	A-0	A-15	A-15	A-0	A-0	A-0	A-30	A-0	A-30
Evacuation stations and external escape routes	(4)	A-0	A-0	A-0	A-0	-	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Open deck spaces	(5)	A-0	A-0	A-0	A-0	-	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Accommodation spaces of minor fire risk	(6)	A-60	A-15	A-0	A-60	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Accommodation spaces of moderate fire risk	(7)	A-60	A-15	A-15	A-60	A-0	A-0	A-15	A-15	A-0	A-0	A-0	A-0	A-0	A-0
Accommodation spaces of greater fire risk	(8)	A-60	A-15	A-15	A-60	A-0	A-15	A-15	A-30	A-0	A-0	A-0	A-0	A-0	A-0
Sanitary and similar spaces	(9)	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Tanks, voids and auxiliary machinery spaces having little or no fire risk	(10)	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0[a]	A-0	A-0	A-0	A-0
Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and other similar spaces of moderate fire risk	(11)	A-60	A-60	A-60	A-60	A-0	A-0	A-15	A-30	A-0	A-0	A-0[a]	A-0	A-0	A-30
Machinery spaces and main galleys	(12)	A-60	A-60	A-60	A-60	A-0	A-60	A-60	A-60	A-0	A-0	A-30	A-30[a]	A-0	A-60
Store-rooms, workshops, pantries, etc.	(13)	A-60	A-30	A-15	A-60	A-0	A-15	A-30	A-30	A-0	A-0	A-0	A-0	A-0	A-0
Other spaces in which flammable liquids are stowed	(14)	A-60	A-60	A-60	A-60	A-0	A-30	A-60	A-60	A-0	A-0	A-0	A-0	A-0	A-0

Note: To be applied to Tables I and II.

a Where adjacent spaces are in the same numerical category and superscript "a" appears a bulkhead or deck between such spaces need not be fitted if deemed unnecessary by the Director General, . For example, in category (12) a bulkhead will not be required between a galley and its annexed pantries provided the pantry bulkhead and decks maintain the integrity of the galley boundaries. A bulkhead is, however, required between a galley and machinery space even though both spaces are in category (12).

b The ship's side, to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to life rafts and evacuation slides may be reduced to "A-30".

c Where public toilets are installed completely within the stairway enclosure, the public toilet bulkhead within the stairway enclosure can be of "B" class integrity.

d Where spaces of categories (6), (7), (8) and (9) are located completely within the outer perimeter of the assembly station, the bulkheads of these spaces are allowed to be of "B-0" class integrity. Control positions for audio, video and light installations may be considered as part of the assembly station.

69. Fire integrity of bulkheads and decks in ships carrying not more than 36 passengers:

(a) In addition to complying with the specific provisions for fire integrity of bulkheads and decks, the minimum fire integrity of bulkheads and decks shall be as prescribed in Tables III and IV.

(b) The following requirements govern application of the tables:

(i) Tables III and IV shall apply respectively to the bulkheads and decks separating adjacent spaces;

(ii) 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 (11) below. Where the contents and use of a space are such that there is a doubt as to its classification for the purpose of this regulation, or where it is possible to assign two or more classifications to a space, it is to be treated as a space within the relevant category having the most stringent boundary requirements. Smaller, enclosed rooms within a space that have less than 30 % communicating openings to that space are considered separate spaces. The fire integrity of the boundary bulkheads and decks of such smaller rooms shall be as prescribed in Tables III and IV. The title of each category is intended to be typical rather than restrictive. The number in parentheses preceding each category refers to the applicable column or row in the tables.

(1) *Control stations*

Spaces containing emergency sources of power and lighting.
Wheelhouse and chartroom.
Spaces containing the ship's radio equipment.
Fire control stations.
Control room for propulsion machinery when located outside the machinery space.
Spaces containing centralized fire alarm equipment.

(2) *Corridors*

Passenger and crew corridors and lobbies.

(3) *Accommodation spaces*

Spaces as defined in sub rule (1) of rule 40, excluding corridors.

(4) *Stairways*

Interior stairways, lifts, totally enclosed emergency escape trunks, and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto.
In this connection, a stairway which is enclosed only at one level is to be regarded as part of the space from which it is not separated by a fire door.

(5) *Service spaces (low risk)*

Lockers and store-rooms not having provisions for the storage of flammable liquids and having areas less than 4 [m^2] and drying rooms and laundries.

(6) *Machinery spaces of category A*

Spaces as defined in sub rule (24) of rule 40.

(7) *Other machinery spaces*

Electrical equipment rooms (auto-telephone exchange, air-conditioning duct spaces).
Spaces as defined in sub rule (23) of rule 40 excluding machinery spaces of category A.

(8) *Cargo spaces*

All spaces used for cargo (including cargo oil tanks) and trunk ways and hatchways to such spaces, other than special category spaces.

(9) *Service spaces (high risk)*

Galleys, pantries containing cooking appliances, paint and lamp rooms, lockers and store-rooms having areas of 4 [m^2] or more, spaces for the storage of flammable liquids, saunas and workshops other than those forming part of the machinery spaces.

10) *Open decks*

Open deck spaces and enclosed promenades having little or no fire risk. Enclosed promenades shall have no significant fire risk, meaning that furnishing shall be restricted to deck furniture. In addition, such spaces shall be naturally ventilated by permanent openings. Air spaces (the space outside superstructures and deckhouses).

(11) *Special category and ro-ro spaces*

Spaces as defined in sub rules (34) and (39) of rule 40.

(iii) In determining the applicable fire integrity standard of a boundary between two spaces within a main vertical zone or horizontal zone which is not protected by an automatic sprinkler system complying with the provisions of the fourth Schedule or between such zones neither of which is so protected, the higher of the two values given in the tables shall apply; and

(iv) In determining the applicable fire integrity standard of a boundary between two spaces within a main vertical zone or horizontal zone which is protected by an automatic sprinkler system complying with the provisions of Schedule… or between such zones both of which are so protected, the lesser of the two values given in the tables shall apply. Where a zone with sprinklers and a zone without sprinklers meet within accommodation and service spaces, the higher of the two values given in the tables shall apply to the division between the zones.

(c) Continuous "B" class ceilings or linings, in association with the relevant decks or bulkheads, may be accepted as contributing, wholly or in part, to the required insulation and integrity of a division.

(d) External boundaries, which are required in 5.2 to be of steel or other equivalent material, may be pierced for the fitting of windows and side scuttles provided that there is no requirement for such boundaries to have "A" class integrity. Similarly, in such boundaries, which are not required to have "A" class integrity, doors may be constructed of materials which are to the satisfaction of the Director General, .

(e) Saunas shall comply with sub rule (d) of rule 68.

Table III : Fire integrity of bulkheads separating adjacent spaces (Ships with not more than 36 passengers)

Spaces		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations	(1)	A-0 [c]	A-0	A-60	A-0	A-15	A-60	A-15	A-60	A-60	*	A-60
Corridors	(2)		C[e]	B-0[e]	A-0[a] B-0[e]	B-0[e]	A-60	A-0	A-0	A-15 A-0[d]	*	A-15
Accommodation spaces	(3)			C[e]	A-0[a] B-0[e]	B-0[e]	A-60	A-0	A-0	A-15 A-0[d]	*	A-30 A-0[d]
Stairways	(4)				A-0[a] B-0[e]	A-0[a] B-0[e]	A-60	A-0	A-0	A-15 A-0[d]	*	A-15
Service spaces (low risk)	(5)					C[e]	A-60	A-0	A-0	A-0	*	A-0
Machinery spaces of category A	(6)						*	A-0	A-0	A-60	*	A-60
Other machinery spaces	(7)							A-0[b]	A-0	A-0	*	A-0
Cargo spaces	(8)								*	A-0	*	A-0
Service spaces (high risk)	(9)									A-0[b]	*	A-30
Open decks	(10)											A-0
Special category and ro-ro spaces[g]	(11)											A-0

Table IV : Fire integrity of decks separating adjacent spaces (Ships with not more than 36 passengers)

Space below		-- Space above --										
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations	(1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0	A-0	*	A-30
Corridors	(2)	A-0	*	*	A-0	*	A-60	A-0	A-0	A-0	*	A-0
Accommodation spaces	(3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0	A-0	*	A-30 A-0[d]
Stairways	(4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0	A-0	*	A-0
Service spaces (low risk)	(5)	A-15	A-0	A-0	A-0	*	A-60	A-0	A-0	A-0	*	A-0
Machinery spaces of category A	(6)	A-60	A-60	A-60	A-60	A-60	*	A-60[f]	A-30	A-60	*	A-60
Other machinery spaces	(7)	A-15	A-0	A-0	A-0	A-0	A-0	*	A-0	A-0	*	A-0
Cargo spaces	(8)	A-60	A-0	A-0	A-0	A-0	A-0	A-0	*	A-0	*	A-0
Service spaces (high risk)	(9)	A-60	A-30 A-0[d]	A-30 A-0[d]	A-30 A-0[d]	A-0	A-60	A-0	A-0	A-0	*	A-30
Open decks	(10)	*	*	*	*	*	*	*	*	*	-	A-0
Special category and ro-ro spaces [g]	(11)	A-60	A-15	A-30 A-0[d]	A-15	A-0	A-30	A-0	A-0	A-30	A-0	A-0

Notes: To be applied to both Tables III and IV as appropriate.

a For clarification as to which applies, see rules 67 and 68.

b Where spaces are of the same numerical category and superscript b appears, a bulkhead or deck of the rating shown in the tables is only required when the adjacent spaces are for a different purpose, (e.g. in category (9)). A galley next to a galley does not require a bulkhead but a galley next to a paint room requires an "A-0" bulkhead.

c Bulkhead separating the wheelhouse and chartroom from each other may have a "B-0" rating.

d See (iii) and (iv) of sub rule b of rule 69.

e For the application of sub rule (2) of rule 66, "B-0" and "C", where appearing in Table III, is to be read as "A-0".

f Fire insulation need not be fitted if the machinery space in category (7), in the opinion of the Director General, , has little or no fire risk.

g For ro-ro spaces, also refer rule 76.

* Where an asterisk appears in the tables, the division is required to be of steel or other equivalent material, but is not required to be of "A" class standard. However, where a deck, except in a category (10) space, is penetrated for the passage of electric cables, pipes and vent ducts, such penetrations shall be made tight to prevent the passage of flame and smoke. Divisions between control stations (emergency generators) and open decks may have air intake openings without means for closure, unless a fixed gas fire-fighting system is fitted.

For the application of sub rule (2) of rule 66, an asterisk, where appearing in Table IV, except for categories (8) and (10), is to be read as “A-0”.

70. Protection of stairways and lifts in accommodation area:

(1) Stairways shall be within enclosures formed of "A" class divisions, with positive means of closure at all openings, except that:

(a) a stairway connecting only two decks need not be enclosed, provided the integrity of the deck is maintained by proper bulkheads or self-closing doors in one 'tween-deck space. When a stairway is closed in one 'tween-deck space, the stairway enclosure is to be protected in accordance with the tables for decks in rule 68 or 69 and:

(b) stairways may be fitted in the open in a public space, provided they lie wholly within the public space.

(2) Lift trunks shall be so fitted as to prevent the passage of smoke and flame from one ‘tween-deck to another and shall be provided with means of closing so as to permit the control of draught and smoke. Machinery for lifts located within stairway enclosures shall be arranged in a separate room, surrounded by steel boundaries, except that small passages for lift cables

are permitted. Lifts which open into spaces other than corridors, public spaces, special category spaces, stairways and external areas shall not open into stairways included in the means of escape.

71. Penetration in fire-resisting divisions and prevention of heat transmission:

(1) Where "A" class divisions are penetrated, such penetrations shall be tested in accordance with Fire Test Procedure Code, subjected to the provisions of sub rule (5) of rule 72. In the case of ventilation ducts, sub rule (2) and sub rule (4)-(a) of rule 77 apply. However, where a pipe penetration is made of steel or equivalent material having a thickness of 3 [mm] or greater and a length of not less than 900 [mm] (preferably 450 [mm] on each side of the division), and no openings, testing is not required. Such penetrations shall to be suitably insulated by extension of the insulation at the same degree of fire integrity of the division.

(2) Where "B" class divisions are penetrated for the passage of electric cables, pipes, trunks, ducts, etc., or for the fitting of ventilation terminals, lighting fixtures and similar devices, arrangements shall be made to ensure that the fire resistance is not impaired, subject to the provisions of sub rule (4)-(b) of rule 77. Pipes other than steel or copper that penetrate "B" class divisions shall be protected by either:

(a) a fire tested penetration device, suitable for the fire resistance of the division pierced and the type of pipe used; or

(b) a steel sleeve, having a thickness of not less than 1.8 [mm] and a length of not less than 900 [mm] for pipe diameters of 150 [mm] or more and not less than 600 [mm] for pipe diameters of less than 150 [mm] (preferably equally divided to each side of the division). The pipe shall be connected to the ends of the sleeve by flanges or couplings; or the clearance between the sleeve and the pipe is not to exceed 2.5 [mm]; or any clearance between pipe and sleeve shall be made tight by means of non-combustible or other suitable material.

(3) Uninsulated metallic pipes penetrating "A" or "B" class divisions shall be of materials having a melting temperature which exceeds 950ºC for “A-0” and 850ºC for “B-0” class divisions.

(4) In designing structural fire protection details, the risk of heat transmission at intersections and terminal points of required thermal barriers is to be considered. The insulation of a deck or bulkhead is to be carried past the penetration, intersection or terminal point for a distance of at least 450 [mm] in the case of steel and aluminium structures. If a space is divided with a deck or a bulkhead of "A" class standard having insulation of different values, the insulation with the higher value is to continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 [mm].

72. Protection of openings in "A" class divisions:

(1) Except for hatches between cargo, special category, store and baggage spaces, and between such spaces and weather decks, all openings shall be provided with permanently attached means of closing which shall be at least as effective for resisting fires as the divisions in which they are fitted.

(2) The construction of doors and door frames in "A" class divisions, with the means of securing them when closed, shall provide resistance to fire as well as to the passage of smoke and flame equivalent to that of the bulkheads in which the doors are situated, this being determined in accordance with the Fire Test Procedures Code. Such doors and door frames shall be constructed of steel or other equivalent material. Watertight doors need not be insulated.

(3) It shall be possible for each door to be opened and closed from each side of the bulkhead by one person only.

(4) Fire doors in main vertical zone bulkheads, galley boundaries and stairway enclosures other than power-operated watertight doors and those which are normally locked, shall satisfy the following requirements:

(a) the doors shall be self-closing and be capable of closing against an angle of inclination of up to 3.5° opposing closure;

(b) the approximate time of closure for hinged fire doors shall be not more than 40 seconds and no less than 10 seconds from the beginning of their movement with the ship in upright position. The approximate uniform rate of closure for sliding fire doors shall be of not more than 0.2 [m/s] and not less than 0.1 [m/s] with the ship in the upright position;

(c) the doors, except those for emergency escape trunks, shall be capable of remote release from the continuously manned central control station, either simultaneously or in groups and shall be capable of release also individually from a position at both sides of the door. Release switches shall have an on-off function to prevent automatic resetting of the system;

(d) use of hold-back hooks not subject to central control station release is prohibited;

(e) a door closed remotely from the central control station shall be capable of being re-opened at both sides of the door by local control. After such local opening the door shall close automatically again;

(f) indication shall be provided at the fire door indicator panel in the continuously manned central control station whether each of the remote-released doors are closed;

(g) the release mechanism shall be so designed that the door will automatically close in the event of disruption of the control system or central power supply;

(h) local power accumulators for power-operated doors shall be provided in the immediate vicinity of the doors to enable the doors to be operated after disruption of the control system or central power supply at least ten times (fully opened and closed) using the local controls;

(i) disruption of the control system or central power supply at one door is not to impair the safe functioning of the other doors;

(j) remote-released sliding or power-operated doors shall be equipped with an alarm that sounds for at least 5 seconds but no more than 10 seconds after the door is released from

the central control station and before the door begins to move and continue sounding until the door is completely closed;

(k) a door designed to re-open upon contacting an object in its path shall re-open not more than 1 [m] from the point of contact;

(l) double-leaf doors equipped with a latch necessary for their fire integrity shall have a latch that is automatically activated by the operation of the doors when released by the control system;

(m) doors giving direct access to special category spaces which are power-operated and automatically closed need not be equipped with the alarms and remote- release mechanisms required in (c) and (j);

(n) the components of the local control system shall be accessible for maintenance and adjusting; and

(o) power-operated doors shall be provided with a control system of an approved type which shall be able to operate in case of fire, this being determined in accordance with the Fire Test Procedures Code. This system shall satisfy the following requirements:

(i) the control system shall be able to operate the door at the temperature of at least 200°C for at least 60 minutes, served by the power supply;

(ii) the power supply for all other doors not subject to fire shall not be impaired; and

(iii) at temperatures exceeding 200°C the control system shall be automatically isolated from the power supply and shall be capable of keeping the door closed up to at least 945°C.

(5) In ships carrying not more than 36 passengers, where a space is protected by an automatic sprinkler fire detection and alarm system complying with the provisions the fifth Schedule or fitted with a continuous "B" class ceiling, openings in decks not forming steps in main vertical zones nor bounding horizontal zones shall be closed reasonably tight and such decks shall meet the "A" class integrity requirements in so far as is reasonable and practicable in the opinion of the Director General, .

(6) The requirements for "A" class integrity of the outer boundaries of a ship shall not apply to glass partitions, windows and sidescuttles, provided that there is no requirement for such boundaries to have "A" class integrity in sub rule (3) of rule 74. The requirements for "A" class integrity of the outer boundaries of the ship shall not apply to exterior doors, except for those in superstructures and deckhouses facing lifesaving appliances, embarkation and external assembly station areas, external stairs and open decks used for escape routes. Stairway enclosure doors need not meet this requirement.

(7) Except for watertight doors, weathertight doors (semi-watertight doors), doors leading to the open deck and doors which need to be reasonably gastight, all "A" class doors located in stairways, public spaces and main vertical zone bulkheads in escape routes shall be equipped with a self-closing hose port. The material, construction and fire resistance of the hose port shall be equivalent to the door into which it is fitted, and shall be a 150 [mm] square clear

opening with the door closed and shall be inset into the lower edge of the door, opposite the door hinges or, in the case of sliding doors, nearest the opening.

(8) Where it is necessary that a ventilation duct passes through a main vertical zone division, a fail-safe automatic closing fire damper shall be fitted adjacent to the division. The damper shall also be capable of being manually closed from each side of the division. The operating position shall be readily accessible and be marked in red light-reflecting colour. The duct between the division and the damper shall be of steel or other equivalent material and, if necessary, insulated to comply with the requirements of sub rule (1) of rule 71. The damper shall be fitted on at least one side of the division with a visible indicator showing whether the damper is in the open position.

73. Openings in "B" class divisions:

(1) Doors and door frames in "B" class divisions and means of securing them shall provide a method of closure which will have resistance to fire equivalent to that of the divisions, this being determined in accordance with the Fire Test Procedure Code except that ventilation openings may be permitted in the lower portion of such doors. Where such opening is in or under a door the total net area of opening shall not exceed 0.05 [m^2]. Alternatively, a non-combustible air balance duct routed between the cabin and the corridor, and located below the sanitary unit is permitted where the cross-sectional area of the duct does not exceed 0.05 [m^2]. All ventilation openings shall be fitted with a grill made of non-combustible material. Doors shall be non-combustible.

(2) Cabin doors in "B" class divisions shall be of a self-closing type. Holdback hooks are not permitted.

(3) The requirements for 'B' class integrity of the outer boundaries of a ship shall not apply to glass partitions, windows and side scuttles. Similarly, the requirements for 'B' class integrity shall not apply to exterior doors in superstructures and deckhouses. For ships carrying not more than 36 passengers, the use of combustible materials in doors separating cabins from the individual interior sanitary spaces, such as showers, may be permitted.

(4) In ships carrying not more than 36 passengers, where an automatic sprinkler system complying with the provisions of the fourth Schedule is fitted:

(a) openings in decks not forming steps in main vertical zones nor bounding horizontal zones shall be closed reasonably tight and such decks shall meet the "B" class integrity requirements in so far as is reasonable and practicable in the opinion of the Director General, ; and

(b) openings in corridor bulkheads of "B" class materials shall be protected in accordance with the provisions of sub rule (2) of rule 67.

74. Windows and sidescuttles:

(1) Windows and sidescuttles in bulkheads within accommodation and service spaces and control stations other than those to which the provisions of sub rule (6) of rule 72 and sub rule (3) of rule 73 shall be so constructed as to preserve the integrity requirements of the

type of bulkheads in which they are fitted, this being determined in accordance with the Fire Test Procedures Code.

(2) Notwithstanding the requirements of Tables I to IV, windows and sidescuttles in bulkheads separating accommodation and service spaces and control stations from weather shall to be constructed with frames of steel or other suitable material. The glass is to be retained by a metal glazing bead or angle.

(3) Windows facing life-saving appliances, embarkation and assembly stations, external stairs and open decks used for escape routes, and windows situated below life raft and escape slide embarkation areas shall have fire integrity as required in Table I. Where automatic dedicated sprinkler heads are provided for windows, "A-0" windows may be accepted as equivalent. To be considered under this paragraph, the sprinkler heads shall either be:

(a) dedicated heads located above the windows, and installed in addition to the conventional ceiling sprinklers; or

(b) conventional ceiling sprinkler heads arranged such that the window is protected by an average application rate of at least 5 litres/m^2 and the additional window area is included in the calculation of the area of coverage.

Windows located in the ship's side below the lifeboat embarkation area shall have fire integrity at least equal to "A-0" class.

75. Protection of openings in machinery spaces boundaries:

(1) Application: The provision of this rule shall apply to machinery spaces of category A and, where the Director General, considers it desirable, to other machinery spaces.

(2) The number of skylights, doors, ventilators, openings in funnels to permit exhaust ventilation and other openings to machinery spaces shall be reduced to a minimum consistent with the needs of ventilation and the proper and safe working of the ship.

(3) Skylights shall be of steel and shall not contain glass panels.

(4) Means of control shall be provided for closing power-operated doors or actuating release mechanisms on doors other than power-operated watertight doors. The control shall be located outside the space concerned, where they will not be cut off in the event of fire in the space it serves. The means of control shall be situated at one control position or grouped in as few positions as possible to the satisfaction of the Director General, . Such positions shall have safe access from the open deck.

(5) Doors, other than power-operated watertight doors shall be so arranged that positive closure is assured in case of fire in the space by power-operated closing arrangements or by the provision of self-closing doors capable of closing against an inclination of 3.5° opposing closure, and having fail-safe hook-back facilities provided with a remotely operated release device. Doors for emergency escape trunks need not be fitted with a fail-safe holdback facility and a remotely operated release device.

(6) Windows shall not be fitted in machinery space boundaries. Glass may be used in control rooms within the machinery spaces.

76. Protection of cargo space boundaries:

(1) In passenger ships carrying more than 36 passengers, the boundary bulkheads and decks of special category and ro-ro spaces shall be insulated to "A-60" class standard. However, where a category (5), (9) and (10) space, as defined in rule 68, is on one side of the division the standard may be reduced to "A-0". Where fuel oil tanks are below a special category space, the integrity of the deck between such spaces may be reduced to "A-0" standard.

(2) In passenger ships carrying not more than 36 passengers, the boundary bulkheads of special category spaces shall be insulated as required for category (11) spaces in Table III and the horizontal boundaries as required for category (11) spaces in Table IV.

(3) In passenger ships carrying not more than 36 passengers the boundary bulkheads and decks of closed and open ro-ro spaces (other than special category spaces) shall have a fire integrity as required for category (8) spaces in Table III and the horizontal boundaries as required for category (8) spaces in Table IV.

(4) Indicators shall be provided on the navigating bridge, which will indicate when any fire door leading to or from the special category spaces is closed.

77. Ventilation ducts and dampers:

(1) Ventilation ducts shall be of non-combustible material. Short ducts, however, not generally exceeding 2 [m] in length and with a free cross-sectional area not exceeding 0.02 [m^2] need not be non-combustible material, subject to following:

(a) these ducts are of a material having low flame spread characteristics;

(b) these are only used at the end of the ventilation device;

(c) these shall not be situated less than 600 [mm], measured along the duct, from an opening in an 'A' or 'B' class division including continuous 'B' class ceilings.

Note : The term 'free cross sectional area' means, even in the case of a pre-insulated duct, the area calculated on the basis of the inner diameter of the duct.

(2) The following arrangements shall be tested in accordance with the Fire Test Procedures Code:

(a) fire dampers, including relevant means of operation; and

(b) duct penetrations through "A" class divisions. Where steel sleeves are directly joined to ventilation ducts by means of riveted or screwed flanges or by welding, the test is not required.

(3) Arrangement of ducts:

(a) The ventilation systems for machinery spaces of category A, vehicle spaces, ro-ro spaces, galleys, special category spaces and cargo spaces are, in general, be separated from each other and from the ventilation systems serving other spaces, except that the galley ventilation systems in passenger ships carrying not more than 36 passengers, need not be completely separated, but may be served by separate ducts from a ventilation unit serving other spaces. In any case, an automatic fire damper is to be fitted in the galley ventilation duct near the ventilation unit. Ducts provided for the ventilation of machinery spaces of category A, galleys, vehicle spaces, ro-ro spaces or special category spaces are not to pass through accommodation spaces, service spaces or control stations unless the ducts comply with either (i) to (iv) or (v) to (vi) below:

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

(ii) suitably supported and stiffened;

(iii) fitted with automatic fire dampers close to the boundaries penetrated; and

(iv) insulated to "A-60" class standard from the machinery spaces, galleys, vehicle spaces, ro-ro spaces or special category spaces to a point at least 5 [m] beyond each fire damper;
or
(v) constructed of steel in accordance with paragraphs (i) and (ii) above; and

(vi) insulated to "A-60" class standard throughout the accommodation spaces, service spaces or control stations;

except that penetrations of main zone divisions are also to comply with the requirements of sub rule (8) of rule 72.

(b) Ducts provided for ventilation to accommodation spaces, service spaces or control stations are not to pass through machinery spaces of category A, galleys, vehicle spaces, ro-ro spaces or special category spaces unless they comply with either (i) to (iii) or (v) to (vi) below:

(i) the ducts where they pass through a machinery space of category A, galley, vehicle space, ro-ro space or special category space are constructed of steel in accordance with (i) and (ii) of paragraph (a) of this sub rule;

(ii) automatic fire dampers are fitted close to the boundaries penetrated; and

(iii) the integrity of the machinery space, galley, vehicle space, ro-ro space or special category space boundaries is maintained at the penetrations;
or

(iv) the ducts where they pass through a machinery space of category A, galley, vehicle space, ro-ro space or special category space are constructed of steel in accordance with (i) and (ii) of paragraph (a) of this sub rule; and

(v) the ducts are insulated to "A-60" standard within the machinery space, galley, vehicle space, ro-ro space or special category space;

except that penetrations of main zone divisions are also to comply with the requirements of sub rule (8) of rule 72.

(4) Details of duct penetrations:

(a) Where a thin plated duct with a free cross-sectional area equal to, or less than, 0.02 [m^2] passes through "A" class bulkheads or decks, the opening shall be lined with a steel sheet sleeve having a thickness of at least 3_[mm] and a length of at least 200 [mm], divided preferably into 100 [mm] on each side of the bulkhead or, in the case of the deck, wholly laid on the lower side of the decks pierced. Where ventilation ducts with a free cross-sectional area exceeding 0.02 [m^2] pass through "A" class bulkheads or decks, the opening shall be lined with a steel sheet sleeve, unless such ducts are of steel construction in the vicinity of passage through a deck or bulkhead and the ducts and sleeves shall comply with the following:

(i) The sleeves shall have a thickness of at least 3 [mm] and a length of at least 900 [mm]. When passing through bulkheads, this length shall be divided preferably into 450 [mm] on each side of the bulkhead. These ducts, or sleeves lining such ducts, shall be provided with fire insulation. The insulation shall have at least the same fire integrity as the bulkhead or deck through which the duct passes; and

(ii) Ducts with a free cross-sectional area exceeding 0.075 [m^2] shall be fitted with fire dampers in addition to the requirements of (i) above. The fire damper shall operate automatically, but shall also be capable of being closed manually from both sides of the bulkhead or deck. The damper shall 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. Fire dampers shall be easily accessible. Where they are placed behind ceilings or linings, these ceilings or linings shall be provided with an inspection door on which a plate reporting the identification number of the fire damper is provided. The fire damper identification number shall also be placed on any remote controls required.

(b) Ventilation ducts with a free cross-sectional area exceeding 0.02 [m^2] passing through 'B' class bulkheads shall be lined with steel sheet sleeves of 900 [mm] in length divided preferably into 450 [mm] on each side of the bulkheads unless the duct is of steel for this length.

(5) Ventilation systems for ships carrying more than 36 passengers:

(a) The ventilation system of a passenger ship carrying more than 36 passengers shall comply with the additional requirements in the following paragraphs (b) to (f) of this sub rule.

(b) In general, the ventilation fans shall be so disposed that the ducts reaching the various spaces remain within the main vertical zone.

(c) Where ventilation systems penetrate decks, precautions shall be taken, in addition to those relating to the fire integrity of the deck required by sub rule (1) of rule 71 and sub rule (5) of rule 72, to reduce the likelihood of smoke and hot gases passing from one 'tween-deck space to another through the system. In addition to insulation requirements contained in this rule, vertical ducts are, if necessary shall be insulated as required by the appropriate Tables I and II.

(d) Except in cargo spaces, ventilation ducts shall be constructed of the following materials:

(i) ducts not less than 0.075 [m^2] in sectional area and all vertical ducts serving more than a single 'tweendeck space' shall be constructed of steel or other equivalent material;

(ii) ducts less than 0.075 [m^2] in sectional area and other than the vertical ducts referred to in paragraph (i) above, shall be constructed of non-combustible materials. Where such ducts penetrate 'A' or 'B' class divisions, due regard shall be given to ensuring the fire integrity of the division.

(iii) short lengths of duct, not in general exceeding 0.02 [m^2] in sectional area nor 2 [m] in length, need not be non-combustible provided that all of the following conditions are met:

- the duct is constructed of a material of low flame spread characteristics;
- the duct is used only at the terminal end of the ventilation system; and
- the duct is not located closer than 600 [mm] measured along its length to a penetration of an 'A' or 'B' class division, including continuous 'B' class ceilings.

(e) Stairway enclosures shall be ventilated and served by an independent fan and duct system which will not serve any other spaces in the ventilation systems.

(f) Exhaust ducts shall be provided with hatches for inspection and cleaning. The hatches shall be located near the fire dampers.

(6) Exhaust ducts from galley ranges:

(a) Requirements for ships carrying more than 36 passengers:

Exhaust ducts from galley ranges shall meet the requirements of paragraphs (a)-(v) and (a)-(vi) of sub rule (3) of rule 77 and shall be fitted with:

(i) a grease trap readily removable for cleaning unless an alternative approved grease removal system is fitted;

(ii) a fire damper located in the lower end of the duct, which is automatically and remotely operated, and in addition a remotely operated fire damper located in the upper end of the duct;

(iii) a fixed means for extinguishing a fire within the duct;

(iv) remote-control arrangements for shutting off the exhaust fans and supply fans, for operating the fire dampers mentioned in paragraph (ii) above and for operating the fire-extinguishing system, which will be placed in a position close to the entrance to the galley. Where a multi-branch system is installed, a remote means located with the above controls shall be provided to close all branches exhausting through the same main duct before an extinguishing medium is released into the system; and

(v) suitably located hatches for inspection and cleaning.

(b) Requirements for ships carrying not more than 36 passengers

Where the exhaust ducts from galley ranges pass through accommodation spaces or spaces containing combustible materials, such exhaust ducts shall be constructed of 'A' class divisions. Each exhaust duct shall be fitted with:

(i) a grease trap readily removable for cleaning;

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

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

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

Structural Integrity

78. Purpose of the requirements:

The purpose of rules 79 to 82 is to maintain structural integrity of the ship preventing partial or whole collapse of the ship structures due to strength deterioration by heat. For this purpose, materials used in the ships' structure shall ensure that the structural integrity is not degraded due to fire.

79. Material of hull, superstructures, structural bulkheads, decks and deckhouses:

The hull, superstructures, structural bulkheads, decks and deckhouses shall be constructed of steel or other equivalent material. For the purpose of applying the definition of steel or other equivalent material as given in sub rule (36) of rule 40, the "applicable fire exposure" shall be according to the integrity and insulation standards given in Tables I to IV. For example, where divisions such as decks or sides and ends of deckhouses are permitted to have "B-0" fire integrity, the "applicable fire exposure" shall be half an hour.

80. Structure of aluminium alloy:

Unless otherwise specified in rule 79, in cases where any part of the structure is of aluminium alloy, the following shall apply.

(1) the insulation of aluminium alloy components of 'A' or 'B' class divisions except structures, which in the opinion of the Director General, are non- load bearing, shall be such that the

temperature of the structural core does not rise more than 200°C above the ambient temperature at any time during the applicable fire exposure to the standard fire test.

(2) special attention shall be given to the insulation of aluminium alloy components of columns, stanchions and other structural members required to support lifeboat and life raft stowage, launching and embarkation areas, and 'A' and 'B' class divisions to ensure:

(a) that for such members supporting lifeboat and liferaft areas and 'A' class divisions, the temperature rise limitation specified in sub rule (1) shall apply at the end of one hour, and

(b) that for such members required to support 'B' class divisions, the temperature rise limitation specified in sub rule (1) shall apply at the end of half an hour.

81. Machinery spaces of category A

(1) Crowns and casings: Crowns and casings of machinery spaces of category A shall be of steel construction and shall be insulated as required by Tables I and III, as appropriate.

(2) Floor plating: The floor plating of normal passageways in machinery spaces of category A shall be made of steel.

82. Materials of overboard fittings:

Materials readily rendered ineffective by heat shall not be used for overboard scuppers, sanitary discharges and other outlets which are close to the waterline and where the failure of the material in the event of fire would give rise to danger of flooding.

Section D. Escape

Notification of Crew and Passengers

83. Purpose of requirements:

The purpose of rules 84 and 85 is to notify crew and passengers of a fire for safe evacuation. For this purpose, a general emergency alarm system and a public address system are to be provided.

84. General emergency alarm system:

A general emergency alarm system shall be used for notifying crew and passengers of a fire.

85. Public address systems in passenger ships:

A public address system or other effective means of communication shall be available throughout the accommodation and service spaces, control stations and open decks.

Means of Escape

86. Purpose of requirements:

The purpose of this regulation is to provide means of escape so that persons onboard can safely and swiftly escape to the lifeboat and life raft embarkation deck. For this purpose, the following functional requirements shall be met:

(1) safe escape routes shall be provided;

(2) escape routes are to be maintained in a safe condition, clear of obstacles; and

(3) additional aids for escape shall be provided as necessary to ensure accessibility, clear marking, and adequate design for emergency situations.

87. General requirements for escape:

(1) Unless expressly provided otherwise, at least two widely separated and ready means of escape shall be provided from all spaces or group of spaces.

(2) Lifts shall not be considered as forming one of the means of escape as required by this section.

88. Means of escape from control stations, accommodation and service spaces:

(1) Stairways and ladders shall be so arranged as to provide ready means of escape to the lifeboat and liferaft

embarkation deck from passenger and crew accommodation spaces and from spaces in which the crew is normally employed, other than machinery spaces.

(2) Unless expressly provided otherwise in this section, a corridor, lobby, or part of a corridor from which there is only one route of escape is prohibited. Dead-end corridors used in service areas which are necessary for the practical utility of the ship, such as fuel oil stations and athwartship supply corridors, may be permitted, provided such dead-end corridors are separated from crew accommodation areas and are inaccessible from passenger accommodation areas. Also, a part of a corridor that has a depth not exceeding its width is considered a recess or local extension and is permitted.

(3) All stairways in accommodation and service spaces and control stations shall be of steel frame construction except where the use of other equivalent material is specially approved.

(4) If a radiotelegraph station has no direct access to the open deck, two means of escape from or access to such station shall be provided, one of which may be a porthole or window of sufficient size.

(5) Doors in escape routes shall, in general, open in-way of the direction of escape, except that:

(a) Individual cabin doors may open into the cabins in order to avoid injury to persons in the corridor when the door is opened; and

(b) Doors in vertical emergency escape trunks may open out of the trunk in order to permit the trunk to be used both for escape and for access.

(6) Escape from spaces below the bulkhead deck:

(a) Below the bulkhead deck two means of escape, at least one of which shall be independent of watertight doors, shall be provided from each watertight compartment or similarly restricted space or group of spaces. Exceptionally, the Director General, may dispense with one of the means of escape for crew spaces that are entered only occasionally, if the required escape route is independent of watertight doors.

(b) Where dispensation is given under the provisions of (a) above, this sole means of escape shall provide safe escape. However, stairways shall not be less than 800 mm in clear width with handrails on both sides.

(7) Escape from spaces above the bulkhead deck:

Above the bulkhead deck there shall be at least two means of escape from each main vertical zone or similarly restricted space or group of spaces, at least one of which shall give access to a stairway forming a vertical escape.

(8) Direct access to stairway enclosures:

Stairway enclosures in accommodation and service spaces shall have direct access from the corridors and shall be of a sufficient area to prevent congestion, having in view the number of persons likely to use them in an emergency. Within the perimeter of such stairway enclosures, only public toilets, lockers of non-combustible material providing storage for non-hazardous safety equipment and open information counters are permitted. Only public spaces, corridors, lifts, public toilets, special category spaces and open ro-ro spaces to which any passengers carried can have access, other escape stairways required by paragraph (a) of sub rule (9) and external areas are permitted to have direct access to these stairway

enclosures. Small corridors or "lobbies" used to separate an enclosed stairway from galleys or main laundries may have direct access to the stairway provided they have a minimum deck area of 4.5 [m^2], a width of not less than 900 [mm] and contain a fire hose station.

(9) Details of means of escape:

(a) At least one of the means of escape required by paragraph (a) and (b) of sub rule (6) shall consist of a readily accessible enclosed stairway, which will provide continuous fire shelter from the level of its origin to the appropriate lifeboat and liferaft embarkation decks, or to the uppermost weather deck if the embarkation deck does not extend to the main vertical zone being considered. In the latter case, direct access to the embarkation deck by way of external open stairways and passageways will be provided and will have emergency lighting and slip-free surfaces underfoot. Boundaries facing external open stairways and passageways forming part of an escape route and boundaries in such a position that their failure during a fire would impede escape to the embarkation deck shall have fire integrity, including insulation values, in accordance with Tables I to IV, as appropriate.

(b) Protection of access from the stairway enclosures to the lifeboat and liferaft embarkation areas shall be provided either directly or through protected internal routes which have fire integrity and insulation values for stairway enclosures as determined by Tables I to IV, as appropriate.

(c) Stairways serving only a space and a balcony in that space shall not be considered as forming one of the required means of escape.

(d) Each level within an atrium shall have two means of escape, one of which shall give direct access to an enclosed vertical means of escape meeting the requirements of paragraph (a).

(e) The widths, number and continuity of escapes shall be in accordance with the requirements in the tenth Schedule.

(10) Marking of escape routes:

(a) In addition to the emergency lighting the means of escape, including stairways and exits, shall be marked by lighting or photo-luminescent strip indicators placed not more than 300 [mm] above the deck at all points of the escape route including angles and intersections. The marking shall enable passengers to identify the routes of escape and readily identify the escape exits. If electric illumination is used, it shall be supplied by the emergency source of power and it shall be so arranged that the failure of any single light or cut in a lighting strip will not result in the marking being ineffective. Additionally, escape route signs and fire equipment location markings shall be of photoluminescent material or marked by lighting. Such lighting or photoluminescent equipment shall be evaluated, tested and applied to the satisfaction of the Director General, .

(b) In ships carrying more than 36 passengers, the requirements of (a) above shall also apply to the crew accommodation areas.

(11) Normally locked doors that form part of an escape route:

(a) Cabin and stateroom doors shall not require keys to unlock them from inside the room. There shall not be any doors along any designated escape route, which require keys to unlock them when moving in the direction of escape.

(b) Escape doors from public spaces that are normally latched shall be fitted with a means of quick release. Such means shall consist of a door-latching mechanism incorporating a device that releases the latch upon the application of a force in the direction of escape flow. Quick release mechanisms shall be_designed and installed to the satisfaction of the Director General, and in particular:

(i) consist of bars or panels, the actuating portion of which extends across at least one half of the width of the door leaf, at least 760 [mm] and not more than 1120 [mm] above the deck;

(ii) cause the latch to release when a force not exceeding 67 [N] is applied; and

(iii) not be equipped with any locking device, set screw or other arrangement that prevents the release of the latch when pressure is applied to the releasing device.

(12) Emergency escape breathing devices:

(a) Emergency escape breathing devices shall comply with the eighth Schedule.

(b) At least two emergency escape breathing devices are to be carried in each main vertical zone.

(c) In ships carrying more than 36 passengers, two emergency escape breathing devices, in addition to those required in paragraph (b) above, are to be carried in each main vertical zone.

(d) However, paragraphs (b) and (c) do not apply to stairway enclosures which constitute individual main vertical zones and for the main vertical zones in the fore or aft end of a ship which do not contain spaces of categories (6), (7), (8) or (12) defined in sub rule (b) of rule 68.

89. Means of escape from machinery spaces:

(1) Escape from spaces below the bulkhead deck:

Where the space is below the bulkhead deck the two means of escape shall consist of either:

(a) two sets of steel ladders as widely separated as possible , leading to doors in the upper part of the space similarly separated and from which access is provided to the appropriate lifeboat and liferaft embarkation decks. One of these ladders shall be located within a protected enclosure that satisfies category (2) of sub rule (b) of rule 68, or category (4) of sub rule (b) of rule 69, as appropriate, from the lower part of the space it serves to a safe position outside the space. Self-closing fire doors of the same fire integrity standards shall be fitted in the enclosure. The ladder shall be fixed in such a way that heat is not transferred into the enclosure through non-insulated fixing points. The protected enclosure shall have minimum internal dimensions of at least 800 [mm] x 800 [mm], and shall have emergency lighting provisions; or

(b) one steel ladder leading to a door in the upper part of the space from which access is provided to the embarkation deck and additionally, in the lower part of the space and in a position well separated from the ladder referred to, a steel door capable of being operated from each side and which provides access to a safe escape route from the lower part of the space to the embarkation deck.

(2) Escape from spaces above the bulkhead deck:

Where the space is above the bulkhead deck, the two means of escape shall be as widely separated as possible and the doors leading from such means of escape shall be in a position from which access is provided to the appropriate lifeboat and liferaft embarkation decks. Where such means of escape require the use of ladders, these shall be of steel.

(3) Dispensation from two means of escape:

In a ship of less than 1,000 gross tonnage, one of the means of escape may be dispensed with due regard being paid to the width and disposition of the upper part of the space. In a ship of 1,000 gross tonnage and above, one means of escape from any such space, including a normally unattended auxiliary machinery space may be dispensed with, so long as either a door or a steel ladder provides a safe escape route to the embarkation deck, due regard being paid to the nature and location of the space and whether persons are normally employed in that space. In the steering gear space, a second means of escape shall be provided when the emergency steering position is located in that space unless there is direct access to the open deck.

(4) Escape from machinery control rooms:

Two means of escape shall be provided from a machinery control room located within a machinery space, at least one of which will provide continuous fire shelter to a safe position outside the machinery space.

(5) Emergency escape breathing devices:

(a) On all ships, within the machinery spaces, emergency escape breathing devices shall be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of fire. The location of emergency escape breathing devices shall take into account the layout of the machinery space and the number of persons normally working in the spaces.

(b) The number and location of these devices shall be indicated in the fire control plan required in the M.S (Fire fighting appliances) rules.

(c) Emergency escape breathing devices shall comply with the Eighth Schedule.

90. Means of escape from special category and open ro-ro spaces to which any passengers carried can have access:

(1) In special category and open ro-ro spaces to which any passengers carried can have access, the number and locations of the means of escape both below and above the bulkhead deck shall be to the satisfaction of the Director General, and, in general, the safety of access to the embarkation deck shall be at least equivalent to that provided for under sub rules(39)-(a),(40)(42)-(a)and(42)-(b).Such spaces shall be provided with designated walkways to the means of

escape with a breadth of at least 600 mm. The parking arrangements for the vehicles shall maintain the walkways clear at all times.

(2) One of the escape routes from the machinery spaces where the crew is normally employed shall avoid direct access to any special category space.

91. Means of escape from ro-ro spaces:

At least two means of escape shall be provided in ro-ro spaces where the crews are normally employed. The escape routes shall provide a safe escape to the lifeboat and liferaft embarkation decks and shall be located at the fore and aft ends of the space.

92. Additional requirements for ro-ro passenger ships:

(1) General:

(a) Escape routes shall be provided from every normally occupied space on the ship to an assembly station. These escape routes shall be arranged so as to provide the most direct route possible to the assembly station, and shall be marked with symbols approved by the Director General, .

(b) The escape route from cabins to stairway enclosures shall be as direct as possible, with a minimum number of changes in direction. It shall not be necessary to cross from one side of the ship to the other to reach an escape route. It shall not be necessary to climb more than two decks up or down in order to reach an assembly station or open deck from any passenger space.

(c) External routes shall be provided from open decks, as referred to in paragraph (b) above, to the survival craft embarkation stations.

(d) Where enclosed spaces adjoin an open deck, openings from the enclosed space to the open deck are, where practicable shall be capable of being used as an emergency exit.

(e) Escape routes shall not be obstructed by furniture and other obstructions. With the exception of tables and chairs which may be cleared to provide open space, cabinets and other heavy furnishings in public spaces and along escape routes shall be secured in place to prevent shifting if the ship rolls or lists. Floor coverings shall also be secured in place. When the ship is underway, escape routes shall be kept clear of obstructions such as cleaning carts, bedding, luggage and boxes of goods.

(2) Instruction for safe escape:

(a) Decks shall be sequentially numbered, starting with "1" at the tank top or lowest deck. These numbers shall be prominently displayed at stair landings and lift lobbies. Decks may also be named, but the deck number is always to be displayed with the name.

(b) Simple "mimic" plans showing the "you are here" position and escape routes marked by arrows, shall be prominently displayed on the inside of each cabin door and in public spaces. The plan shall show the directions of escape, and shall be properly oriented in relation to its position on the ship.

(3) Strength of handrails and corridors:

(a) Handrails or other handholds shall be provided in all corridors along the entire escape route, so that a firm handhold is available at every step of the way, where possible, to the assembly stations and embarkation stations. Such handrails shall be provided on both sides of longitudinal corridors more than 1.8 [m] in width and transverse corridors more than 1 [m] in width. Particular attention shall be paid to the need to be able to cross lobbies, atriums and other large open spaces along escape routes. Handrails and other handholds shall be of such strength as to withstand a distributed horizontal load of 750 [N/m] applied in the direction of the centre of the corridor or space, and a distributed vertical load of 750 [N/m] applied in the downward direction. The two loads need not be applied simultaneously.

(b) The lowest 0.5 [m] of bulkheads and other partitions forming vertical divisions along escape routes shall be able to sustain a load of 750 [N/m] to allow them to be used as walking surfaces from the side of the escape route with the ship at large angles of heel.

(4) Evacuation analysis:

Escape routes shall be evaluated by an evacuation analysis early in the design process. The analysis shall be used to

identify and eliminate, as far as practicable, congestion which may develop during an abandonment, due to normal movement of passengers and crew along escape routes, including the possibility that crew may need to move along these routes in a direction opposite the movement of passengers. In addition, the analysis shall be used to demonstrate that escape arrangements are sufficiently flexible to provide for the possibility that certain escape routes, assembly stations, embarkation stations or survival craft may not be available as a result of a casualty.

Section E. Operational Requirements

Operational Readiness and Maintenance

93. Purpose of requirements:

The purpose of rules 94 to 96 is to maintain and monitor the effectiveness of the fire safety measures the ship is provided with. For this purpose, the following functional requirements shall be met:

(1) fire protection systems and fire-fighting systems and appliances shall be maintained ready for use; and

(2) fire protection systems and fire-fighting systems and appliances shall be properly tested and inspected.

94. Applicability:

(1) At all times while the ship is in service, the requirements of sub rule (1) of rule 93 shall be complied with. A ship is not in service when:

(a) it is in for repairs or lay-up (either at anchor or in port) or in dry-dock;

(b) it is declared not in service by the owner or the owner's representative; and

(c) there are no passengers on board.

95. Operational readiness:

(1) The following fire protection systems shall be kept in good order so as to ensure their required performance if a fire occurs:

(a) structural fire protection including fire resisting divisions, and protection of openings and penetrations in these divisions;

(b) fire detection and fire alarm systems; and

(c) means of escape systems and appliances.

(2) Fire-fighting systems and appliances shall be kept in good working order and readily available for immediate use. Portable extinguishers, which have been discharged, shall be immediately recharged or replaced with an equivalent unit.

96. Maintenance, testing and inspections:

(1) Maintenance, testing and inspections shall be carried out based on a maintenance plan approved by the Director General, and in a manner having due regard to ensuring the reliability of fire-fighting systems and appliances.

(2) The maintenance plan shall be kept on board the ship and shall be available for inspection whenever required.

(3) The maintenance plan shall include at least the following fire protection systems and fire-fighting systems and appliances, where installed:

(a) fire mains, fire pumps and hydrants including hoses, nozzles and international shore connections;

(b) fixed fire detection and fire alarm systems;

(c) fixed fire-extinguishing systems and other fire extinguishing appliances;

(d) automatic sprinkler, fire detection and fire alarm systems;

(e) ventilation systems including fire and smoke dampers, fans and their controls;

(f) emergency shut down of fuel supply;

(g) fire doors including their controls;

(h) general emergency alarm systems;

(i) emergency escape breathing devices;

(j) portable fire extinguishers including spare charges; and

(k) fire-fighter's outfits.

(4) The maintenance programme may be computer-based.

(5) In addition to the fire protection systems and appliances listed in sub rule (3) of this rule, ships carrying more than 36 passengers shall have a maintenance plan for low-location lighting and public address systems.

Instructions, Onboard Training and Drills

97. Purpose of requirements:

The purpose of rules 98 to 101 is to mitigate the consequences of fire by means of proper instructions for training and drills of persons onboard in correct procedures under emergency conditions. For this purpose, the crew shall have the necessary knowledge and skills to handle fire emergency cases, including passenger care.

98. Instructions, duties and organization:

(1) Crew members shall receive instruction on fire safety onboard the ship.

(2) Crew members shall also receive instructions on their assigned duties.

(3) Parties responsible for fire-extinguishing shall be organized. These parties shall have the capability to complete their duties at all times while the ship is in service.

99. Onboard training and drills:

(1) Crew members shall be trained to be familiar with the arrangements of the ship as well as the location and operation of any fire-fighting systems and appliances that they may be called upon to use.

(2) Training in the use of the emergency escape breathing devices shall be considered as part of on board training.

(3) Performance of crew members assigned fire-fighting duties shall be periodically evaluated by conducting onboard training and drills to identify areas in need of improvement, to ensure competency in fire-fighting skills is maintained, and to ensure the operational readiness of the fire-fighting organization.

(4) Onboard training in the use of the ship's fire-extinguishing systems and appliances shall be planned and conducted.

(5) Fire drills shall be conducted and recorded, having due regard to notification of passengers and movement of passengers to assembly stations and embarkation decks.

100. Training manuals:

(1) A training manual, written in the working language of the ship, shall be provided in each crew mess room and recreation room or in each crew cabin.

(2) The training manual, which may comprise several volumes, shall contain the instructions and information required in sub rule (3) in easily understood terms and illustrated wherever possible. Any part of such information may be provided in the form of audio-visual aides in lieu of the manual.

(3) The training manual shall explain the following in detail:

(a) general fire safety practice and precautions related to the dangers of smoking, electrical hazards, flammable liquids and similar common shipboard hazards;

(b) general instructions on fire-fighting activities and fire-fighting procedures including procedures for notification of a fire and use of manually operated call points;

(c) meanings of the ship's alarms;

(d) operation and use of fire-fighting systems and appliances;

(e) operation and use of fire doors;

(f) operation and use of fire and smoke dampers; and

(g) escape systems and appliances.

101. Fire control plans:

(1) In all ships, fire control plans as given below are to be approved and permanently displayed for the guidance of ship's officers. The Graphical symbols for fire control plans shall be as given in the M.S (Fire fighting appliances) rules.

(2) A general arrangement plan shall show clearly for each deck:

(a) the control stations;

(b) various fire sections enclosed by 'A' and 'B' class divisions together with particulars of fire detection and alarm systems;

(c) the sprinkler installation;

(d) the fire extinguishing appliances;

(e) means of access to different compartments, etc.;

(f) the ventilation system including particulars of the fan control positions, position of dampers and identification numbers of the ventilating fans serving each section.

(3) Alternatively, the above mentioned details may be set out in a booklet, a copy of which shall be supplied to each officer, and at least one copy shall be available at all times on board in an accessible position. Plans and booklets are to be kept up to date, any alterations being recorded thereon as soon as practicable.

(4) A duplicate set of fire control plans or a booklet containing such plans shall be permanently stored in a prominently marked weathertight enclosure outside the deckhouse for the assistance of shore-side fire-fighting personnel.

Operations

102. Purpose of requirements:

(1) The purpose of rule 103 is to provide information and instructions for proper ship and cargo handling operations in relation to fire safety. For this purpose, fire safety operational booklets shall be provided on board.

103. Fire safety operational booklets:

(1) The required fire safety operational booklet shall contain the necessary information and instructions for the safe operation of the ship and cargo handling operations in relation to fire safety. The booklet shall include information concerning the crew’s responsibilities for the general fire safety of the ship while loading and discharging cargo and while underway. Necessary fire safety precautions for handling general cargoes are to be explained.

(2) The fire safety operational booklet shall be provided in each crew mess room and recreation room or in each crew cabin.

(3) The fire safety operational booklet shall be written in the working language of the ship.

(4) The fire safety operational booklet may be combined with the training manuals required in rule 100.

Section F: Alternative Design and Arrangements

104. Purpose of requirements:

The purpose of rules 105 to 108 is to provide a methodology for alternative design and arrangements for fire safety.

105. General:

(1) Fire safety design and arrangements may deviate from the prescriptive requirements set out in Sections B,C,D,E, or G, provided that the design and arrangements meet the fire safety objectives and the functional requirements.

(2) When fire safety design or arrangements deviate from the prescriptive requirements of this Chapter, engineering analysis, evaluation and approval of the alternative design and arrangements shall be carried out in accordance with this section.

106. Engineering analysis:

The engineering analysis is to be prepared and submitted to the Director General, and shall include, as a minimum, the following elements:

(1) determination of the ship type and space(s) concerned;

(2) identification of prescriptive requirement(s) with which the ship or the space(s) will not comply;

(3) identification of the fire and explosion hazards of the ship or the space(s) concerned, including:

(a) identification of the possible ignition sources;

(b) identification of the fire growth potential of each space concerned;

(c) identification of the smoke and toxic effluent generation potential for each space concerned;

(d) identification of the potential for the spread of fire, smoke or of toxic effluents from the space(s) concerned to other spaces;

(4) determination of the required fire safety performance criteria for the ships or the space(s) concerned addressed by the prescriptive requirement(s), in particular:

(a) performance criteria shall be based on the fire safety objectives and on the functional requirements of this part;

(b) performance criteria shall provide a degree of safety not less than that achieved by using the prescriptive requirements; and

(c) performance criteria shall be quantifiable and measurable;

(5) detailed description of the alternative design and arrangements, including a list of the assumptions used in the design and any proposed operational restrictions or conditions; and

(6) technical justification demonstrating that the alternative design and arrangements meet the required fire safety performance criteria.

107. Documentation:

(1) A copy of the engineering analysis document required by rule 106, as approved by the Director General, , indicating that the alternative design and arrangements comply with this section, shall be carried onboard the ship.

108. Re-evaluation due to change of conditions:

If the assumptions, and operational restrictions that were stipulated in the alternative design and arrangements are changed, the engineering analysis shall be carried out under the changed condition and shall be approved by the Director General, .

Section G: Special Requirements

Helicopter Facilities

109. Purpose of requirements:

The purpose of rules 110 to 116 is to provide additional measures in order to address the fire safety objectives of this chapter for ships fitted with special facilities for helicopters. For this purpose, the following functional requirements shall be met:

(1) helideck structure shall be adequate to protect the ship from the fire hazards associated with helicopter operations;

(2) fire fighting appliances shall be provided to adequately protect the ship from the fire hazards associated with helicopter operations;

(3) refuelling and hangar facilities and operations shall provide the necessary measures to protect the ship from the fire hazards associated with helicopter operations; and

(4) operation manuals and training shall be provided.

110. Application:

(1) In addition to complying with the requirements of sections B, C, D and E, as appropriate, ships equipped with helidecks shall comply with the requirements of this section.

(2) Where helicopters land or conduct winching operations on an occasional or emergency basis on ships without helidecks, fire-fighting equipment shall be fitted in accordance with the general requirements for passenger ships in M.S (Fire fighting appliances) Rules. This equipment shall be made readily available in close proximity to the landing or winching areas during helicopter operations.

111. Structure:

(1) Construction of steel or other equivalent material: In general, the construction of the helidecks shall be of steel or other equivalent materials. If the helideck forms the deckhead of a deckhouse or superstructure, it shall be insulated to "A-60" class standard.

(2) Construction of aluminium or other low melting point metals:

(a) If helideck platform of such construction located above the ship's deckhouse or similar structure:

(i) The deckhouse top and bulkheads under the platform shall have no openings; and

(ii) Windows under the platform shall be provided with steel shutters.

(b) After each fire on the platform or in close proximity its suitability for further use shall be determined.

112. Means of escape:

(1) A helideck shall be provided with both a main and an emergency means of escape and access for fire fighting and rescue personnel. These shall be located as far apart from each other as is practicable and preferably on opposite sides of the helideck.

113. Fire-fighting appliances:

(1) In close proximity to the helideck, fire-fighting appliances shall be provided as required by the M.S (Fire fighting appliances) rules.

114. Drainage facilities:

Drainage facilities in way of helidecks shall be constructed of steel and shall lead directly overboard independent of any other system and shall be designed so that drainage does not fall onto any part of the ship.

115. Helicopter refuelling and hangar facilities:

Where the ship has helicopter refuelling and hangar facilities, the following requirements shall be complied with:

(1) a designated area is to be provided for the storage of fuel tanks which shall be:

(a) as remote as is practicable from accommodation spaces, escape routes and embarkation stations; and

(b) isolated from areas containing a source of vapour ignition;

(2) the fuel storage area shall be provided with arrangements whereby fuel spillage may be collected and drained to a safe location;

(3) tanks and associated equipment shall be protected against physical damage and from a fire in an adjacent space or area;

(4) where portable fuel storage tanks are used, special attention shall be given to:

(a) design of the tank for its intended purpose;

(b) mounting and securing arrangements;

(c) electric bonding; and

(d) inspection procedures;

(5) storage tank fuel pumps shall be provided with means which permit shutdown from a safe remote location in the event of a fire. Where a gravity fuelling system is installed, equivalent closing arrangements shall be provided to isolate the fuel source;

(6) the fuel pumping unit shall be connected to one tank at a time. The piping between the tank and the pumping unit shall be of steel or equivalent material, as short as possible, and protected against damage;

(7) electrical fuel pumping units and associated control equipment shall be of a type suitable for the location and potential hazards;

(8) fuel pumping units shall incorporate a device which will prevent over-pressurization of the delivery or filling hose;

(9) equipment used in refuelling operations shall be electrically bonded;

(10) "NO SMOKING" signs shall be displayed at appropriate locations;

(11) hangar, refuelling and maintenance facilities shall be treated as category 'A' machinery spaces with regard to structural fire protection, fixed fire-extinguishing and detection system requirements;

(12) enclosed hangar facilities or enclosed spaces containing refuelling installations shall be provided with mechanical ventilation, as required for closed ro-ro spaces of cargo ships. Ventilation fans shall be of non-sparking type; and

(13) electric equipment and wiring in enclosed hangar or enclosed spaces containing refuelling installations shall comply with sub rules (2), (3) and (4) of rule 120.

116. Operations manual and fire-fighting service:

(1) Each helicopter facility shall have an operations manual, including a description and a checklist of safety precautions, procedures and equipment requirements. This manual may be part of the ship's emergency response procedures.

(2) The procedures and precautions to be followed during refuelling operations shall be in accordance with recognized safe practices and contained in the operations manual.

(3) Fire-fighting personnel consisting of at least two persons trained for rescue and fire-fighting duties and fire-fighting equipment shall be immediately available at all times when helicopter operations are expected.

(4) Fire-fighting personnel shall be present during refuelling operations. However, the fire-fighting personnel shall not be involved with refuelling activities.

(5) On-board refresher training shall be carried out and additional supplies of fire-fighting media shall be provided for training and testing of the equipment.

Protection of Vehicle, Special Category and Ro-ro Spaces

117. Purpose of requirements:

The purpose of rules 118 to 123 is to provide additional safety measures in order to address the fire safety objectives of this part for ships fitted with vehicle, special category and ro-ro spaces. For this purpose, the following functional requirements shall be met:

(1) fire protection systems shall be provided to adequately protect the ship from the fire hazards associated with vehicle, special category and ro-ro spaces;

(2) ignition sources shall be separated from vehicle, special category and ro-ro spaces; and

(3) vehicle, special category and ro-ro spaces shall be adequately ventilated.

118. Application:

In addition to complying with the requirements of Sections B, C, D and E, as appropriate, vehicle, special category and ro-ro spaces shall comply with the requirements of this section.

119. Basic principles:

(1) The basic principle underlying the provisions of this section is that the main vertical zoning required by rule 66 may not be practicable in vehicle spaces and, therefore, equivalent protection must be obtained in such spaces on the basis of a horizontal zone concept and by the provision of an efficient fixed fire-extinguishing system. Based on this concept, a horizontal zone for the purpose of these requirements may include special category spaces on more than one deck provided that the total overall clear height for vehicles does not exceed 10 [m]. The "Total overall clear height" is the sum of distances between deck and web frames of the decks forming one horizontal zone.

(2) The basic principle underlying the provisions of sub rule (1) are also applicable to ro-ro spaces.

(3) The requirements of ventilation systems, openings in "A" class divisions and penetrations in "A" class divisions for maintaining the integrity of vertical zones in this part shall be applied equally to decks and bulkheads forming the boundaries separating horizontal zones from each other and from the remainder of the ship.

120. Precaution against ignition of flammable vapours:

(1) Ventilation systems:

(a) There shall be provided an effective power ventilation system sufficient to give at least the following air changes:

Special category spaces	10 air changes per hour
Closed ro-ro and vehicle spaces other than special category spaces for ships carrying more than 36 passengers	10 air changes per hour
Closed ro-ro and vehicle spaces other than special category spaces for ships carrying not more than 36 passengers	6 air changes per hour

An increased number of air changes may be required when vehicles are being loaded and unloaded.

(b) The power ventilation system required by this sub rule shall be separate from other ventilation systems and shall be in operation at all times when vehicles are in such spaces. Ventilation ducts serving such cargo spaces capable of being effectively sealed shall be separated for each such space. The system shall be capable of being controlled from a position outside such spaces.

(c) The ventilation system shall be such as to prevent air stratification and the formation of air pockets.

(d) Means shall be provided on the navigation bridge to indicate any loss of the required ventilating capacity.

(e) Arrangements shall be provided to permit a rapid shutdown and effective closure of the ventilation system from outside of the space in case of fire, taking into account the weather and sea conditions.

(f) Ventilation ducts, including dampers, within a common horizontal zone shall be made of steel. Ventilation ducts that pass through other horizontal zones or machinery spaces shall be "A-60" class steel ducts constructed in accordance with sub rule 3 (a) of rule 45.

(g) Permanent openings in the side plating, the ends or deckhead of the space shall be so situated that a fire in the cargo space does not endanger stowage areas and embarkation stations for survival craft and accommodation spaces, service spaces and control stations in superstructures and deckhouses above the cargo spaces.

(2) Electrical equipment and wiring:

(a) Except as provided in paragraph (b) of this sub rule, electrical equipment and wiring shall be of a type suitable for use in an explosive petrol and air mixture.

(b) In case of other than special category spaces below the bulkhead deck, above a height of 450 [mm] from the deck and from each platform for vehicles, if fitted, except platforms with openings of sufficient size permitting penetration of petrol gases downwards, electrical equipment of a type so enclosed and protected as to prevent the escape of sparks will be permitted as an alternative on condition that the ventilation system is so designed and operated as to provide continuous ventilation of the cargo spaces at the rate of at least ten air changes per hour whenever vehicles are on board.

(3) Electrical equipment and wiring in exhaust ventilation ducts:

Electrical equipment and wiring, if installed in an exhaust ventilation duct, shall be of a type approved for use in explosive petrol and air mixtures and the outlet from any exhaust duct is to be sited in a safe position, having regard to other possible sources of ignition.

(4) Other ignition sources:

Other equipment, which may constitute a source of ignition of flammable vapours, will not be permitted.

(5) Scuppers and discharges:

Scuppers shall not be led to machinery or other spaces where sources of ignition may be present.

121. Detection and alarm:

(1) Fixed fire detection and fire alarm systems: Except as provided in sub rule (3), there shall be provided a fixed fire detection and fire alarm system complying with the requirements of fifth Schedule. The fixed fire detection system shall be capable of rapidly detecting the onset of fire. The type of detectors and their spacing and location shall be to the satisfaction of the Director General, , taking into account the effects of ventilation and other relevant factors. After being installed the system shall be tested under normal ventilation conditions and shall give an overall response time to the satisfaction of the Director General, .

(2) Sample extraction smoke detection systems:

Except open ro-ro spaces, open vehicle spaces and special category spaces, a sample extraction smoke detection system complying with the requirements of ninth Schedule may be used as an alternative of the fixed fire detection and fire alarm system required in sub rule (1).

(3) Special category spaces:

(a) An efficient fire patrol system shall be maintained in special category spaces. However, if an efficient fire patrol system is maintained by a continuous fire watch at all times during the voyage, a fixed fire detection and fire alarm systems is not required.

(b) Manually operated call points shall be spaced so that no part of the space is more than 20 [m] from a manually operated call point, and one shall be placed close to each exit from such spaces.

122. Structural protection:

Notwithstanding the provisions of rules 66 to 68, in ships carrying more than 36 passengers, the boundary bulkheads and decks of special category spaces and ro-ro spaces shall be insulated to "A-60" class standard. However, where a category (5), (9) and (10) space, as defined in rule 68, is on one side of the division the standard may be reduced to "A-0". Where fuel oil tanks are below a special category space or a ro-ro space, the integrity of the deck between such spaces, may be reduced to "A-0" standard.

123. Fire –extinction: Fire fighting appliances are to be provided in vehicle, special category and ro-ro spaces as required by the M.S (Fire fighting appliances) rules.

SHIPS OF CLASSES VI & VII

124. Fire protection

Every ship of class VI and VII should satisfy all the requirements of this chapter as applicable for a passenger ship carrying not more than 36 passengers.

FIRE CONTROL PLANS for all Classes

127.

(1) There shall be permanently exhibited in all ships for the guidance of the ships' officers, general arrangement plans showing clearly for each deck the control stations, the various

fire sections enclosed by fire retarding bulkheads (if any) together with particulars of fire alarms, fire detecting systems, the sprinkler installations (if any), the fire extinguishing appliances, means of access to different compartments, decks, etc. and the ventilating system including the particulars of the master fan controls, the position of dampers and identification numbers of ventilating fans serving each section. In addition instructions concerning the maintenance and operation of all the equipment and installations shall be readily available at the control stations.

(2) All plans and instructions shall be kept up-to-date.

CHAPTER 3

BILGE PUMPING ARRANGEMENTS

128. General

(1) Every ship to which these rules apply shall be provided with an efficient pumping plant capable of pumping and draining out water from any watertight compartment, other than a space permanently appropriated for the carriage of fresh water, water ballast or oil for which other efficient means of pumping or drainage are provided. Such pumping arrangements shall be adequate under all practicable conditions after a casualty, whether the ship remains upright or not. For this purpose, wing suctions shall be provided except in narrow compartments at the ends of the ship where a single suction may be sufficient. Efficient arrangement shall also be provided whereby water in any watertight compartment may find its way to the suction pipes.

(2) Where the inner bottom plate extends to the ship's side, the bilge suctions shall be led to wells placed at the wings. Such wells shall be not less than $0.17m^3$ capacity and shall be constructed of steel plates.

(3) Suitable scupper pipes shall be fitted for draining `between deck spaces'. Care shall be taken to ensure that a between deck of any watertight compartment does not drain into an adjacent watertight compartment.

(4) Scupper pipes shall not be led into the machinery spaces or tunnel from adjacent compartments. Such scupper pipes may be led to a well constructed drain tank in the tunnel or machinery space but closed to these spaces. A bilge suction pipe with a non-return valve shall be provided from this tank to the bilge main. The air and sounding pipe to the tank shall be led above the bulkhead deck. Where one tank is used for the drainage of a number of compartments, the scupper pipes shall be fitted with screw down non-return valves.

(5) Drains led from refrigerated spaces shall be fitted with liquid sealed traps. Where such drains are situated in the lower hold of a ship, the drains shall be fitted with non-return valves. All scupper pipes passing through refrigerated compartments shall be suitably insulated. Liquid sealed traps shall be of adequate depth and provided with suitable access for cleaning and refilling with brine.

(6) Where the Director General considers that provision of drainage would be undesirable, it may dispense with such arrangements, if satisfied that the safety of the ship will not thereby be impaired.

(7) Where the freeboard to the bulkhead deck or the freeboard deck, respectively, is such that the deck edge is immersed when the ship heels more than 5°, the drainage shall be by means of a sufficient number of scuppers of suitable size discharging directly overboard, fitted in accordance with the requirements of rules 19& 20.

(8) Where the freeboard is such that the edge of the bulkhead deck, is immersed when the ship heels 5° or less, the drainage of the enclosed cargo spaces on the bulkhead deck, shall be led to a suitable space, or spaces, of adequate capacity, having a high water level alarm and provided with suitable arrangements for discharge overboard. In addition it shall be ensured that :

(i) the number, size and disposition of the scuppers are such as to prevent unreasonable accumulation of free water ;

(ii) the pumping arrangements required by this rule, take account of the requirements for any fixed pressure water-spraying fire-extinguishing system ;

(iii) water contaminated with petrol or other dangerous substances is not drained to machinery spaces or other spaces where sources of ignition may be present ; and

(iv) where the enclosed cargo space is protected by a carbon dioxide fire-extinguishing system the deck scuppers are fitted with means to prevent the escape of the smothering gas.

129. Number and type of bilge pumps. Ships of classes I to V.

(1) Every ship of Classes I to V shall have atleast three power pumps connected to the bilge main one of which may be driven by the main engine. Where the bilge pump numeral for the ship is 30 or more, one independent power pump shall be provided in addition.

The bilge pump numeral shall be calculated as follows:

when P_1 is greater than P:

bilge pump numeral = $72\ (M+2P_1)/\ (V+P_1-P)$

in other cases: bilge pump numeral = $72\ (M+2P)/\ V$

where:

L = the length of the ship (metres), as defined in Part1;

M = the volume of the machinery space (cubic metres), as defined in Part 1, that is below the bulkhead deck; with the addition thereto of the volume of any permanent oil fuel bunkers which may be situated above the inner bottom and forward of, or abaft, the machinery space;

P = the whole volume of the passenger and crew spaces below the bulkhead deck (cubic metres), which are provided for the accommodation and use of passengers and crew, excluding baggage, store, provision and mail rooms;

V = the whole volume of the ship below the bulkhead deck (cubic metres);
$P_1 = KN$,
where:
N = the number of passengers for which the ship is to be certified; and
$K = 0.056L$

(2) Sanitary, ballast and general service pumps may be acceptable as individual power bilge pumps if such pumps are fitted with necessary connections to the bilge pumping system.

(3) Where practicable, power bilge pumps shall be placed in separate watertight compartments and so arranged or situated that these different compartments may not simultaneously be flooded by damage to the same part of the ship. If the engines and boilers are in two or more watertight compartments, the pumps available for bilge service shall be distributed throughout these compartments as far as possible.

(4) On ships of 91.5 metres or more in length or having a bilge pump numeral of 30 or more, the arrangements shall be such that atleast one power Pump is available for use in all ordinary circumstances in which a ship may be flooded at sea. This requirement will be met if-

(i) one of the required pumps is an efficient emergency pump of a submersible type having its source of power and the necessary controls situated above the bulkhead deck. Such pump and its source of power shall not be installed forward of the collision bulkhead or nearer to the side of the ship than one-fifth of the breadth of the ship measured at right angles to the centre line of the ship at the level of the deepest sub-division load line; or

(ii) the pumps and their sources of power are so disposed throughout the length of the ship that under any condition of flooding which the ship is required to withstand at least one pump in an undamaged compartment will be available.

130. Number and type of bilge pumps for ships of class VI and VII

(1) Every ship of Class VI and VII of less than 91.5 metres in length shall be provided with pumps connected to the bilge main in accordance with the following table :-

Number of Pumps

Length of ship	**Main Engine Driven Pump ***	**Independent Power Pump**	**Hand Pumps†**
Under 15 metres	1	-	One of the lever type for each watertight compartment or One of the crank type.
15 metres and under 30 metres	1	1	One of the lever type for each watertight compartment or One of the crank type.
30 metres and under 75 metres	1	1	One of the crank type
75 meters and above	1	2	-

† The hand pump may be replaced by an independent power pump.

* The main engine driven pump may be replaced by an independent power pump.

(2) Ships of Class VI and VII of 91.5 metres in length and upwards shall comply with the requirements of rule 129 in the like manner as it is complied with by ships of Class I to V.

131. Requirements for bilge pumps and bilge suctions

(1) Every bilge pump shall be self-priming unless efficient means of priming are provided. For this purpose a central priming system of a vacuum creating apparatus may be acceptable subject to the condition that details of any such system shall be submitted to the Director General, for prior approval. Every such pump other than a hand pump of the lever type and any pump provided for the fore or after peak compartments shall, whether operated by hand or by power, be so arranged as to be capable of drawing water from any space required to be drained by these rules.

(2) Every power bilge pump shall be capable of giving a speed of water of not less than 122 metres per minute through the ship's main bilge pipe. Every power bilge pump shall have a direct suction from the space in which it is situated provided that not more than two direct suctions shall be required in any one space. Where two or more direct suctions are provided there shall be atleast one on the port side and one on the starboard side. Every direct suction in the machinery space shall be of a diameter not less than that of the ship's main bilge line.

(3) In coal burning ships, there shall be provided in the stokehold, in addition to the other suction required by this rule, a flexible suction hose of sufficient length to reach from

the fitting on an independent power bilge pump to each side of the stokehold bilges. The hose shall have an internal diameter of 100 millimetres or 12 millimetres larger than the largest branch pipe required under clause (b) of sub-rule (1) of rule 133, whichever is less.

(4) In addition to the direct bilge suction or suctions required by this rule, there shall be provided in the machinery space a direct suction from the main circulating pump leading to the lowest drainage level of the machinery space and fitted with a non-return valve. The diameter of this direct suction pipe shall be at least two-thirds the diameter of the pump inlet in the case of steam ships and of the same diameter as the pump inlet in the case of motor ships. Where the main circulating pump is not suitable for this purpose, the Director General, may in its place permit the provision of the direct emergency bilge suction led from the largest available independent power driven pump to the lowest drainage level of the machinery space. The capacity of the pump so connected shall exceed that of a required bilge pump by an amount satisfactory to the Director General, . The open end of such suctions or strainers, if any, attached thereto shall be accessible for cleaning. The spindles of the sea inlet and direct suction valves shall extend well above the engine-room platform. If the boiler is fired by coal and there is not watertight bulkhead separating the boiler room from the engine room, a direct discharge overboard shall be fitted from one of the aforesaid pumps. Alternatively, a bypass may be fitted to the circulating pump discharge.

(5) Hand bilge pumps shall be workable from above the bulkhead deck and shall be so arranged that the bucket and the valves can be withdrawn for examination and overhauled under flooding conditions.

132. Arrangements of bilge pipes

(1) All pipes from bilge pumps for draining cargo or machinery spaces shall be entirely

distinct from pipes which may be used for filling or emptying spaces where water or oil is carried.

(2) All bilge pipes used in or under coal bunkers or fuel storage tanks or in boiler or machinery spaces including spaces in which oil settling tanks or oil fuel pumping units are situated shall be of steel or other approved material.

(3) Bilge suction pipes shall not be led through oil tanks unless the pipes are enclosed in an oil-tight trunkway. Such pipes shall not be led through double bottom tanks**.** If bilge suction pipes pass through deep ballast water tanks, such pipes should be of heavy gauge and the number of pipe joints kept to a minimum. The pipes shall be led above the line of the double bottom.

(4) Bilge pipes shall be made with flanged joint and shall be thoroughly secured in position and protected, where necessary, against risk of damage. Efficient expansion joints or bends shall be provided in each line of pipe.

(5) The bilge pumping arrangements for cargo spaces containing flammable or toxic liquids shall be designed so that inadvertent pumping of such liquids through the main bilge system or any other system connected to a pump located in a machinery space can be prevented. Additional means of draining such cargo spaces shall be provided if this is found to be necessary when taking into consideration the quantity and characteristics of the liquids and their location.

133. Diameter of bilge suction pipes

(1) (a) The diameter of the bilge main shall be calculated according to the following formulae, namely:-

$$d_m = 1.68 * SQRT(L (B + D)) + 25$$

where, d_m = the internal diameter of the bilge main in millimetres.

L = the length of the ship in metres.

B = the breadth of the ship in metres.

D : is the moulded depth of the ship to the bulkhead deck (metres) provided that, in a ship having an enclosed cargo space on the bulkhead deck which is internally drained in accordance with the requirements of paragraph 50(8) and which extends for the full length of the ship, D shall be measured to the next deck above the bulkhead deck. Where the enclosed cargo spaces cover a lesser length, D shall be taken as the moulded depth to the bulkhead deck plus lh/L where l and h are the aggregate length and height respectively of the enclosed cargo spaces (metres).

(b) The diameter of a branch bilge pipe shall be obtained from the following formulae, namely :-

$$d_b = 2.15 * SQRT(L_c (B + D)) + 25$$

where, d_b = the internal diameter of the branch bilge suction pipe in millimetres.

L_c = the length of the compartment in metres.

(2) No main bilge suction pipe shall be less than 62.5 millimetres in bore and no branch suction pipe shall be less than 50 millimetres or more than 100 millimetres in bore.

134. Precautions against flooding through bilge pipes

(1) In every ship, the bilge and ballast pumping system shall be so arranged as to prevent the possibility of water passing from the sea and from water ballast spaces into cargo and machinery spaces or from one watertight compartment to another. The bilge

connection to any pump which is provided with suction from the sea or from water ballast spaces shall be made by means of either a non-return valve or a cock which cannot be open at the same time to the bilges and to the sea or to the bilges and water ballast spaces. Valves in bilge distribution boxes shall be of a non-return type. A system of lock-up valves or blank flanges shall be provided for the purposes of preventing any deep tank in a ship having bilge and ballast connections being inadvertently run up from the sea where it contains cargo or pumped out through the bilge pipe when it contains water ballast. Instructions for working of such arrangement shall be conspicuously displayed near the valves.

(2) In every ship of Classes I to VI provision shall be made to prevent the flooding of any watertight compartment served by a bilge suction pipe in the event of the pipe being severed or otherwise damaged by collision or grounding in any other watertight compartments. Where any part of such a pipe is situated nearer to the ship's side than one-fifth of the midship breadth of the ship measured at the level of the deepest sub-division load water line or in a duct keel, a non-return valve shall be fitted to the pipe in the compartment containing the open end of the pipe.

(3) The main bilge line on ships of Class I to VII shall not be situated nearer to the ship's side than one-fifth of the breadth of the ship measured at right angles to the centre line of the ship at the level of the deepest sub-division load water line. Where any bilge pump or its pipe connecting it to the bilge main is not so situated, the arrangements shall be such that any damage to it will not put the other bilge pumping arrangements out of action. For this purpose, a non-return valve shall be provided in the pipe connection leading to the pump at its junction with the main bilge line.

135. Bilge, valves, cocks, etc. of ships of classes I to VI

(1) All bilge distribution boxes, valves and cocks shall be in positions which are accessible at all times in ordinary circumstances and shall be so arranged that in the event of flooding, one of the bilge pumps may operate on any watertight compartment in the ship. If there is only one system of pipes common to all bilge pumps, the necessary cocks or valves for controlling the bilge suctions shall be capable of being operated from above the bulkhead deck. Where, in addition to the main bilge pumping system, an emergency bilge pumping system is installed it shall be independent of the main system and shall be so arranged that the pump is capable of being operated on any compartment under flooding conditions. In that case, only the cocks and valves necessary for the operation of the emergency system shall be capable of being operated from above the bulkhead deck.

(2) In ships of Class VI and VII of under 30 metres in length which are provided with a lever type hand pump for each watertight compartment the valves and cocks on the

bilge main for controlling the bilge suctions need not be provided with arrangements for operating them from above the bulkhead deck.

(3) The operating rod for bilge suction valves or cocks shall be led as directly as possible. Every such rod passing through a cargo or coal bunker space shall be protected against damage in such spaces.

(4) Every valve or cock which is required by this rule to be operated from above the bulkhead deck shall have its control at its place of operation clearly marked to show the purpose it serves and how it may be opened or closed and means to indicate when it is open or when it is closed.

136. Bilge mud boxes and strum boxes

Bilge suctions in the machinery space shall be led from readily accessible mud boxes placed wherever practicable above the level of the working floor of such space. The boxes shall have straight tail pipes to the bilges and the covers secured in such a manner as will permit them to be readily opened and closed. The suction ends in hold spaces and tunnel wells shall be enclosed in strum boxes having perforations approximately 8 millimetres in diameter and the combined area of such perforations shall not be less than twice the area of the suction pipe end. Strum boxes shall be so constructed and arranged that they can be cleared without breaking any joint of the suction pipe. The distance between the open end of the tail pipe and the bottom shall be adequate to allow a full flow of water and to facilitate cleaning.

137. Sounding pipes

In every ship to which these rules apply, all tanks forming part of the structure of the ship and all watertight compartment not being part of the machinery space shall be provided with efficient arrangement for sounding which shall be protected where necessary against damage. Where such arrangement consists of sounding pipes, a thick steel doubling plate shall be securely fixed below each sounding pipe for the sounding rod to strike upon. All sounding pipes shall extend to positions above the ship's bulkhead deck which shall at all times be readily accessible. Sounding pipes for bilges, cofferdams and double bottom tanks situated in the machinery space shall extend to the bulkhead deck unless the upper ends of the pipes are accessible in the machinery space in ordinary circumstances and are furnished with cocks having parallel plugs and permanently secured handles, so loaded that on being released they automatically close the cock. The sounding pipes for bilges of insulated holds shall be insulated and be not less than 62.5 millimetres in diameter.

CHAPTER – 4

Electrical Equipment and Installations

138. General

Electrical installations shall be such that :

(1) all electrical auxiliary services necessary for maintaining the ship in normal operational and habitable conditions will be ensured without recourse to the emergency source of electrical power ;

(2) electrical services essential for safety will be ensured under various emergency conditions ; and

(3) the safety of passengers, crew and ship from electrical hazards will be ensured.

(4) New installation of materials which contain asbestos shall be prohibited except for those items permitted by Rule 169(8) of Part II Chapter 5.

139. Main source of electrical power and lighting systems

Ships of Classes I to VI :

(1) (a) A main source of electrical power of sufficient capacity to supply all those services mentioned in sub–rule 138(1) shall be provided. This main source of electrical power shall consist of at least two generating sets.

(b) The capacity of these generating sets shall 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. Minimum comfortable conditions of habitability shall also be ensured which include at least adequate services for cooking, heating, domestic refrigeration, mechanical ventilation, sanitary and fresh water.

(c) The arrangements of the ship's main source of electrical power shall be such that the services referred to in sub–rule138(1) can be maintained regardless of the speed and direction of rotation of the propulsion machinery or shafting. The generator sets shall be so located as to ensure that they do not become inoperative in the event of partial flooding of the machinery space through leakage from a damaged compartment or otherwise.

(d) In addition, the generating sets shall be such as to ensure that with any one generator or its primary source of power out of operation, the remaining generating sets shall be capable of providing the electrical services necessary to start the main propulsion plant from a dead ship condition. The emergency source of electrical power may be used for the purpose of starting from a dead ship

condition if its capability either alone or combined with that of any other source of electrical power is sufficient to provide at the same time those services required to be supplied by rule 140(2)(a) to 140(2)(c)

(e) Where transformers constitute an essential part of the electrical supply system required by this rule, the system shall be so arranged as to ensure the same continuity of the supply as is stated in this rule.

(2) (a) A main electric lighting system which shall provide illumination throughout those parts of the ship normally accessible to and used by passengers or crew shall be supplied from the main source of electrical power.

(b) The arrangement of the main electric lighting system shall be such that a fire or other casualty in spaces containing the main source of electrical power, associated transforming equipment, if any, the main switchboard and the main lighting switchboard, will not render the emergency electric lighting system required by rule 140(2)(a) and 140(2)(b) inoperative.

(c) The arrangement of the emergency electric lighting system shall be such that a fire or other casualty in spaces containing the emergency source of electrical power, associated transforming equipment, if any, the emergency switchboard and the emergency lighting switchboard will not render the main electric lighting system required by this regulation inoperative.

(3) Where there is only one main generating station, the main switchboard shall be located in the same main fire zone. Where there are more than one main generating stations and only one main switchboard, the switchboard shall be situated in the main fire zone in which one of the generating stations is located.

An environmental enclosure for the main switchboard, such as may be provided by a machinery control room situated within the main boundaries of the space, is not to be considered as separating the switchboards from the generators.

(4)(a) where the main source of electrical power is necessary for propulsion and steering of the ship, the system shall be so arranged that the electrical supply to equipment necessary for propulsion and steering and to ensure safety of the ship will be maintained or immediately restored in the case of loss of any one of the generators in service ;

(b) load shedding or other equivalent arrangements shall be provided to protect the generators required by this regulation against sustained overload ;

(c) where the main source of electrical power is necessary for propulsion of the ship, the main busbar shall be subdivided into at least two parts which shall normally be connected by circuit breakers or other approved means ; so far as is practicable, the connection of generating sets and other duplicated equipment shall be equally divided between the parts ;

140. Emergency source of electrical power

Ships of Classes I to V :

(1)(a) A self-contained emergency source of electrical power shall be provided.

(b) The emergency source of electrical power, associated transforming equipment, if any, transitional source of emergency power, emergency switchboard and emergency lighting switchboard shall be located above the uppermost continuous deck and shall be readily accessible from the open deck. They shall not be located forward of the collision bulkhead.

(c) The location of the emergency source of electrical power and associated transforming equipment, if any, the transitional source of emergency power, the emergency switchboard and the emergency electric lighting switchboards in relation to the main source of electrical power, associated transforming equipment, if any, and the main switchboard shall be such as to ensure to the satisfaction of Director General that a fire or other casualty in spaces containing the main source of electrical power, associated transforming equipment, if any, and the main switchboard or in any machinery space of category A will not interfere with the supply, control and distribution of emergency electrical power. As far as practicable, the space containing the emergency source of electrical power, associated transforming equipment, if any, the transitional source of emergency electrical power and the emergency switchboard shall not be contiguous to the boundaries of machinery spaces of category A or those spaces containing the main source of electrical power, associated transforming equipment, if any, or the main switchboard.

(d) Provided that suitable measures are taken for safeguarding independent emergency operation under all circumstances, the emergency generator may be used exceptionally, and for short periods, to supply non-emergency circuits.

(2) The electrical power available shall be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously. The emergency source of electrical power shall be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the following services for the periods specified hereinafter, if they depend upon an electrical source for their operation :

(a) For a period of 36 h, emergency lighting :

(i) at every muster and embarkation station and over the sides

(ii) in alleyways, stairways and exits giving access to the muster and embarkation stations,

(iii) in all service and accommodation alleyways, stairways and exits, personnel lift cars ;

(iv) in the machinery spaces and main generating stations including their control positions ;

(v) in all control stations, machinery control rooms, and at each main and emergency switchboard ;

(vi) at all stowage positions for firemen's outfits ;

(vii) at the steering gear ; and

(viii) at the fire pump, the sprinkler pump and the emergency bilge pump referred to in sub-rule (2)(d) and at the starting position of their motors.

(b) For a period of 36 h :

(i) the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force ; and

(ii) the VHF radio installation required by MS(Distress and Safety Radio Communication) Rules, 1995. and, if applicable :

(aa) the MF radio installation required by MS(Distress and Safety Radio Communication) Rules, 1995.

(bb) the ship earth station required by MS(Distress and Safety Radio Communication) Rules, 1995, and

(cc) the MF/HF radio installation required by MS(Distress and Safety Radio Communication) Rules, 1995

(c) For a period of 36 h :

(i) all internal communication equipment required in an emergency ;

(ii) the shipborne navigational equipment ; where such provision is unreasonable or impracticable the Director General may waive this requirement for ships of less than 5,000 gross tonnage ;

(iii) the fire detection and fire alarm system, and the fire door holding and release system ; and

(iv) for intermittent operation of the daylight signaling lamp, the ship's whistle, the manually operated call points, and all internal signals that are required in an emergency ;

unless such services have an independent supply for the period of 36 h from an accumulator battery suitably located for use in an emergency.

(d) For a period of 36 h :

(i) one of the fire pumps

(ii) the automatic sprinkler pump, if any ; and

(iii) the emergency bilge pump and all the equipment essential for the operation of electrically powered remote controlled bilge valves.

(e) For the period of time required by rule 210(15) the steering gear if required to be so supplied by that rule.

(f) For a period of half an hour :

(i) any watertight doors required by rule 16 to be power-operated together with their indicators and warning signals ;

(ii) the emergency arrangements to bring the lift cars to deck level for the escape of persons. The passenger lift cars may be brought to deck level sequentially in an emergency.

(g) In a ship engaged regularly on voyages of short duration, the Director General if satisfied that an adequate standard of safety would be attained may accept a lesser period than the 36 h period specified in sub-rules 2(a) to 2(e) but not less than 12 h.

(3) The emergency source of electrical power may be either a generator or an accumulator battery, which shall comply with the following :

(a) Where the emergency source of electrical power is a generator, it shall be :

(i) driven by a suitable prime mover with an independent supply of fuel having a flashpoint (closed cup test) of not less than 43°C ;

(ii) started automatically upon failure of the electrical supply from the main source of electrical power and shall be automatically connected to the emergency switchboard ; those services referred to in sub-rule (4) shall then be transferred automatically to the emergency generating set. The automatic starting system and the characteristic of the prime mover shall be such as to permit the emergency generator to carry its full rated load as quickly as is safe and practicable, subject to a maximum of 45 s and

(iii) provided with a transitional source of emergency electrical power according to sub-rule (4) .

(b) Where the emergency source of electrical power is an accumulator battery, it shall be capable of :

(i) carrying the emergency electrical load as per sub-rule (2) without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage ;

(ii) automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power ; and

(iii) immediately supplying at least those services specified in sub-rule (4).

(c) where electrical power is necessary to restore propulsion, the capacity shall be sufficient to restore propulsion to the ship in conjunction with other machinery, as appropriate, from a dead ship condition within 30 min after blackout.

(4) The transitional source of emergency electrical power required by sub-rule (3)(a)(iii) shall consist of an accumulator battery suitably located for use in an emergency which shall operate without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage and be of sufficient capacity and so arranged as to supply automatically in the event of failure of either the main or emergency source of electrical power at least the following services, if they depend upon an electrical source for their operation :

(a) For half an hour :

(i) the lighting required by sub-rules (2)(a) and (2)(b);

(ii) all services required by sub-rules (2)(c)(i), (2)(c)(iii) and (2)(c)(iv) unless such services have an independent supply for the period specified from an accumulator battery suitably located for use in an emergency.

(b) Power to operate the watertight doors, as required by rule 16(7)(c)(cc) but not necessarily all of them simultaneously, unless an independent temporary source of stored energy is provided. Power to the control, indication and alarm circuits as required by rule 16(7)(b) or half an hour.

(5) An indicator shall be mounted in a suitable place on the main switchboard or in the machinery control room to indicate when the batteries constituting either the emergency source of electrical power or the transitional source of emergency electrical power referred to in sub-rule (3)(a)(iii) or (4) are being discharged.

(6) The emergency generator and its prime mover and any emergency accumulator battery shall be so designed and arranged as to ensure that they will function at full rated power when the ship is upright and when inclined at any angle of list up to 22.5° or when inclined up to 10° either in the fore or aft direction, or is in any combination of angles within those limits.

(7) Provision shall be made for the periodic testing of the complete emergency system and shall include the testing of automatic starting arrangements.

141. Emergency source of electric power

Ships of Class VI and VII :

(1) Where in the case of any ship of classes VI and VII the emergency bilge pump provided in pursuance of sub-rule (2) of rule 130 is electrically operated, there shall be provided in a position above the bulkhead deck outside the machinery casing a self-contained emergency source of electric power capable of operating the pump for a period of 24 hours.

(2) The emergency source of electric power may be either an accumulator complying with the requirements of sub-rule (1) without being recharged or suffering an excessive voltage drop or a generator driven by a compression ignition engine with an independent fuel supply and with efficient starting arrangements. The fuel provided for such engine shall have a flash point of not less than 43ºC.

(3) The emergency source of electric power shall be so arranged that it will operate efficiently when the ship is listed 22-1/2 degrees either way and when the trim of the ship is 10 degrees from an even keel.

(4) Where an electrically operated emergency bilge pump is not provided, the emergency source of electric power shall be capable of operating simultaneously for a period of six hours the following services, namely:-

(a) The emergency lighting required at every boat station on deck and oversides, in all alleyways, stairways and exits, in the main machinery space and main generating space on the navigating bridge and in the chart room;

(b) The general alarm;

(c) Fire detection and alarm systems;

(d) The navigation lights, if solely electric, and the daylight signaling lamp, if operated by main source of power.

142. Supplementary emergency lighting for ro-ro passenger ships

In addition to the emergency lighting required by sub-rule 140(2) on every passenger ship with ro-ro cargo spaces or special category spaces as defined in part II, Ch2.

(1) all passenger public spaces and alleyways shall be provided with supplementary electric lighting that can operate for at least 3 h when all other sources of electrical power have failed and under any condition of heel. The illumination provided shall be such that the approach to the means of escape can be readily seen. The source of power for the supplementary lighting shall consist of accumulator batteries located within the lighting units that are continuously charged, where practicable, from the emergency switchboard. Alternatively, any other means of lighting which is at least as effective may be accepted by the Director General . The supplementary lighting shall be be such that any failure of the lamp will be immediately apparent. Any accumulator battery provided shall be replaced at intervals having regard to the specified service life in the ambient conditions that they are subject to in service ; and

(2) a portable rechargeable battery operated lamp shall be provided in every crew space alleyway, recreational space and every working space which is normally occupied unless supplementary emergency lighting, as required by sub-rule (1), is provided.

143. Starting arrangements for emergency generating sets

1) Emergency generating sets shall be capable of being readily started in their cold condition at a temperature of 0 °C. If this is impracticable, or if lower temperatures are likely to be encountered, provision acceptable to the Director General shall be made for the maintenance of heating arrangements, to ensure ready starting of the generating sets.

(2) Each emergency generating set arranged to be automatically started shall be equipped with starting devices approved by the Director General with a stored energy capability of at least three consecutive starts.

(a) The source of stored energy shall be protected to preclude critical depletion by the automatic starting system, unless a second independent means of starting is provided. In addition, a second source of energy shall be provided for an additional three starts within 30 min unless manual starting can be demonstrated to be effective.

(3) The stored energy shall be maintained at all times, as follows :

(a) electrical and hydraulic starting systems shall be maintained from the emergency switchboard ;

(b) compressed air starting systems may be maintained by the main or auxiliary compressed air receivers through a suitable non-return valve or by an emergency air compressor which, if electrically driven, is supplied from the emergency switchboard ;

(c) all of these starting, charging and energy storing devices shall be located in the emergency generator space ; these devices are not to be used for any purpose other than the operation of the emergency generating set. This does not preclude the supply to the air receiver of the emergency generating set from the main or auxiliary compressed air system through the non-return valve fitted in the emergency generator space.

(4)(a) Where automatic starting is not required, manual starting is permissible, such as manual cranking, inertia starters, manually charged hydraulic accumulators, or powder charge cartridges, where they can be demonstrated as being effective.

(b) When manual starting is not practicable, the requirements of sub-rules (2) & (3) shall be complied with except that starting may be manually initiated.

144. Emergency switchboards

(1) (a) The emergency switchboard shall be installed as near as is practicable to the emergency source of electrical power.

(b) Where the emergency source of electrical power is a generator, the emergency switchboard shall be located in the same space unless the operation of the emergency switchboard would thereby be impaired.

(c) The emergency switchboard shall be supplied during normal operation from the main switchboard by an interconnector feeder which is to be adequately protected at the main switchboard against overload and short circuit and which is to be disconnected automatically at the emergency switchboard upon failure of the main source of electrical power. Where the system is arranged for feedback operation, the interconnector feeder is also to be protected at the emergency switchboard at least against short circuit.

(d) No accumulator battery fitted in accordance with this rule shall be installed in the same space as the emergency switchboard.

(e) In order to ensure ready availability of the emergency source of electrical power, arrangements shall be made where necessary to disconnect automatically non-emergency circuits from the emergency switchboard to ensure that power shall be available to the emergency circuits.

145. Systems of supply

(1) The following systems of supply may be used :

(a) Direct Current (D.C.)

(i) two wire system;

(ii) three wire with the middle wire earthed.

(b) Alternating Current (A.C.)

(i) single phase - two wire;

(ii) three phase - three wire;

(iii) three phase - four wire with the neutral earthed but without hull return.

(2) With parallel systems and constant pressure, the voltage for A.C. shall not exceed-

(a) 1000V for-

(i) generation;

(ii) power for machinery;

(iii) cooking equipment permanently connected to fixed wiring;

(iv) heating equipment permanently connected to fixed wiring.

(b) 250 V for-

(i) lighting, heaters in cabins and public rooms;

(ii) for all other purposes not otherwise specified.

146. Shore supply

(1) Where arrangements are made for the supply of electricity from a source on shore, a suitable connection box shall be provided for receiving the cables from the shore supply. Such box shall be fitted with a circuit breaker or isolating switch and fuses and terminals of adequate size and shape to facilitate satisfactory connection being made. Permanently fixed cables shall be led from the connection box to the main switchboard with a linked switch or a circuit breaker at the main switchboard.

(2) For three phase shore supply with earthed neutral, an earth terminal shall be provided for connecting the hull to the shore earth.

(3) Every shore connection shall be provided with an indication at the main switchboard to show when the cable is energized.

(4) Means shall be provided for checking, with respect to incoming supply the polarity in the case of Direct Current and the phase sequence in the case of three phase Alternating Current.

(5) A suitable notice shall be displayed at the connection box giving full information on the supply system the normal voltage (and frequency in the case of alternating current) of the ships system and the procedure for carrying out the connection.

147. Switchboards, Switch Gear and Protective Equipment

Switchboards

(1) The main and emergency switchboards shall be so arranged as to give easy

access back and front without danger to attendants. The space at the rear of the switchboard shall be not less than 0.6 metres and shall be adequate for carrying out maintenance work. The sides and backs, and where necessary the fronts, of switchboards shall be suitably guarded. There shall be provided non-conducting mats or gratings at the front and back of the switchboard. No exposed parts which may have a voltage between conductors or to earth exceeding 250 Volts D.C. or 55 Volts A.C. shall be installed on the face of any switchboard or control panel. Pipe lines and other fittings shall not to be installed directly above or in front or behind switchboards.

(2) Section and distribution boards shall be suitably enclosed unless they are installed in a space or compartment to which only authorized persons have access. All enclosures shall be constructed of, or lined with, non-inflammable and non-hygroscopic material and shall be of robust construction.

(3) All measuring instruments and apparatus controlling circuits shall be clearly labeled for identification. Every fuse and every circuit breaker shall be marked with the full load current which the fuse or circuit breaker protects. The labels for fuses shall also be marked with appropriate sizes of fuse element. Other protective devices shall be provided with suitable labels indicating the appropriate settings of those devices.

148. Bus bars

Bus bars and their connections shall be of copper. All connections shall be so made as will avoid corrosion. Bus bars and their supports shall be so designed as to withstand the mechanical stresses which may arise during short circuits. The current rating of equalizer bus bars and switches shall not be less than half the full load current of the largest generator.

149. Instruments for D.C. generators

(1) For generators which are not operated in parallel, at least one voltmeter and one ammeter shall be provided for each generator.

(2) For parallel operation, one ammeter shall be provided for each generator and two voltmeters. One voltmeter shall be connected to the bus bars and the other shall be capable of measuring the voltage of any generator.

(3) For compound wound generators fitted with equalizer connections the ammeter shall be connected to the pole opposite to that connected to the series winding of the generator. For three wire generators, the ammeter shall be located between the equalizer connection and the generator.

(4) For three wire system supplied by a three wire generator or by a balancing booster, an ammeter shall be connected to each outer pole of each balancing generator and the voltmeter between each pole of the bus bars and the middle wire.

150. Instruments for A.C. generators

(1) Each generator, being an alternating current generator not operated in parallel shall be provided with

(a) one voltmeter;

(b) one frequency meter;

(c) (i) one ammeter with an ammeter switch to enable the current in each phase to be read; or

(ii) an ammeter in each phase.

(2) For every generator above 50 KVA, a Wattmeter shall be provided.

(3) Alternating current generators operated in parallel shall each be provided with a wattmeter and an ammeter in each phase or an ammeter with a selector switch for measuring the current in each phase.

(4) For paralleling operation, two voltmeters two frequency meters and a synchronizing device comprising either a synchroscope and lamps or equivalent arrangements shall be provided. Of the voltmeters and frequency meters so provided, one voltmeter and one frequency meter shall be connected to the bus bars. The other voltmeter and frequency meter shall be arranged to enable the voltage and frequency of any generator to be measured.

151. Instrument scales

(1) The upper limit of the scale of every voltmeter shall be approximately 120 per cent of the normal voltage of the circuit. The normal operating voltage shall be clearly marked.

(2) The upper limit of the scale of every ammeter shall be approximately 130 per cent of the normal rating of the circuit in which it is installed. The normal full load shall be clearly indicated.

(3) Ammeters for use with direct current generators and wattmeters for use with alternating current generators shall be capable of indicating 15 per cent reverse current or power respectively.

(4) The secondary windings of instrument transferor shall be efficiently earthed.

152. Earth indicators

Every insulated distribution system shall be provided with earth lamps or other means to indicate the state of the insulation from earth.

153. Protection of installations

(1) Installations shall be protected against accidental over currents including short circuits. The protective devices shall be such as will provide complete and co-ordinated protection to ensure continuity of service under faulty conditions through discriminative action of the protective device and elimination of the fault so as to reduce damage to the system and hazards of fire.

(2) Circuit breakers and automatic switches provided for overload protection shall have tripping characteristics appropriate to the system to be protected. Fuses shall not be used for overload protection above 300 amperes but may be used for any short circuit protection. Over current releases of circuit breakers for generators and for circuits with preference tripping shall be capable of adjustment.

(3) The breaking capacity of every protective device shall be not less than the maximum value of the short circuit current which can flow at the point of installation at the instant of contact separation. The making capacity of every circuit breaker or switch intended to be capable of being closed, if necessary, on a short circuit shall not be less than the maximum value of the short circuit current at the point of installation.

(4) Every protective device or conductor not intended for short circuit interruption shall be adequate for the maximum short circuit current which can occur at the point of installation having regard to the time required for the short circuit to be removed.

154. Protection of circuits

(1) Short circuit protection shall be provided in each live pole of a D.C. system and in each phase of an A.C. system. Overload protection shall be provided in-

(a) at least one line or phase in a two wire D.C. system;

(b) a single phase A.C. system;

(c) both outer lines in a three wire D.C. system;

(d) at least two phases in an insulated three phase A.C. system; and

(e) all the three phases in an earthed three phase A.C. system.

(2) No fuse or circuit breaker shall be inserted in an earth conductor. Every switch or circuit breaker fitted in any system shall be such that will operate simultaneously in the earthed conductor and the insulated conductors.

155. Protection of generators

(1) In addition to over current protection, there shall be provided a circuit breaker for generators not arranged to run in parallel. Such circuit breaker shall be arranged to open all insulated poles, or multi-pole linked switch with fuse in each insulated pole.

(2) In the case of generators arranged to run in parallel, there shall be provided a circuit breaker arranged to open simultaneously all insulated poles. Such circuit breaker shall be provided with instantaneous reverse current protection which shall operate at not more than 15 per cent of the rated current.

(3) In the case of alternating current generators there shall be provided a reverse power protection with time delay and set within the limits of 2 to 15 per cent of full load.

(4) In the case of direct current generators arranged to operate parallel, the following additional provisions shall be made, namely :

(i) where an equalizer connection is in use, the reverse current protection shall be provided in the pole opposite to that in which the series winding is connected;

(ii) where the generators are compound wound generators there shall be provided-

(a) an equalizer switch for each generator, so interlocked that it closes before and opens after the main contact of the circuit breakers with which it is associated; or

(b) a three pole circuit breaker with all poles operating simultaneously;

(iii) in the three wire system, there shall be provided a switch in the connection to the middle wire, so interlocked with the generator switch or circuit breaker connected to the outers as to operate simultaneously with them.

156. Essential services

Where generators are operated in parallel and essential machinery is electrically driven, arrangements shall be made to disconnect automatically the excess non-essential loads when the generators are overloaded. This load shedding may be carried out in one or more stages.

157. Power transformers

The primary circuits of power transformers shall be protected against short circuit by circuit breakers or fuses. Where transformers are arranged to operate in parallel, means of isolation shall be provided on the secondary windings.

158. Distribution system

(1) Multiple pole circuit breakers or switch and fuses shall be provided for the isolation and protection of each main distribution circuit.

(2) The hull return system shall not be used in any such ship for the power, heat and light distribution systems thereof.

(3) The final sub-circuits of any hull return system of distribution shall be two Wire.

(4) The requirements of sub-rules (2) and (3) do not preclude the use of -

(a) impressed current cathodic protection systems;

(b) limited and locally earthed systems; and

(c) insulation monitoring devices with a maximum circulation current of 30 milliamperes.

(5) (i) In every ship of Classes VIII & IX electric and electrohydraulic steering gear shall be served by two circuits fed from the main switchboard, one of which

may pass through the emergency switchboard, if provided. Each circuit shall have adequate capacity for supplying all the motors which are normally connected to it and which operate simultaneously and if transfer arrangements are provided in the steering gear room to permit either circuit to supply any motor or combination of motors, the capacity of each circuit shall be adequate for the most severe load condition. The circuits shall be separated as widely as practicable throughout its length both vertically and horizontally. Indicators shall be provided which will show when the power units of the steering gear are running. These indicators shall be situated in the machinery control room or in any other approved position and on the navigating bridge.

(ii) The steering gear circuits shall have short circuit protection only.

(iii) Where a three phase supply is used, a system of alarms shall be provided which will indicate failure of any one of the supply phases. The alarms shall be both audible and visual and situated in a suitable position on the navigating bridge.

(iv) In ships of less than 1600 tons gross if the auxiliary gear is not electrically powered or is powered by electrical motor primarily intended for other services, the main steering gear may be fed with one circuit from the main switchboard. Where any such electrical motor primarily intended for other services is arranged to power the auxiliary steering gear, the requirements of clauses (ii) and (iii) of this sub-rule may be waived if the protection arrangements are otherwise adequate.

(6) If, in any ship, the power supply for-

(i) an automatic sprinkler system which requires not less than two sources of power supply;

(ii) sea water pumps;

(iii) compressors; and

(iv) automatic alarms

is electrical, it shall be taken from the main generator sets and from an emergency source of electric power. One supply shall be taken from the main switchboard and another from the emergency switchboard by separate feeders reserved solely for that purpose. Such feeders shall be run to a changeover switch situated near the sprinkler unit and the switch shall normally be kept closed to the feeders from the emergency switchboard. The changeover switch shall be clearly marked and no other switch shall be fitted in these feeders.

(7) Motors shall be protected individually against overload and short circuit. All lighting circuits are to be provided with overload and short circuit protection.

159. Protection of Motors, pilot lamps, etc.

Protection shall be provided for voltmeters, voltage coils for measuring instruments, earth indicating devices and pilot lamps together with the connecting leads. The pilot lamp installed as an integral part of another item of equipment may not be individually protected except in the case of pilot lamps, a fault in the pilot lamps is likely to jeopardize the supply to essential equipment.

160. Switch gear

Circuit breakers and switches shall be of the air-break type. The over current releases of circuit breakers for generators and the setting of preference tripping relays shall be adjustable. The handles and operating mechanism of switch gear shall be so arranged that the hands of the operator cannot accidentally touch live metal parts or be injured through an arc arising from the switch or circuit breaker or the rupturing of a fuse.

161. Cables

(1) All metal sheaths and armour of cables shall be electrically continuous and shall be earthed.

(2) Where the cables are neither sheathed nor armoured, adequate precautions shall be taken to ensure that there is no risk of fire in the event of any electrical fault. All electric cables external to equipment shall be flame retardant and shall be installed so that their flame retarding or equivalent properties are not impaired. Installation of cables which do not comply with the foregoing for particular purposes, such as radio frequency cables, may be permitted if it can be shown that compliance would be impracticable.

(3) All electrical wiring shall be supported in such a manner as to avoid chafing and other injury.

(4) All joints in electrical conductors shall be made in suitable junction boxes except in the case of low voltage communication systems. All such junction and outlet boxes shall be so constructed as to prevent the spread of fire therefrom. The electrical, mechanical, flame retarding and, where applicable, fire resisting properties of the terminations and joints in any conductor shall be at least equivalent to those of the conductor.

(5) The insulation of cables shall be adequate for the purpose having regard to the location in which the cables are to be used. Under normal conditions, the rated operating temperature of insulating material shall be at least $10^{o}C$ above the ambient temperature of the space in which the cable is installed. Cables having differing temperature ratings shall not be bunched together.

(6) Cables exposed to mechanical damage in spaces such as cargo holds shall be suitably protected even if the cables are armoured. Where metal covering is provided it shall be protected against corrosion. Such coverings shall be suitably earthed.

(7) Cables passing through watertight bulkheads or compartments shall be encased in suitable watertight glands.

(8) Cables installed in refrigerating spaces shall have watertight and impervious sheath and shall be protected against damage.

(9) Cables passing through any hazardous areas or serving electrical equipment in such areas shall -

(a) be appropriate having regard to the dusts, gases or vapours to which they may be subjected; and

(b) unless they form part of intrinsically safe circuits be enclosed in a gas-tight steel conduit or include a metallic sheath braid or wire armour for earth leakage detection or be protected in some other satisfactory manner. additional protection against mechanical damage shall be provided in locations where such damage may occur.

(10) (a) Cables for alternating current supplies rated in excess of 20 amps, and of single core shall have armours of non-magnetic material;

(b) Cables belonging to the same circuit shall be installed in the same conduit, unless the conduit is of non-magnetic material;

(c) Two, three or four single core cables forming single and three phase circuits shall be in contact with each other as far as possible;

(d) Magnetic material and fittings shall be avoided as far as possible in close proximity with cables.

(11) Cables serving emergency services shall not so far as is practicable be routed through galleys, laundries, machinery spaces of Category A and their casings or other high risk areas except insofar as it is necessary to provide emergency services in such areas. Cables connecting fire pumps to the emergency switchboard shall be of a fire resistant type where they pass through high fire risk areas.

(12) Cabling for emergency alarms and public address systems fitted in ro-ro passenger ships shall be approved by the Director General .

(13) Cables serving emergency services shall where practicable be installed in such a manner as to preclude them being rendered unserviceable by the effect of a fire in an adjacent space and subsequent heating of the dividing bulkhead.

162. General electrical precautions against shock, fire and 0ther hazards.

(1) (a) All electrical equipment shall be so constructed and installed that there will be no danger or injury to any person handling it in a proper manner. Exposed metal parts of electrical equipment which are not intended to have a voltage above that of earth, but which may have such a voltage under fault conditions, shall be earthed unless such equipment is -

(i) supplied at a voltage not exceeding 50 volts direct current or 50 volts root mean square alternating current between conductors, hereinafter referred to as "RMS ac", from a source other than an auto-transformer;
(ii) supplied at a voltage not exceeding 250 volts RMS ac by safety isolating transformers supplying only one consuming device; or
(iii) of double insulation construction.

(b) All electrical apparatus shall be constructed and installed so that it will not cause injury when handled or touched in the normal manner. In particular when electrical lamps, welding equipment, tools or other apparatus are used in confined or damp spaces or spaces with large exposed conductive surfaces, special provision shall be made so far as is practicable, to ensure that the danger of electric shock is reduced to a minimum. Such spaces shall at least include open decks and machinery spaces.

(2) All electric fittings shall be so made as to prevent undue rise in temperature which may be injurious to the electrical wiring or which may result in a risk of fire.

(3) Every ship which is fitted with electric or electro-hydraulic steering gear shall be provided with indicators which will show when the power units are running. Such indicators shall be situated in suitable positions on the navigating bridge and in the machinery space or machinery control room.

(4) Distribution systems shall be so arranged that outbreak of fire in any main fire zone will not interfere with essential service in any other main fire zone. Main and emergency feeders passing through any main fire zone shall be separated as widely as practicable, both horizontally and vertically.

(5) Every electrical space heater forming part of the equipment of a ship shall be fixed in position and shall be so constructed as to reduce the risk of fire to a minimum. No such heater shall be constructed with an element so exposed that clothing, curtains or other material can be scorched or set on fire by heat from the element. The installations shall be so arranged as to prevent excessive heating of adjacent bulkheads or decks.

(6) No Electrical equipment shall be installed in any space where flammable mixtures are liable to collect, e.g. in compartments assigned principally to accumulator batteries, in paint lockers, acetylene stores or similar spaces unless the Director General is satisfied that such equipment is: -
(a) essential for operational or safety purposes;
(b) of a type which will not ignite the mixture concerned;

(b) of a type that is certified for use in the flammable dusts, gases or vapours to

which it may be subjected; and

(c) appropriate to the space concerned.

(7) All lighting and power circuits terminating in a cargo space shall be provided with a multiple pole switch outside the space for disconnecting all such circuits.

(8) In special category spaces the electrical equipment shall be certified for use in explosive petrol and air mixtures and the cables shall be appropriate for use in such mixtures; except that in such spaces above the bulkhead deck, electrical equipment that is enclosed and protected to prevent discharge of sparks may be used if installed more than 450 millimetres above any deck on which vapours may accumulate.

(9) In cargo spaces, other than special category spaces, intended for the carriage of motor vehicles with fuel in their tanks for their propulsion the electrical equipment shall be certified for use in explosive petrol and air mixtures and he cables shall be appropriate for use in such mixtures.

(10) In any ventilation trunk connected to any enclosed space for the carriage of motor vehicles with fuel in their tanks for their propulsion, including a special category space, electrical equipment shall be certified for use in explosive petrol and air mixtures and the cables shall be appropriate for use in such mixtures.

(11) (a) Electrical equipment and cables shall not be installed in enclosed cargo spaces, special category spaces or open ro-ro cargo spaces intended for the carriage of dangerous goods which are flammable liquids with a flash point below 23°C (Closed Cup Test) or flammable gases unless the Director General considers the location therein essential.

(b) If permitted, any electrical equipment installed in such spaces shall be certified for, and cables shall be appropriate for, use with the flammable dusts, gases or vapours to which it may be exposed.

(c) Cable penetrations of the decks and bulkheads of such spaces shall be sealed against the passage of gas or vapour.

(d) Electrical equipment and cables which do not comply with the foregoing for particular applications may be installed, provided such equipment and cables are capable of being electrically isolated by the removal of links or the operation of lockable switches.

163. Navigation lights

(1) Navigation lights shall be connected separately to a distribution board exclusively provided for this purpose, and connected directly, or through transformers, to the main or emergency switchboard. The distribution board shall be accessible to the officer on watch.

(2) Each navigation light shall be controlled and protected in each insulated pole by a switch and fuse or circuit breaker mounted on the distribution board. Each navigation light shall be provided with an automatic indicator giving audio and/or visual indication of failure of the light. If an alarm device alone is fitted, it shall be connected to a primary or secondary battery. If a visual signal is used, and such signal is connected in series with the navigation light, means shall be provided to prevent extinction of navigation light due to failure of the signal.

(3) Provision shall be made on the bridge for navigation lights to be transferred to an alternative circuit.

164.Rotating machines.

(1) Turbine D.C. generators arranged to run in parallel with other generators shall be

provided with a switch to each turbine which will open the generator circuit breaker when the over speed protective device of the turbine functions.

(2) The governor of an A.C. generating set shall be capable of adjustment of load to within 5 per cent of full load.

(3) Ship's generators including their exciters and all continuously rated motors shall be suitable for continuous duty at the full rated output at maximum cooling water or air temperatures for an unlimited period without undue temperature rise. All other generators and motors shall be rated in accordance with he duty standards adopted for their performance when tested under the designed load condition without excessive increase in temperature.

(4) All generators shall be such as will be able to withstand without injury an excess current of 50 per cent for 15 seconds after the normal running temperature is reached at fully rated value.

(5) Means shall be taken to ensure that the flow of current circulating between the shaft and bearings does not cause any ill effect.

(6) Large A.C. machines and propulsion motors shall be provided with suitably embedded temperature detectors.

165. D.C. generators.

(1) Automatic voltage regulators shall be provided for shunt wound D.C. generators.

(2) D.C. generators used for charging batteries without series regulating resistors shall be either

(a) shunt wound, or

(b) compound wound, and be so arranged that the series winding can be switched out of service.

(3) Means shall be provided at the switchboard to enable the voltage of any D.C. generator to be adjusted separately between no load and full load to within 1 per cent of the rated voltage.

(4) (a) The inherent regulation of generators shall be such that for shunt and stabilized shunt wound generators set at full load, the steady no load voltage shall not exceed 115 per cent of the full load value.

(b) The full load voltage shall be within 2.5 per cent of rated voltage for compound

wound generators, at full load operating temperature with the voltage at 20 per cent load being within 1 per cent of rated voltage.

(5) All D.C. generators shall be capable of delivering continuously the full load

current at the rated voltage when running at full load engine speed at all ambient temperature upto the maximum specified temperature.

(6) All D.C. generators required to run in parallel shall be stable from no load to the full total combined load with satisfactory load sharing.

(7) The series winding of two wire generators shall be connected to the negative terminal.

166. A.C. generators.

(1) Each alternating current service generator, unless of the self-regulating type, shall be operated in conjunction with a separate automatic voltage regulator.

(2) The voltage regulation of any A.C. generator with its AVR shall be such that at all loads, from no load to full load, the rated voltage at the rated power factor is maintained within the range of 2.5 per cent, plus or minus.

(3) Alternating current systems shall be such that when one generator is out of action, the remaining set(s) shall have sufficient reserve capacity to permit the starting of the largest motor in the ship without causing any motor to stall or any device to fail due to excessive voltage drop.

(4) Alternating current generators required to run in parallel shall be stable from 20 per cent load to full load with satisfactory load sharing.

167. Batteries

(1) Alkaline batteries and lead-acid batteries shall not be installed in the same compartment.

(2) Large batteries shall be installed in a space assigned to the batteries only.

(3) Batteries intended for starting engines, etc. shall be loaded as close as possible to the engines. The compartments in which batteries are located shall be well ventilated without any means of closing ventilators. Any light fitted in such compartments shall be of an inherently safe type.

(4) Where acid is used as an electrolyte, the battery trays or boxes shall be lined with lead. Alternatively, the deck below the battery cells may be protected with lead or other acid resisting material.

(5) Switches, fuses and other electrical equipment liable to are shall not be fitted in any battery compartment.

(6) Battery used for starting main engines shall comprise of at least two batteries of such combined size as to be capable of giving the main engine not less than twelve consecutive starts if the engine is of the reversible type and not less than six consecutive starts if the engine is of the non-reversible type.

(7) Adequate facilities for charging batteries shall be provided and shall be fitted with the necessary fittings and protected against reversal of current.

(8) Batteries shall be protected against short circuit by a fuse in each insulated conductor or a multiple pole circuit breaker at a position adjacent but outside the battery compartment.

(9) Where batteries supply the emergency source of power, the voltage drop shall not exceed 12.5 per cent of the nominal rated voltage and the voltage variation of the batteries shall be within plus 10 per cent and minus 12.5 per cent from fully charged to completion of full performance of its duty at one-half hour discharge rate.

(10) Batteries intended as emergency source of power shall be separate and distinct from batteries intended for other purposes and shall not be used for any purpose other than emergency power.

168. Spare parts and tools

Every ship shall be provided with an adequate quantity of replacements for those parts of the ship's electrical equipment and installations which, having regard to the intended service of the ship, it would be essential for the safety of the ship and of persons on board to replace in the event of failure while the ship is at sea, together with such tools as are necessary for the fitting of these replacements.

CHAPTER 5

Boilers and Machinery

169. General

(1) This part applies to every ship of Classes I to VII.

(2) In every ship the machinery, boilers and other pressure vessels, associated piping systems and fittings shall be of a design and construction adequate for the service for which they are intended and shall 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 surfaces and other hazards. The design shall have regard to the materials used in construction including design standards, material specifications, and certification etc, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

(3) Where main or auxiliary machinery including pressure vessels or any parts of machinery referred to under sub-rule 169(2) are subject to internal pressure and may be subject to dangerous overpressure, means shall be provided where practicable to protect against such excessive pressure.

(4) Where main or auxiliary machinery or any parts of such machinery are subject to internal pressure, those parts shall, before being put into service for the first time, be subjected to hydraulic test to a pressure not less than 1.5 times the maximum allowable working pressure or to a pressure suitably in excess of the working pressure having regard to -

(a) the design and the material of which they are constructed;

(b) the purpose for which they are intended to be used; and

(c) the working conditions under which they are intended to be used;

and such parts shall be maintained in an efficient condition.
Every such main or auxiliary machinery or any part thereof which has been subjected to hydraulic pressure in accordance with this sub-rule shall be capable of withstanding such test at any time thereafter.

(5) Where the arrangements of the main propulsion machinery are unconventional and without a known history of satisfactory service the Director General may require a separate source of propulsion power to be provided sufficient to give the ship a navigable speed.

(6) The main and auxiliary machinery essential for the propulsion and overall safety of the ship shall be provided with effective means of control.

(7) Suitable starting arrangement shall be provided in order that the machinery may be capable of being brought into operation when initially no power is available on board.

(8) For all ships, new installation of materials which contain asbestos shall be prohibited except for:

(a) vanes used in rotary vane compressors and rotary vane vacuum pumps;

(b) watertight joints and linings used for the circulation of fluids when, at high temperature (in excess of 350ºC) or pressure (in excess of 7 x 10_6 Pa), there is a risk of fire, corrosion or toxicity; and

(c) supple and flexible thermal insulation assemblies used for temperatures above 1000ºC.

170. Boilers and other pressure vessels.

(1) Every boiler and every unfired steam generator shall be provided with atleast two safety valves. Provided that the Director General may, having regard to the output and other features of any boiler or unfired steam generator, permit only one safety valve to be fitted if it is satisfied that adequate protection against over pressure is thereby provided.

(2) Every boiler or other pressure vessel and its respective mountings shall, before being put into service for the first time, be subjected to appropriate testing including a hydraulic test to a pressure of not less than 1.5 times the maximum allowable working pressure:

which will ensure that the boiler or other pressure vessel and its mountings are adequate in strength and design for the service for which it is intended and having regard to -

(a) the design and the material of which it is constructed;

(b) the purpose for which it is intended to be used; and

(c) the working conditions under which it is intended to be used;

and every such boiler or other pressure vessel and its respective mountings shall at any time thereafter be capable of withstanding such a test and shall be maintained in an efficient condition.

Provided that the Director General may permit any other method of testing of any boiler or pressure vessel design for its intended purpose to be substituted for the hydraulic test, if it is shown to its satisfaction that such method is at least as effective as the hydraulic test.

(3) Provision shall be made to facilitate the cleaning, inspection and maintenance of all boilers and pressure vessels.

171. Boiler water level indicators

(1) Every boiler shall have atleast two independent means of indicating the water level, one of which shall be a glass water gauge and the other an additional glass water gauge or an approved equivalent water line indicator.

(2) Single ended boilers shall have two water level indicators fitted one on each side of the boiler. Double ended boilers shall have four water level indicators, one indicator being in position on each side of each end of the boiler.

(3) Each oil fired water tube boiler shall be fitted with a water level detection system which will operate audible and visible alarms and shut off automatically the oil supply to the burners when the water level falls below a safe level.

(4) Water tube boilers serving turbine machinery shall be fitted with a high water level alarm.

(5) Every oil fired boiler which is not continuously attended shall be provided with arrangements to shut off the fuel supply and give an alarm at an attended location to satisfy the requirement under sub-rule 181(6).

172. Requirements of machinery

I. General

(1) In every ship main or auxiliary machinery essential for the propulsion and safety of the ship shall be provided with effective means for its operation and control.

(2) Access shall be provided to facilitate the cleaning, inspection and maintenance of main propulsion and auxiliary machinery.

(3) In every ship means shall be provided whereby the normal operation of propulsion machinery can be sustained or restored when there is a breakdown of -

(a) a generating set which serves as a main source of electrical power;

(b) the sources of steam supply;

(c) the boiler feed water systems;

(d) the fuel oil supply systems for boilers and engines;

(e) the sources of lubricating oil pressure;

(f) the sources of water pressure;

(g) a condensate pump and the arrangements to maintain vacuum in condensers;

(h) the mechanical air supply for boilers;

(i) an air compressor and receiver for starting or control purposes;

(j) the hydraulic, pneumatic or electrical means for control of main propulsion machinery including controllable pitch propeller; or

(k) any other auxiliary system essential for propulsion.

A partial reduction in propulsion capability from normal operation may be permitted if it can be shown that the safety of the ship will not be impaired.

(4) In any ship the main propulsion machinery and all auxiliary machinery essential to the propulsion and the safety of the ship shall be designed to operate when the ship is upright and when inclined at any angle of list up to and including 15 degrees either way under static conditions and 22.5 degrees either way under dynamic conditions (rolling) and simultaneously inclined dynamically (pitching) 7.5 degrees by bow or stern. The Director General may permit deviation from these angles, taking into consideration the type, size and service conditions of the ship.

(5) Non-metallic expansion joints in piping systems, if located in a system which penetrates the ship's side and both the penetration and the non-metallic expansion joint are located below the deepest load waterline, shall be inspected as part of the surveys and replaced as necessary, or at an interval recommended by the manufacturer.

(6) Operating and maintenance instructions and engineering drawings for ship machinery and equipment essential to the safe operation of the ship shall be written in a language understandable by those officers and crew members who are required to understand such information in the performance of their duties.

(7) Location and arrangement of vent pipes for fuel oil service, settling and lubrication oil tanks shall be such that in the event of a broken vent pipe this shall not directly lead to the risk of ingress of seawater splashes or rainwater. Two fuel oil service tanks for each type of fuel used on board necessary for propulsion and vital systems or equivalent arrangements shall be provided on each new ship, with a capacity of at least 8 h at maximum continuous rating of the propulsion plant and normal operating load at sea of the generator plant.

II. Machinery

(1) In every such ship the propulsion machinery systems shall be designed, constructed and installed so that undue stress due to vibration is not induced during normal operation.

(2) All gearing and every shaft and coupling used for transmission of power for the propulsion and safety of the ship or for the safety of persons on board shall be so designed and constructed that they will withstand the maximum working stresses to which they will be subjected in all service conditions taking into account the type of engines by which these components are driven or of which they form part.

(3) Main turbine propulsion machinery and, where applicable, main internal combustion propulsion machinery and auxiliary machinery shall be provided with automatic shutoff arrangements in the case of failures such as lubricating oil supply failure which could lead

rapidly to complete breakdown, serious damage or explosion. The Director General may permit provisions for overriding automatic shutoff devices.

(4) In every ship each internal combustion engine having a cylinder diameter of 200 millimetres or greater, or a crankcase volume of 0.6 cubic metres or greater, shall be provided with crankcase explosion relief valves of a suitable type having sufficient area to relieve abnormal pressure in the crankcase. Each explosion relief valve shall be arranged or provided with means to ensure that any discharge from it is so directed as to minimize the possibility of injury to personnel.

III. Means of going astern

(1) Every ship shall have sufficient power for going astern to secure proper control of ship in all normal circumstances. Astern power in ships of Classes I to VI shall generally be not less than 60 per cent of the ahead power. The main propulsion and machinery arrangement shall be such that the propulsion of the ship can be reversed with sufficient speed to enable the ship to be handled properly.

(2) The ability of the machinery to reverse the direction of thrust of the propeller in sufficient time, and so to bring the ship to rest within a reasonable distance from maximum ahead service speed, shall be demonstrated and recorded.

(3) The stopping times, ship headings and distances recorded on trials, together with the results of trials to determine the ability of ships having multiple propellers to navigate and manoeuvre with one or more propellers inoperative, shall be recorded. The results of such trials shall be available on board for the use of the master or designated personnel.

(4) Where the ship is provided with supplementary means for manoeuvring or stopping, the effectiveness of such means shall be demonstrated and recorded as referred to in rules 172.III(2) and 172.III(3).

173. Remote control of propulsion machinery

(1) Main and auxiliary machinery essential for the propulsion, control and safety of the ship shall be provided with effective means for its operation and control. All control systems essential for the propulsion, control and safety of the ship shall be independent or designed such that failure of one system does not degrade the performance of another system.

(2) Where remote control of propulsion machinery from the navigation bridge is provided, the following shall apply :

(a) the speed, direction of thrust and, if variable, the pitch of the propeller shall be fully controllable from the navigation bridge under all sailing conditions, including manoeuvring ;

(b) the control shall be performed by a single control device for each independent propeller, with automatic performance of all associated services, including, where necessary, means of preventing overload of the propulsion machinery. Where multiple propellers are designed to operate simultaneously, they may be controlled by one control device ;

(c) the main propulsion machinery shall be provided with an emergency stopping device on the navigation bridge which shall be independent of the navigation bridge control system ;

(d) propulsion machinery orders from the navigation bridge shall be indicated in the main machinery control room and at the manoeuvring platform.

(e) remote control of the propulsion machinery shall be possible only from one location at a time ; at such locations interconnected control positions are permitted. At each location there shall be an indicator showing which location is in control of the propulsion machinery. The transfer of control between the navigation bridge and machinery spaces shall be possible only in the main machinery space or the main machinery control room. This system shall include means to prevent the propelling thrust from altering significantly when transferring control from one location to another ;

(f) it shall be possible to control the propulsion machinery locally, even in the case of failure in any part of the remote control system. It shall also be possible to control the auxiliary machinery, essential for the propulsion and safety of the ship, at or near the machinery concerned.

(g) the design of the remote control system shall be such that in case of its failure an alarm will be given.

(h) Unless the Director General considers it impracticable the preset speed and direction of thrust of the propellers shall be maintained until local control is in operation ;

(i) indicators shall be fitted on the navigation bridge, the main machinery control room and at the manoeuvring platform, for :

(i) propeller speed and direction of rotation in the case of fixed pitch propellers ; and
(ii)propeller speed and pitch position in the case of controllable pitch propellers.

(j) an alarm shall be provided on the navigation bridge and in the machinery space to indicate low starting air pressure which shall be set at a level to permit further main engine starting operations. If the remote control system of the propulsion machinery is designed for automatic starting, the number of automatic consecutive attempts which fail to produce a start shall be limited in order to safeguard sufficient starting air pressure for starting locally.

(k) Automation systems shall be designed in a manner which ensures that threshold warning of impending or imminent slowdown or shutdown of the propulsion system

is given to the officer in charge of the navigational watch in time to assess navigational circumstances in an emergency. In particular, the systems shall control, monitor, report, alert and take safety action to slow down or stop propulsion while providing the officer in charge of the navigational watch an opportunity to manually intervene, except for those cases where manual intervention will result in total failure of the engine and/or propulsion equipment within a short time, for example in the case of overspeed.

(3) Where the main propulsion and associated machinery, including sources of main electrical supply, are provided with various degrees of automatic or remote control and are under continuous manual supervision from a control room the arrangements and controls shall be so designed, equipped and installed that the machinery operation will be as safe and effective as if it were under direct supervision. Particular consideration shall be given to protect such spaces against fire and flooding.

(4) In general, automatic starting, operational and control systems shall include provisions for manually overriding the automatic controls. Failure of any part of such systems shall not prevent the use of the manual override.

Requirements for Steam Turbines

174. General

(1) Plates, castings and forging and pipes used in the construction of all turbine cylinders, rotors, discs couplings and other important components shall be of suitable composition.

(2) Materials used for high temperature applications shall be satisfactory from the point of view of creep strength, corrosion resistance and scaling properties at high temperature to ensure satisfactory performance under service conditions. Ordinary cast iron shall not be used for temperatures exceeding 220^{O}C.

175. Design and construction

(1) The design and arrangement of turbine machinery shall be such as to ensure that adequate provision for expansion of the various parts is made to meet all normal operating conditions.

(2) Indicators shall be provided for determining the axial position of the rotors relative to the casings and for showing the longitudinal expansion at the sliding feet of the turbine.

(3) Pipes and ducts shall be connected to the turbine casings in such a way that no excessive thrust loads are applied to the turbines.

(4) Gland sealing systems of self-draining type shall be provided and precaution shall be taken to ensure that the condensed steam does not re-enter the gland. The steam supply to the gland shall be fitted with an efficient drain trap.

(5) Turbine bearings shall be so located and supported that lubrication of the bearings is not adversely affected by heat from the adjacent parts of the turbine. Means shall be provided for preventing oil from reaching the glands and the casings.

(6) All rotors finished bladed and completed are to be balanced dynamically.

176. Governors and safety arrangements

(1) Every steam turbine shall be fitted with an over speed governor so as to shut off steam automatically when the speed exceeds 15 per cent of the maximum design speed. A hand trip gear shall also be provided for this purpose.

(2) Means shall be provided which will automatically shut off the steam to ahead turbine in the event of any failure of the lubricating system. The system however should not hamper supply of steam to astern turbines for stopping the machinery quickly.

(3) Auxiliary turbines intended for driving electrical generators shall be fitted with speed governors and adjusted to comply with the following requirements, namely :-

(i) 10 per cent momentary variation and 5 per cent permanent variation in speed when full load is suddenly put on or taken off; and

(ii) For any A.C. installation, a permanent variation in speed of the machines intended for parallel operation which shall be within the tolerance of plus or minus 0.5 per cent.

(4) Relief valves shall be provided at the exhaust end or other suitable positions of all main turbines and the discharge outlets shall be clearly visible and suitably guarded, where necessary.

(5) Non-return valves or other suitable means which will prevent steam and water returning to the turbines shall be fitted in bled steam connections.

(6) In single screw ships fitted with turbines having more than one cylinder, the arrangements shall be such that steam can be led direct to the LP turbine and either the H.P. or LP turbine can exhaust directly to the condenser. Adequate arrangements and controls shall be provided for these emergency conditions so that the pressure and temperature of the steam can be so controlled as not to be injurious to the turbines or condenser.

177. General requirements for oil engines

(1) The fuel oil supplied for use in oil engines for main propulsion or for driving electrical generators, except emergency generators, shall have a flash point of not less than 60^{O}C (Close cup test) :

Provided that the Director General may permit use of oil of flash point of less than 60^{o}C but not less than 43^{o}C subject to the condition that the arrangements in the system are such as to ensure that the temperature of the space in which such fuel is used or stored will never reach to such level as to be within 10^{O}C below the flash point of the oil.

(2) Relief valves shall be fitted to each cylinder cover of over 200 mm. in diameter. The discharge from the relief valves shall be so directed as not to be harmful to those in attendance. The relief valves shall be adjusted to not more than 20 per cent in excess of the maximum design cylinder pressure.

(3) All generating sets shall be installed with their axis of rotation on the fore and aft direction. The lubrication shall be efficient at all running speeds with the ship listed to any angle upto 15^{O} and with a trim of 10^{o} when rolling $22\text{-}1/2^{O}$ from the vertical.

(4) With direct reversing engines the reversing gear shall be such that when operated from ahead to astern or vice-versa there shall be no possibility of the propelling machinery continuing to run in a direction contrary to that corresponding to the position of the reversing gear. For this purpose, in addition to inter-locking arrangement audible and visible alarms shall be fitted.

Pressure Piping Systems

178. Steam pipe systems

(1) In every ship, each steam pipe and fitting connected thereto through which steam may pass shall be so designed and constructed as to withstand the maximum working stresses to which it may be subjected with a factor of safety which is adequate having regard to:-

(i) the material of which it is constructed; and

(ii) working conditions under which it may be used.

(2) Every steam pipe and fitting shall, before being put into service for the first time, be subjected to a test to a hydraulic pressure of not less than twice the maximum allowable working pressure. Such pipes and fittings shall at any time thereafter be capable of withstanding such a test.

(3) Provisions shall be made to avoid excessive stresses in any steam pipe due to expansion and contraction resulting from variation of temperature vibration or other causes.

(4) Efficient means shall be provided for draining and supporting steam pipes. The drainage arrangement shall be such that pipes will be kept clear of water and the possibility of water hammer action is avoided under all conditions likely to arise in service.

(5) Steam and exhaust pipes to steering gear, winches and similar equipment shall not pass through passages or crew accommodation or spaces which may be used for cargo:

Provided that the Director General may permit passing of such pipes through passage ways forming part of the accommodation if the pipes are properly lagged or encased and comply with the following requirements, namely :-

(i) the pipes are constructed of solid drawn steel;

(ii) the pipes and flanges are of scantling suitable for the maximum steam pressure;

(iii) all connections in the pipes are by face to face flanges properly jointed; and

(iv) adequate drainage arrangements are fitted.

(6) Valves and fittings intended either for steam pressure above 10.5 kg. per cm^2 or temperature above 220°C shall be of steel or other approved material.

(7) If a steam pipe is likely to receive steam from any source at a higher pressure than it can withstand with an adequate factor of safety, an efficient reducing valve, relief valve and pressure gauge shall be fitted to such pipe.

179. Boiler feed systems

(1) Two or more feed pumps of sufficient capacity shall be provided to feed the boilers under full load condition when any one of the pumps is out of action. Feed pumps may be worked from the main engine or may be independently driven :

Provided that atleast one of the pumps so provided is of an independent type of adequate capacity.

(2) Independent feed pumps required for feeding the boilers shall be fitted with automatic regulators for controlling their output. Where only one independent pump is provided, a standby feed pump shall also be provided as a second means of feed to the boilers.

(3) Feed pumps shall be provided with valves or cocks interposed between the pump and the suction and discharge pipes so that any pump can be opened up for overhaul or inspection while the other pumps are in operation.

(4) One of the independent feed pumps shall be provided with an emergency suction to the sea:

Provided that such suction may be omitted if large reserve feed tanks are provided and an evaporator of adequate capacity is fitted.

180. Feed water filter

Filters shall be provided for continuous filtration of the boiler feed water.

181. Boiler Feed arrangement

(1) Every boiler shall have atleast two efficient and separate feed systems, each with its own check valve. Check valve chests should, in general, be attached directly to the boiler with a stop valve fitted in each chest or between the chest and boiler so that either of the feed systems may be examined while other feed system is in operation.

(2) In water tube boilers, atleast one of the feed systems shall be fitted with an approved apparatus whereby the feed supply can be automatically controlled. The feed check valve should, where necessary, be fitted with efficient gearing for effective control from the boiler room floor or other convenient position.

(3) Feed water heaters, filters and fittings between the pumps and the boiler shall be constructed to a working pressure 25 per cent in excess of the boiler pressure or the auxiliary pressure of feed line to which it may be subjected, whichever is the greater.

(4) An efficient relief valve suitably adjusted shall be fitted to prevent over-pressure in any part of the feed systems. The relief valve should be such that it cannot be readily overloaded.

(5) In ships fitted with closed feed systems, means shall be provided for automatic cutting off of steam from the main engines before over-pressure occurs in the condenser. Such means should be so designed as to operate without manual supervision.

(6) In every ship where oil fired boilers are fitted there shall be provided an automatic boiler low level alarm and an automatic boiler low level shut off valve in the fuel supply pipe to the furnace fronts. Alarms shall also be provided to indicate failure of air supply or flame.

(7) Every feed check valve, fitting or pipe shall, before being put into service for the first time, be subjected to a test by hydraulic pressure to two and a half times the maximum working pressure of the boiler to which it is connected or to twice the maximum working pressure of the feed line, whichever is the greater. All feed pipes shall be adequately supported.

(8) If it is possible for oil or other contaminants to enter the feed water system of a boiler, the arrangements for supplying boiler feed water shall provide for the interception of oil and contaminants in the feed water.

(9) In every ship in which boilers are fitted provision shall be made to ensure that a supply of suitable reserve feed water is available, having regard to the nature and intended duration of the voyage.

(10) Boilers shall be provided with means to supervise and control the quality of the feedwater.

182. Compressed air starting systems

(1) In every ship in which machinery essential for the propulsion and safety of the ship or of persons on board is required to be started, operated or controlled solely by compressed air, there shall be provided at least two air compressors. Such compressors shall be of efficient design and of sufficient strength and capacity for the service for which they are intended:

Provided that in ships of Class VII only one such compressor may be provided.

(2) (a) In every ship of Class I, II, III, IV, V and VI the main engine to be started by compressor air, there shall, in addition to two air compressors required by sub-rule (1), be provided a starting air compressor which can be put into operation without any external aid and which is capable of operating when no other power units are working or no compressed air is available. For this purpose, such air compressor shall be capable of being driven by a hand-starting oil engine.

(b) Every ship of Class VII of 500 tons and upwards shall be provided with atleast one starting air compressor complying with the requirements of clause (a).

(3) (a) In ships of Classes I, II, III, IV, V and VI, there shall be fitted atleast two starting air receivers of such aggregate capacity as will be sufficient for starting-

(i) each reversible type main engine for atleast twelve times; and

(ii) each non-reversible type main engine for atleast six times.

(b) Ships of Class VII shall be fitted with atleast one starting air receiver complying with the requirements of clause (a).

183. Air compressor

(1) An efficient relief valve shall be fitted in the high pressure discharge from each air compressor. The relief valve shall be of such size and so set that the maximum accumulation of pressure does not exceed the working pressure by more than ten per cent in a condition where the working pressure by more than ten per cent in a condition where the compressor discharge valve is closed and the compressor is running normally.

(2) An efficient relief valve or safety diaphragm shall be fitted on the casing of the high pressure air cooler to provide ample relief in the event of a high pressure air tube bursting.

(3) Efficient means for draining of water and oil shall be fitted in the interstage and final discharge pipe of air compressors.

(4) Cylinders of air compressors shall be tested by hydraulic pressure to twice the maximum working pressure. Cooling coils and tubular coolers for each stage shall be tested by hydraulic pressure to twice the maximum pressure of that stage. The cooling passages of air compressor and cooler casing shall be tested by hydraulic pressure to 2.2 kg. per cm^2.

184. Starting air receiver

(1) Starting air receivers shall be provided with adequate means of access for the purpose of inspection and cleaning.

(2) Such air receivers shall be provided with efficient drainage and protected by relief valves suitably loaded and positioned to avoid any possibility of over-pressure. Any air receiver which can be isolated from the relief valve shall be fitted with one or more fusible plugs to discharge the contents of the receiver in case of fire.

(3) Rivetted air receivers and their dished ends shall comply with the requirements for rivetted boilers and un-stayed dished ends and fusion welded receivers shall comply with the requirements for fusion welded pressure vessels.

(4) All air receivers shall be tested by hydraulic pressure to 1.5 times the maximum working pressure when the maximum working pressure is over 7 kg. per cm^2 and twice the

maximum working pressure when the maximum working pressure is less than 7 kg. per cm^2.

185. Air pressure pipes and fittings

(1) All air pressure pipes shall be properly supported and provision shall be made to keep the interior of every pipe free from the oil which will either prevent the passage of flame from the cylinder of the engine to the pipe or to protect the pipe from the effect of an internal explosion.

(2) The starting air pipe system to main and auxiliary engines shall be entirely separated from the compressor discharge system and shall be served by stop valves on the air receivers. All discharge pipes from air compressors shall lead directly to starting air receivers.

(3) If an air pressure pipe is likely to receive air from any source at a higher pressure than it can withstand with an adequate factor of safety, an efficient reducing valve, relief valve and pressure gauge shall be fitted to such pipe.

(4) Every air pressure pipe or fitting in the system shall, before being put into service for the first time, be subjected to hydraulic test to twice its maximum pressure. After commissioning into service, it shall always be maintained in an efficient condition.

186. Engine cooling water systems

(1) Engine cooling water systems which are required for supply of cooling water to the oil

coolers, fresh water coolers or condensers shall be adequate and shall comply with the requirements of sub-rule (2), (3), (4), (5) and (6).

(2) Each system including the connected water passages shall be arranged to avoid air pockets as far as possible. Air cocks shall be provided for purging the system of air. Suitably placed openings shall be provided in the water spaces for cleaning and inspection.

(3) Means shall be provided for ascertaining that the system is in order and for maintaining passage of sufficient water through each part which requires to be cooled. Arrangements shall be provided for preventing over-pressure in any part of the system.

(4) Ships propelled by steam machinery or having steam auxiliaries shall, in addition to the arrangement for normal supply of circulating water, have an adequate alternative supply.

(5) Ships propelled by internal combustion machinery or having internal combustion machinery shall comply with the following requirements, namely:

(i) atleast two cooling water pumps shall be fitted each of which shall be capable of providing an adequate supply of sea water to the machinery, auxiliary engines, oil coolers and fresh water coolers connected thereto:

Provided that ships of Class VII may be fitted with only one such cooling water pump.

(ii) In ships of Class I to VI fitted with fresh water cooling system, the fresh water pumping arrangement shall be such that adequate supply of fresh water will be maintained and an adequate alternative supply of cooling water will be available, except in the case of an emergency generator, from a stand-by pump.

(iii) An emergency connection to a sea water pump shall be provided.

(iv) Where the direct sea water cooling is employed, suitable suction strainers shall be fitted. These strainers shall be capable of being cleaned without interruption of water supply.

(v) There shall be provided not less than two sea inlets for the sea water cooling pump, one for the main pump and the other for the stand-by pump.

(vi) Exhaust manifolds, pipes and silencers shall be efficiently cooled or adequately lagged save where such lagging is unnecessary, as in the case of funnel casings.

(6) In the selection of materials for engine cooling systems where sea water is used, precautions shall be taken to avoid the use of metals which may give rise to galvanic corrosion.

187. Lubricating oil pumps

(1) (a) In every ship in which oil is circulated under pressure for lubrication, heating or cooling or as the sole means of control of machinery essential for the propulsion or safety of the ship or persons on board, at least two pumps shall be provided each of which shall be adequate for circulating such oil.

Provided that in ships of Class VII only one such pump may be fitted.

(b) Each of such pumps shall be adequate for circulating oil.

(c) Where each main engine has its own lubricating oil pump, a stand-by lubricating oil pump shall also be fitted. Such stand-by pump shall be of adequate capacity so as to be able to circulate necessary oil when one of the lubricating oil pumps is out of action.

(2) Suitable lubricating oil strainers shall be provided which shall be capable of being cleaned without interrupting the supply of oil.

(3) Means shall be provided for ascertaining whether the lubricating oil system is working properly and for preventing over-pressure in any part of the system. Where relief valves are fitted for relieving over-pressure, they shall be in closed circuit.

(4) In ships of Classes I, II, III, IV, V and VI, an audible alarm shall be fitted to the lubricating oil system which will give warning when the pressure of oil supply to the engines falls below a pre-determined level. Alarms shall be actuated from the outlet side of the oil filters, coolers etc.

(5) Oil level indicators fitted to lubricating oil storage tanks or service tanks shall be of such type that does not require the piercing of the lower part of the ship so that, in the event of

damage, there would be no spillage and, in the event of fire, the contents of the tank would not add to the outbreak.

(6) In ships of Classes I, II, III, IV, V and VI propelled by turbine or turbo-electric machinery, the lubricating oil arrangements shall be such that an emergency supply of oil is available in sufficient quantity to maintain adequate lubrication for not less than six minutes. Such emergency supply shall automatically come into use when the supply of lubricating oil from the pump or pumps fails. A system of employing a gravity tank may be acceptable for this purpose.

(7) Arrangements for lubricating bearings and for draining crank cases and oil sumps shall be so designed that the lubrication will be efficient with the ship inclined from the up-right at any angle upto 15^{o} and when pitching 10^{o} longitudinally or rolling upto 22.5^{o} from the vertical.

188. Crank case safety arrangements

(1) In crank cases of forced lubrication engines in which oil spray and mist is normally present, means shall be provided to prevent danger from the resultant explosion.

(2) The crank cases and inspection doors shall be of robust construction and the attachment of the doors shall be substantial.

(3) There shall be fitted to crank doors of each cylinder and to any associated gearing one or more non-return valves designed to relieve the crank case of any abnormal pressure. The valves shall be quick-acting and self-closing and shall open at a pressure of not more than 0.2 kg/cm^2.

(4) The valves shall be so placed that any flame discharged by explosion will be shielded from those on duty and will not endanger anyone in the vicinity. Engines having cylinders of not more than 300 mm bore and having strong crank case doors shall have relief valves at the end of the crank cases:

Provided that engines having cylinders of less than 200 mm bore or a crank case volume of less than 0.6 cubic metres may not be fitted with relief valves.

(5) The total clear area to the relief valves shall be not less than $115/cm^2$ per cubic metre of the gross volume of the crank case.

(6) Lubricating oil pipes from engine to the sump shall be submerged at the outlet ends. In multi-engine installations, drain pipes or vent pipes shall be so arranged that the flame of an explosion cannot pass from one engine to another.

(7) Where crank case vent pipes are fitted, they shall be as small as practicable so as to minimise the in-rush of air after an explosion. Vents from crankcases of main engines shall be led to a safe position on deck. In large engines having more than six cylinders, a diaphragm shall be fitted at about mid length to prevent the passage of flame.

(8) To reduce explosion hazards, ships may, as far as practicable, be fitted with

(a) alarms giving warning of over-heating of running parts of any engine;

(b) smoke detectors in crankcases; and

(c) suitable means for reduction of heat in crank cases.

(9) Where interior lighting is provided in crank cases, it shall be flame-proof and no wiring shall be fitted inside the crank cases.

189. Shafting

(1) All gearing and every shaft and coupling used for transmission of power of machinery essential for the propulsion and safety of the ship or persons on board shall be so designed and constructed that it would withstand the maximum working stresses to which it may be subjected in all service conditions having regard to-

(a) the material of which it is constructed;

(b) the service for which it is intended; and

(c) the type of engine by which it is driven or of which it forms a part.

(2) Effective measures shall be adopted to avoid undue stresses being induced in the shafting system due to excessive vibration.

(3) Calculation with respect to vibrations of the engines and shafting systems shall be submitted to the Director General for previous approval.

Oil Fuel Installations

190. Oil fuel

Oil fuel used on boilers and machinery other than that used in an emergency generator, shall have a flash point of not less than 60^{o}C (close-cup test). The flash point of oil fuel for emergency generators shall be not less than 43^{o}C :

The use of oil fuel having a flashpoint of less than 60°C but not less than 43°C may be permitted subject to the following:

(i) fuel oil tanks except those arranged in double bottom compartments shall be located outside the machinery spaces of category A;

(ii) provisions for the measurement of oil temperature are provided on the suction pipe of the oil fuel pump;

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

(iv) pipe joints of welded construction or of circular cone type or spherical type union joint are applied as much as possible;

191. Plans and particulars of oil fuel arrangements

Detailed plans of the oil fuel storage tanks, settling tanks, overflow tanks and daily service tanks which are built into the ship's structure shall be submitted for previous approval of the Director General . The plans showing the following particulars and details shall also be submitted for previous approval of the Director General :-

(i) the position of storage, settling and service tanks;

(ii) the filling and relief arrangements;

(iii) the air, overflow, sounding and pumping systems including the means of isolating oil from water ballast and the remote control required for valves;

(iv) arrangements of gutterways, coamings, save-alls, and screens;

(v) arrangements of oil fuel units, pipes and fittings and the design of filters and heaters; and

(vi) arrangement of oil fired galleys.

192. Storage of oil fuel

(1). In every ship in which oil or gaseous fuel is used in engines or boilers for the propulsion or safety of the ship, the arrangements for the storage, distribution and utilization of the fuel shall be such that the effective use of the engines can be maintained under all conditions likely to be met by the ship in service;

(2). In every ship in which oil or gaseous fuel is used, the arrangements for the storage, distribution and utilization of the fuel shall be such that, having regard to the hazard of fire and explosion which the use of such fuel may entail, the safety of the ship and of persons on board is preserved.

(3). Every oil fuel installation which serves a boiler supplying steam for the propulsion of the ship shall include not less than two oil fuel units.

(4) (a) Oil fuel may be carried in double bottom tanks under the machinery spaces and under holds and in, deep tanks and other tanks which are suitably constructed.

(b) Oil fuel tanks shall not be situated directly above boilers or other heated surface nor should they be situated abreast boilers unless suitable arrangements are made to shield the tanks from the heat. Oil tanks which overhang boilers shall be efficiently shielded from the heat and arrangements to prevent dripping of oil on the boilers shall be adequate.

(5) Oil fuel tanks shall be part of the ship's structure and shall be located outside machinery spaces of Category A. When oil fuel tanks, except double bottom tanks, are necessarily located adjacent to or within machinery spaces of Category A at least one of their vertical

sides shall be contiguous to the machinery space boundaries and, if practicable, they shall have a boundary common with the double bottom tanks. The area of the tank boundary common with the machinery space shall be kept to a minimum. Any oil fuel tank located within the boundaries of machinery spaces of Category A shall not contain fuel having a flash point of less than 60 degrees C. In general, the use of free-standing oil fuel tanks is to be avoided. When such tanks are employed their use is prohibited in category A machinery spaces. Where it is impracticable to meet the requirements of this sub-rule, the Director General may permit other arrangements.

(6) Double bottom compartments used for oil fuel storage shall be fitted with watertight centre divisions except in narrow tanks at the forward and after ends of ships. In other storage tanks, suitable wash plates shall be fitted, as necessary.

(7) Oil fuel shall not be carried in forepeak tanks.

(8) Where fresh water is stored in a tank adjacent to an oil tank, a cofferdam shall be fitted to prevent contamination of water.

(9) All oil fuel tanks shall be provided with save-alls, gutters or cofferdams to prevent the spread of any leaking oil. Gutters should drain into sumps or wells.

(10) In ships trading in cold climates where oil is likely to become viscous, there shall be provided in the storage tanks heating coils or other suitable means to ensure free flow of oil through the pipes at all times.

(11) Where oil tanks are adjacent to cargo holds or where the double bottom tanks in the cargo holds are used for the storage of oil fuel, efficient means shall be provided by wells and gutters to prevent leaking oil coming in contact with the cargo and to ensure that such oil will drain freely into limbers or wells. Where tanks are of welded construction, save-alls or gutters need not be provided except where there are manhole doors, valves, or other fittings and in boiler rooms where tanks form part of the structure of the ship.

(12) Every pipe connected to any oil fuel storage, settling, or daily service tank [having a capacity of 500 liters and above], not being a double bottom tank, which if damaged would otherwise permit discharge of the contents so as to cause a fire hazard shall be fitted with a valve or cock meeting the requirements of rule 201. In the case of an oil fuel deep tank situated in any shaft or pipe tunnel, in addition to the valve or cock secured to the tank, a valve or valves may be fitted on the pipe line or lines outside the tunnel or tunnels to enable control to be exercised in the event of fire. If such an additional valve is fitted in the machinery space it shall be operated from a position outside this space. The controls for remote operation of the valve for the emergency generator fuel tank shall be in a separate location from the controls for remote operation of other valves for tanks located in machinery spaces.

(13) Provision shall be made which will prevent overpressure in any oil fuel tank, oil fuel filling pipe or any part of the oil fuel system.

(14) Every oil fuel pipe shall be made of steel or other suitable material except that flexible pipes may be permitted in positions where the Director General is satisfied that they are necessary; such flexible pipes and their attachments shall be constructed to the satisfaction of the Director General .

(15) All surfaces with temperatures above 220 degrees C which may be impinged as a result of a fuel system failure shall be properly insulated.

193. Settling, storage and service tanks

(1) Settling tanks, storage tanks and daily service tanks shall be constructed in accordance with approved plans and shall not be situated directly above boilers or other heated surfaces.

(2) Suitable thermometer pockets shall be fitted to each settling tank.

(3) Bilge pipes shall not be led through oil fuel tanks unless the pipes are enclosed in an oil-tight trunkway or the design of such bilge pipes is specially approved having regard to the circumstances.

(4) Means shall be provided for the removal of water from fuel oil. Such means shall include the fitting of water drain valves to daily service tanks, settling tanks and where practicable, to other oil fuel tanks. Open drains for removing water from oil in storage or settling tanks shall not be fitted unless the drain fitting is of a weighted lever or other self-closing type.

Where the removal of water by drain valves is impracticable water separators shall be fitted in the supply lines to propulsion machinery.

194. Filling arrangements

(1) Oil fuel filling stations shall be isolated from other spaces in the ship and should be efficiently drained and ventilated. Provision shall be made which will prevent over-pressure in any oil filling pipe line such as, for example, over-pressure that may occur during filling operation if one tank filling valve is closed before another is opened.

(2) Any relief valve on the filling line shall discharge into an overflow tank of adequate capacity fitted with an alarm device. Alternatively, the discharge from the relief valve may be led back to the filling barge or station.

195. Air and overflow arrangements

(1) Every oil fuel tank shall be fitted with at least one air pipe, the open end of which is led to the open air in such a position that no danger of fire or explosion will be incurred from the issuing oil vapour when the tank is being filled. Every such pipe shall be fitted with a wire gauze diaphragm of ample area which can be readily removed for cleaning.

(2) Where any oil tank can be filled under pressure either from the ship's pumps or when bunkering, the aggregate area of the air pipe or pipes or any overflow pipe or pipes fitted

to an overflow system which is connected to the tank shall be not less than 1.25 times the aggregate area of the filling pipes. The internal diameter of any air pipe shall be not less than 51 millimetres.

(3) Where air pipes serve as overflow pipes, precautions shall be taken to ensure that there is no possibility of the overflow running into or near the boiler room, galley or any other place in which it might become ignited.

(4) To prevent accidental discharge or overflow of oil overboard, the system shall provide for the overflow from any oil fuel tank to be led to an overflow tank of suitable capacity fitted with an alarm device. A visual indicator may, as far as practicable, be provided in the overflow pipe to indicate when the tanks or filling line relief valves are overflowing.

(5) Where air or overflow pipes pass through cargo holds, they shall be suitably protected against damage.

196. Sounding arrangements

(1) Means shall be provided for ascertaining the level of oil in every oil fuel tank by sounding pipes. Sounding pipes shall not terminate in the passenger or crew space nor in any space which is not efficiently ventilated. Other means of ascertaining the amount of oil fuel may be permitted provided that the failure of such means or overfilling of the tanks will not permit release of oil fuel. Where sounding pipes or connections to indicators pass through cargo holds they shall be suitably protected against damage.

(2) Short sounding pipes of oil tanks situated in or below machinery spaces shall be provided with a self-closing arrangement. Such arrangement, if in the form of cocks, should have parallel plugs with handles permanently attached and so loaded that on being released they close the cock automatically.

(3) (a)Generally sounding pipes shall not terminate in machinery spaces.

(b) If sounding pipes terminate in the boiler room or engine room, they shall be so arranged that oil will not be discharged on to any part of the boilers or other fittings or on to any heated surfaces such as exhaust pipes of engines or on to electric generators and motors, if the self-closing fittings on their upper ends are opened when filling or when oil is surging in the tank due to the motion of the ship.

(c) Where the Director General considers that complying with sub-rule (3)(a) is impracticable it may permit the termination of sounding pipes in machinery spaces on condition that –

(i) an oil level gauge is provided meeting the requirements of sub-rule (iv);

(ii) the sounding pipes terminate in locations remote from ignition hazards unless precautions are taken, such as the fitting of effective screens to prevent the oil fuel in the case of spillage through the terminations of the sounding pipes from coming into contact with a source of ignition;

(iii) the terminations 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 oil fuel is not present. Provision shall be made so as to ensure that any spillage of oil through the control cock involves no ignition hazard;

(iv) other oil level gauges may be used in place of sounding pipes. Such means, like the means provided in sub-rule(3)(c)(i), shall not require penetration below the top of the tank and their failure or over-filling of the tanks shall not permit release of fuel.

(4) Sounding arrangements or oil level indicators on settling tanks, daily service tanks or other oil tanks shall be so fitted as to prevent escape of oil should the tanks be over-filled.

197. Pumping arrangements

Suitable provision shall be made to isolate oil fuel from water ballast and pumping arrangements should be such as to permit all oil fuel being transferred in the event of fire from any storage tank or settling tank to another part of the ship.

198. Steam heating arrangements

(1) Where steam is used for heating oil either in tanks, heaters or separators, the exhaust

drains shall discharge the water of condensation into an observation tank.

(2) Steam heating pipes in contact with oil shall be of steel and the thickness of the pipes shall be adequate.

199. Oil fuel pumps, heaters, filters etc.

(1) The Pumps for the oil fuel system shall be entirely separated from the feed bilge and ballast pumps and connections thereto and provided with efficient relief valves which are in closed circuit with the suction side of the pumps.

(2) Means shall be provided for stopping every oil fuel pressure pump and transfer pump from a position outside the compartment in which the pump is situated. The control position shall be such that it will not be likely to be rendered inaccessible by a fire in the engine or boiler room. Cocks or valves shall be interposed between the pumps and the suction pipes in order that the pipes may be shut off when the pumps are opened up for inspection and overhauling.

(3) In every ship, there shall be not less than two oil fuel units each comprising a pressure pump, filter and a heater.

(4) (a) Save-alls and gutters shall be provided under oil fuel pumps, filters, heaters, etc. to prevent oil fuel that may leak under pressure from any pump, filter or heater from coming in contact with boilers or other heated surfaces and to catch leaking oil or oil that may be spilled when any cover or door is removed.

(b) Save-alls or gutters shall be provided beneath furnace mouths of cylindrical boilers and beneath oil burners of water tube boilers. Arrangements shall be made to prevent the possibility of escaping oil from pressure parts of pumps and pipelines coming into contact with boilers or other heater surfaces.

200. Oil pipes

(1) Oil pressure pipes shall be made of seamless steel or other suitable material and those for conveying heated oil shall be placed in a conspicuous position above the platform in well-lighted parts of the boiler room or engine room. Flexible pipes of approved construction may be used between burners and the supply line.

(2) The thickness of seamless steel pipes shall be that given by the appropriate formula for a working pressure of 14 Kg/cm^2 or to the pressure to which the relief valves on the system are loaded, whichever is the greater. The flanges of the coupling shall be suitable for the appropriate pressure and shall be machined and any material used for joints should be the thinnest possible and impervious to oil heated to a temperature of 120^{o}C.

(3) The pipes and fittings shall be tested after jointing to a pressure of 28 kg/cm^2 or to twice the maximum working pressure, whichever is the greater.

(4) Every oil pipe not being an oil pressure pipe shall be made of steel or other suitable material and shall be laid at such a height above the ship's inner bottom, if any, as will facilitate the inspection and repair thereof. Every such pipe shall be suitable for the working pressure of at least 7 kg/cm^2 machined flanges and jointing material impervious to oil. The pipes and fittings shall be tested to a pressure of 3.5 kg/cm^2 or to twice the maximum working pressure, whichever is the greater.

(5) Oil fuel systems containing heated fuel oil at a pressure exceeding 1.8 bar shall be in illuminated locations so that defects and leakage can be readily observed. Where it is impracticable to meet the requirements of this sub-rule the Director General may permit other arrangements.

(6) All external high pressure fuel delivery lines between the high pressure fuel pumps and fuel injectors shall be protected with a jacketed piping system capable of containing fuel from a high pressure line failure. A jacketed pipe incorporates an outer pipe into which the high pressure fuel pipe is placed forming a permanent assembly. The jacketed piping system shall include a means for collection of leakages and arrangements shall be provided for an alarm to be given of a fuel line failure. A suitable enclosure on engines having an output of 375 kW or less having fuel injection pumps serving more than one injector may be used as an alternative to the jacketed piping system.

(7) Oil fuel lines shall be screened or otherwise suitably protected to avoid as far as practicable oil spray or oil leakages onto hot surfaces, into machinery air intakes, or other sources of ignition. The number of joints in such piping systems shall be kept to a minimum.

201. Valves and fittings

(1) Every oil fuel suction pipe from any oil fuel tank situated above the inner bottom having a capacity of 500 liters and above and every oil fuel leveling pipe within the boiler or engine room shall be fitted with valves or cocks secured to each tank to which the pipe is connected. Every such valve or cock fitted to an oil fuel suction pipe shall be so arranged that it may be closed both from the compartment in which it is situated and from a readily accessible position outside such compartment and will not be likely to be cut off in the event of fire in that compartment. Every such valve or cock fitted to an oil fuel leveling pipe shall be so arranged that it can be closed or opened from a readily accessible position above the bulkhead deck and not likely to be cut off or rendered inaccessible by a fire in the compartment in which the pipe is situated. If any oil tank filling pipe is not connected to an oil fuel tank at or near the top of the tank it shall be fitted with a non-return valve or with a valve or cock secured to the tank to which it is connected and so arranged that it may be closed both from the compartment in which it is situated and from a readily accessible position outside such compartment and will not be likely to be cut off in the event of fire.

(2) Master valves at the furnace fronts controlling the supply of oil to burners shall be of a quick-closing type and fitted in a conspicuous position and readily accessible. Provision shall be made to prevent oil from being turned on to any burner unless such burner has been correctly coupled up to the oil supply line.

(3) Every valve used in connection with oil fuel installation shall be so designed and constructed as to prevent the cover of the valve chest being slackened back or loosened when the valve is operated.

202. Ventilation

(1) Ample ventilation shall be provided in engine, boiler and pump rooms where oil fuel is used so that an adequate supply of air is maintained for the safety and well-being of personnel and the operations of machinery, including boilers, at full power in all weather conditions. Such ventilation should also be provided in all compartments adjacent to any oil storage tanks or compartments in which any oil storage tank is situated. Ventilation should supply fresh air to all parts of these spaces and shall be capable of removing foul air in a reasonably short time. Any other machinery space shall be adequately ventilated having regard in particular to the prevention of an accumulation of oil vapour under all normal conditions**.**

(2) The clearance space between boilers and tops of double bottoms and between boilers and sides of storage tanks or bunkers in which oil fuel is carried shall be adequate for the free circulation of air necessary to keep the temperature of stored oil well below the flash point.

(3) Where water tube boilers are installed, there shall be a space of at least 760 millimetres between the tank top and the underside of the boiler casing.

203. Lighting

In spaces where oil vapour may accumulate no artificial light capable of igniting inflammable vapour shall be allowed. Such spaces shall be lighted by electricity and no switches or fuses may be located within them. Electric lamps shall be protected by air-tight glasses and by wire guards and shall be certified flame-proof. Ordinary portable lamps shall not be used in such spaces. Self-contained battery fed lamps of a type suitable for use in atmosphere containing petroleum vapour shall be provided.

204. Funnels, dampers and uptakes

In ships propelled by means of oil fired boilers, funnel dampers shall not be fitted as far as practicable and where fitted, such dampers shall be provided with a suitable device whereby they may be securely locked in a fully open position. Indicators shall also be provided to show whether the dampers are open or shut.

205. Tests of storage, service and settling tanks

(1) Every service tank or storage tank shall be tested by filling it with water to a head of at least 0.3 metre more than can possibly come upon the tank in service, but to not less than 4.5 metres above the bottom of the tank in the case of tanks not forming part of the ship's structure.

(2) Every settling tank shall be tested by hydraulic pressure to 1.1 kg/cm^2.

206. Oil fired cooking ranges

(1) Galleys equipped with oil fired cooking ranges shall be adequately ventilated.

(2) Oil fuel tanks supplying the galley shall be placed outside the galley and the supply of oil to the burners shall be capable of being controlled from the outside and shall be such as is not likely to be rendered inaccessible by a fire in the galley.

(3) The tank shall be provided with an air pipe leading to the open air and there shall be no danger of fire or explosion resulting from the oil vapour when the tank is being filled up. The open end of the pipe shall be fitted with a detachable wire gauze diaphragm. Efficient means for filling the tanks and for preventing over-pressure shall be provided.

207. Lubricating Oil System

(1) The arrangements for the storage, distribution and utilization of lubricating oil in machinery spaces of Category A shall comply with the requirements of sub-rules 192(4b), 192(7),192(12), 192(13), 192(14), 194(2), 195(4), 196(1), 196(3), 199(4b),200(1),200(5) and 200(7) as applicable as they apply to oil fuel installations except that sight flow glasses having an acceptable degree of fire resistance may be permitted. Alternative arrangements may be permitted in machinery spaces other than machinery spaces of Category A where the Director General is satisfied that the safety of the ship is not impaired.

208. Other Oils

(1) The arrangements for the storage, distribution and utilization of flammable oils, other than fuel and lubricating oil, used in power transmission control and activating systems and heating systems shall be such as to ensure the safety of the ship and persons on board. In enclosed spaces containing a source of ignition the arrangements shall comply with sub-rules192(4b),192(7), 192(13), 192(14), 194(2), 195(4), 196(1), 196(3),199(4b), 200(1) and 200(7) as they apply to oil fuel installations

209. Protection against noise

(1)(a) Measures shall be taken to reduce noise levels in machinery spaces as far as is reasonable and practicable.

(b) On completion of a ship, noise levels in machinery spaces shall be measured when the largest number of machines that operate simultaneously in service are working at their normal service loads.

(c) Measurements taken during sea trials at the maximum ahead service speed of the ship will be acceptable as providing the necessary figures.

(d) The equipment and procedures for measuring and recording noise levels in machinery spaces shall generally be in accordance with IMO Resolution A.468(XII) – Code on Noise Level on board Ships.

(2) Noise levels in machinery spaces shall not exceed 110 dB(A) provided that under such conditions as may be specified, higher noise levels may be permitted, having regard to the size of ship and the type of machinery installed.

(3) Any machinery space in which the noise level exceeds 90 dB(A) and which is required to be manned shall be provided with a designated refuge from noise.

(4) Every entrance to a machinery space in which the noise level exceeds 85 dB(A) shall be provided with a warning notice comprising an appropriate IMO symbol and a supplementary sign stating "High Noise Levels - Use Ear Protectors." Sufficient ear protectors shall be provided for use in such spaces.

210. Steering gear

(1) Every ship of Classes I, II, III, IV, V and VI and every ship of Class VII of 500 tons and over shall be provided with an efficient main and auxiliary steering gear. The main steering gear and the auxiliary steering gear shall be so arranged that the failure of one of them will not render the other one inoperative.

Provided that the requirement of this sub-rule shall not apply on systems meeting the requirements under sub-rule (4).

(2)(a) All the steering gear components and the rudder stock shall be of sound and reliable construction of the satisfaction of the Director General . Special consideration shall be given to the suitability of any essential component which is not duplicated. Any such essential component shall, where appropriate, utilize antifriction bearings such as ball-

bearings, roller-bearings or sleeve-bearings which shall be permanently lubricated or provided with lubrication fittings.

(b) The design pressure for calculations to determine the scantlings of piping and other steering gear components subjected to internal hydraulic pressure shall be at least 1.25 times the maximum working pressure to be expected under the operational conditions specified in sub-rule(3)(b), taking into account any pressure which may exist in the low-pressure side of the system. At the discretion of the Director General , fatigue criteria shall be applied for the design of piping and components, taking into account pulsating pressures due to dynamic loads.

(c) Relief valves shall be fitted to any part of the hydraulic system which can be isolated and in which pressure can be generated from the power source or from external forces. The setting of the relief valves shall not exceed the design pressure. The valves shall be of adequate size and so arranged as to avoid an undue rise in pressure above the design pressure.

3 (a) The main steering gear shall be of adequate strength and sufficient power to steer the ship at maximum service speed at the deepest sea going draught.

(b) The main steering gear shall, with the ship at her deepest sea going draught, be capable of putting the rudder over from 35^o on one side to 35^o on the other side with the ship running ahead at maximum service speed. The time taken to put the rudder over from 35^o on either side to 30^o on the other side at maximum service speed shall not exceed 28 seconds.

(c) The main steering gear including the rudder and associated fittings and rudder stock shall be so designed that they are not damaged at maximum astern speed. However, this design requirement need not be proved by trials at maximum astern speed and maximum rudder angle.

(d) The main steering gear and rudder stock shall be operated by power where necessary to meet the requirements of sub-rule (3)(b) and in any case when the Director General requires a rudder stock of over 120 mm diameter in way of the tiller.

(e) The auxiliary steering gear shall be capable of being rapidly brought into action and shall be of adequate strength and sufficient power to enable the ship to be steered at navigable speed. In ships of Classes I, II, III, IV and V the auxiliary steering gear shall be capable of putting the rudder over from 15^o on one side to 15^o on the other side in not more than 60 seconds when the ship is at her deepest draught and is proceeding at one half of her maximum service speed ahead or 7 knots, whichever is the greater. Where the rudder stock is over 230 mm in diameter in way of the tiller, the auxiliary steering gear shall be operated by power.

(4) Where the main steering gear comprises two or more identical power units, an auxiliary steering gear need not be fitted, provided that :

(a) the main steering gear is capable of operating the rudder as required by subrule (3)(b), while any one of the power units is out of operation ;

(b) the main steering gear is so arranged that after a single failure in its piping system or in one of the power units the defect can be isolated so that steering capability can be maintained or speedily regained.

(5) Steering gears, other than of the hydraulic type, shall achieve standards equivalent to the requirements of this sub-rule(4) to the satisfaction of the Director General .

(6) (a) In every ship where a rudder stock of over 230 mm is required, there shall be provided a suitably located alternative steering position.

(b) The remote steering control systems from the principal and alternative steering stations shall be so arranged that failure of either system will not result in inability to steer the ship by means of the other system. Means of communication shall be provided to enable orders to be transmitted from the navigating bridge to the alternative steering position.

(7) Main and auxiliary steering gear power units shall be :

(a) arranged to restart automatically when power is restored after a power failure ; and

(b) capable of being brought into operation from a position on the navigation bridge.

(c) provided with an audible and visual alarm on the navigating bridge that will operate in the event of a power failure to any steering gear power unit.

(8) Steering gear control shall be provided :

(a) for the main steering gear, both on the navigation bridge and in the steering gear compartment ;

(b) where the main steering gear is arranged in accordance with sub-rule(6), by two independent control systems, both operable from the navigation bridge. This does not require duplication of the steering wheel or steering lever. Where the control system consists of a hydraulic telemotor, a second independent system need not be fitted.

(c) for the auxiliary steering gear, in the steering gear compartment and, if power-operated, it shall also be operable from the navigation bridge and shall be independent of the control system for the main steering gear.

(9) Any main and auxiliary steering gear control system operable from the navigation bridge shall comply with the following :

(a) if electric, it shall be served by its own separate circuit supplied from a steering gear power circuit from a point within the steering gear compartment, or directly from switchboard busbars supplying that steering gear power circuit at a point on the switchboard adjacent to the supply to the steering gear power circuit ;

(b) means shall be provided in the steering gear compartment for disconnecting any control system operable from the navigation bridge from the steering gear it serves ;

(c) the system shall be capable of being brought into operation from a position on the navigation bridge ;

(d) in the event of a failure of electrical power supply to the control system, an audible and visual alarm shall be given on the navigation bridge ; and

(e) short circuit protection only shall be provided for steering gear control supply circuits.

(10) The electrical power circuits and the steering gear control systems with their associated components, cables and pipes required by this rule including those required by sub-rule(16) shall be separated as far as is practicable throughout their length.

(11) A means of communication shall be provided between the navigation bridge and the steering gear compartment.

(12) The angular position of the rudder shall :

(a) if the main steering gear is power-operated, be indicated on the navigation bridge. The rudder angle indication shall be independent of the steering gear control system ;

(b) be recognizable in the steering gear compartment.

(13) Hydraulic power-operated steering gear shall be provided with the following :

(a) arrangements to maintain the cleanliness of the hydraulic fluid taking into consideration the type and design of the hydraulic system ;

(b) a low-level alarm for each hydraulic fluid reservoir to give the earliest practicable indication of hydraulic fluid leakage. Audible and visual alarms shall be given on the navigation bridge and in the machinery space where they can be readily observed ; and

(c) a fixed storage tank having sufficient capacity to recharge at least one power actuating system including the reservoir, where the main steering gear is required to be power-operated. The storage tank shall be permanently connected by piping in such a manner that the hydraulic systems can be readily recharged from a position within the steering gear compartment and shall be provided with a contents gauge.

(14) The steering gear compartments shall be :

(a) readily accessible and, as far as practicable, separated from machinery spaces ; and

(b) provided with suitable arrangements to ensure working access to steering gear machinery and controls. These arrangements shall include handrails and gratings or other nonslip surfaces to ensure suitable working conditions in the event of hydraulic fluid leakage.

(15) Where the rudder stock is required to be over 230 mm diameter in way of the tiller, an alternative power supply, sufficient at least to supply the steering gear power unit which complies with the requirements of sub-rule (3)(e) and also its associated control system and the rudder angle indicator, shall be provided automatically, within 45 s, either from

the emergency source of electrical power or from an independent source of power located in the steering gear compartment. This independent source of power shall be used only for this purpose. In every ship of 10,000 gross tonnage and upwards, the alternative power supply shall have a capacity for at least 30 min of continuous operation and in any other ship for at least 10 min.

(16)(a) Means for indicating that the motors of electric and electrohydraulic steering gear are running shall be installed in the machinery control room or in such other position or positions as may be approved, and on the navigation bridge.

(b) Each electric or electrohydraulic steering gear comprising one or more power units shall be served by at least two exclusive circuits fed directly from the main switchboard ; however, one of the circuits may be supplied through the emergency switchboard. An auxiliary electric or electrohydraulic steering gear associated with a main electric or electrohydraulic steering gear may be connected to one of the circuits supplying this main steering gear. The circuits supplying an electric or electrohydraulic steering gear shall have adequate rating for supplying all motors which can be simultaneously connected to them and may be required to operate simultaneously.

(c) Short circuit protection and an overload alarm shall be provided for such circuits and motors. Protection against excess current, including starting current, if provided, shall be for not less than twice the full load current of the motor or circuit so protected, and shall be arranged to permit the passage of the appropriate starting currents. Where a three-phase supply is used an alarm shall be provided that will indicate failure of any one of the supply phases. The alarms required in this rule shall be both audible and visual and shall be situated in a conspicuous position in the main machinery space or control room from which the main machinery is normally controlled.

(d) When in a ship of less than 1,600 gross tonnage an auxiliary steering gear which is required by sub-rule(3)(a) to be operated by power is not electrically powered or is powered by an electric motor primarily intended for other services, the main steering gear may be fed by one circuit from the main switchboard. Where such an electric motor primarily intended for other services is arranged to power such an auxiliary steering gear, the requirement of sub-rule (16)(c) may be waived by the Director General if satisfied with the protection arrangement together with the requirements of sub-rules (7)(a), (7)(b), (7)(c) and (8)(c) applicable to auxiliary steering gear.

(17) Simple operating instructions with a block diagram showing the change-over procedures for remote steering gear control systems and steering gear power units shall, where applicable, be permanently displayed on the navigating bridge and in the steering gear compartment.

(18) The main steering gear in every ship of 70,000 tons or over shall have two or more identical power units complying with the requirements of sub-rules 4(a) and 4(b).

(19) Where steam pipes, exhaust pipes or hydraulic pipes are provided for steering gears, they shall be used exclusively for that purpose.

(20) Fluid used in hydraulic systems of steering gear shall be non-freezing. All moving parts of steering gear shall be so guarded as to prevent possible injury to crew or passengers

Miscellaneous

211. Stores, Spare ear and Tools.- Every ship shall be, provided with such stores, spare gear and tools as are considered sufficient for intended service of the ship and for the purpose of carrying out running repairs to the ship, its boilers and machinery while the ship is at sea.

212. Means of communication – Every ship shall be provided with two means of communicating orders from the navigating bridge to the engine room. One of such means shall be the engine room telegraph.

CHAPTER 6

EQUIPMENT OF SHIPS

Navigational Equipment

213. All ships irrespective of their size, shall have:

(1) a properly adjusted standard magnetic compass, or other means, independent of any power supply, to determine the ship's heading and display the reading at the main steering position.

(2) a spare magnetic compass, interchangeable with the magnetic compass as referred to in subrule 1, or other means to perform the function referred to in subrule 1 by means of replacement or duplicate equipment;

(3) a pelorus or compass bearing device, or other means, independent of any power supply, to take bearings over an arc of the horizon of 360 degrees.

(4) means of correcting heading and bearings to true all times.

(5) nautical charts and nautical publications to plan and display the ship's route for the intended voyage and to plot and monitor positions throughout the voyage. An electronic chart display and information system (ECDIS) may be accepted as meeting the chart carriage requirements of this subrule.

(6) back up arrangements to meet the functional requirements of subrule 4, if this function is partly or fully fulfilled by electronic means

(7) a receiver for a global navigation satellite system or a terrestrial radio navigation system, or other means, suitable for use at all times through out the intended voyage to establish and update the ship's position by automatic means

(8) if less than 150 gross tonnage and if practicable, a radar reflector, or other means, to enable detection by ships navigating by radar at both 9 and 3 Ghz.

(9) when the ships bridge is totally enclosed and unless the Administration determines otherwise, a sound reception system, or other means, to enable the officer in charge of the navigational watch to hear sound signals and determine their direction;

(10) a telephone, or other means, to communicate heading information to the emergency steering position, if provided.

(11) a daylight signaling lamp, or other means, to communicate by light during day and night using an energy source of electrical power not solely dependent upon the ship's power supply.

214. <u>All passenger ships irrespective of their size shall, in addition to meeting the requirements of rule 213, be fitted with:</u>

(1) an echo sounding device, or other electronic means, to measure and display the available depth of water;

(2) a 9GHz radar, or other means, to determine and display the range of bearing of radar transponders and of other surface craft, obstructions, buoys, shorelines and navigational marks to assist in navigation and in collision avoidance;

(3) an electronic plotting aid, or other means, to plot electronically the range and bearings of targets to determine collision risk;

(4) speed and distance measuring device, or other means, to indicate speed and distance through the water;

(5) a properly adjusted transmitting heading device, or other means, to transmit heading information for input to the equipment referred to in subrules 2, 3, 4.

215. <u>All passenger ships irrespective of size shall be fitted with an automatic identification system (AIS), as follows;</u>

(1) AIS shall

(a) provide automatically to appropriately equipped shore stations, other ships and air craft information, including ship's identity, type, position, course, speed, navigational status and other safety related information;

(b) receive automatically such information from similarly fitted ships;

(c) monitor and track ships; and

(d) exchange data with shore based facilities;

(2) the requirements of subrule 1 shall not be applied to cases where international agreements, rules or standards provide for the protection of navigational information ;

(3) AIS shall be operated taking into account the guidelines adopted by the IMO.

216. All passenger ships of 500 gross tonnage and upwards shall, in addition to meeting the requirements of rule 214, with the exception of subrules 214(3) and 214(5), and the requirements of rule 215, have:

(1) a gyro – compass, or other means, to determine and display their heading by shipborne non-magnetic means, being clearly readable by the helmsman at the main steering position. These means shall transmit heading information for input to the equipment referred in subrules 214(2), 215 and 216(5).

(2) a gyro – compass heading repeater, or other means, to supply heading information visually at the emergency steering position if provided.
(3) a gyro – compass heading repeater, or other means, to take bearings, over an arc of the horizon of 360 degrees, using the gyro-compass or other means referred to in subrule 1. However, ships of less than 1600 gross tonnage shall be fitted with such means as far as possible.

(4) rudder, propeller, thrust, pitch and operational mode indicators, or other means, to determine and display rudder angle, propeller revolutions, the force and direction of thrust and, if applicable, the force and direction of lateral thrust and the pitch and operational mode, all to be readable from the conning position; and

(5) an automatic tracking aid, or other means, to plot automatically the range and bearing of other targets to determine collision risk.

217. On all passenger ships of 500 gross tonnage and upwards, failure of one piece of equipment should not reduce the ship's ability to meet the requirements of rules 213(1), 213(3) and 213(5).

218. All passenger ships of 3000 gross tonnage and upwards shall, in addition to meeting the requirements of rule 217, have:

(1) a 3 GHz radar or, where considered appropriate by the administration, a second 9 GHz radar, or other means, to determine and display the range and bearing of other surface craft, obstructions, buoys, shorelines and navigational marks to assist in navigation and in collision avoidance, which are functionally independent of those referred to in rule 214(2); and

(2) a second automatic tracking aid, or other means, to plot automatically the range and bearing of other targets to determine collision risk which are functionally independent of those referred to in rule 216(5).

219. All passenger ships of 10,000 gross tonnage and upwards shall. In addition to meeting the requirements of rule 218 with the exception of subrule 218(2), have:

(1) an automatic radar plotting aid, or other means, to plot automatically the range and bearing of at least 20 other targets, connected to a device to indicate speed and distance through the water, to determine collision risks and simulate a trial manoeuvre; and

(2) a heading or track control system, or other means, to automatically control and keep to a heading and/or straight track.

220. All passenger ships of 50,000 gross tonnage and upwards shall, in addition to meeting the requirements of rule 219, have:

(1) a rate of turn indicator, or other means, to determine and display the rate of turn; and

(2) a speed and distance measuring device, or other means, to indicate speed and distance over the ground in the forward and athwartships direction.

221. When "other means" are permitted under rules 213, 214, 216, 218, 219, and 220 such means must be approved by the Director General

222. The navigational equipment and systems referred to in rules 214 to 221 shall be so installed, tested and maintained as to minimize malfunction.

223. Navigational equipment and systems offering alternative modes of operation shall indicate the actual mode of use.

224. Integrated bridge systems shall be so arranged that failure of one subsystem is brought to the immediate attention of the officer in charge of the navigational watch by audible and visual alarms and does not cause failure to any other subsystem. In case of failure in one part of an integrated navigational system, it shall be possible to operate each other individual item of equipment or part of the system separately.

225. Voyage data recorders : All passenger ships of Type I, II, III & IV shall be fitted with a voyage data recorder of a type approved by the Director General.

226. Long range identification and tracking of ships

(1) All passenger ships irrespective of size, shall be provided with a system to automatically transmit the following information:

i) the identity of the ship
ii) the position of the ship (latitude and longitude); and
iii) the date and time of the position provided

(2) Any shipboard equipment for LRIT shall be of type approved by the Director General. Systems and equipment shall be capable of being switched off on board or be capable of ceasing the distribution of information, where permitted.

227 Defects in navigational equipments

Master of every ship which is required to carry radar, gyro compass or echo sounding device shall take all reasonable steps to maintain the equipments in operating condition. Malfunctioning of any of these equipments shall not however render the ships unseaworthy or liable for detention at ports where repair facilities are not readily available.

228. Anchors and chain cables

(1) Every ship shall be provided with such number of anchors and chain cables as are sufficient in number and strength having regard to the size and intended service of the ship.

(2) Anchors shall be of approved design and duly tested.

(3) Chain cables for anchors may be of wrought iron, mild steel, special and cast steel. They shall be of approved design and suitably tested.

229. Windlass

(1) A windlass of sufficient power and suitable for the chain cable shall be fitted and efficiently secured to the deck. The thickness of deck plating in way of windlass shall be adequately increased and stiffened.

(2) The cables shall be led from the windlass by easy leads through a hawse of adequate thickness and size to house the anchors satisfactorily. Substantial lips shall be provided to the hawse pipe at the deck as well as the shell connection. Where necessary, the shell plating and framing in way of the hawse pipe shall be reinforced.

(3) A chain locker of adequate capacity shall be fitted with easy lead of cable from the windlass and provided with spurling pipe with suitable lips. For the purpose of separating starboard side cables from port side cables suitable arrangements shall be provided in the chain locker. The inboard ends of cables shall be suitably secured to the structure of the chain locker. The arrangement shall be such as would ensure expeditious slipping of the cable, where necessary.

(4) The spare bower anchor shall be stowed where it will be readily available when required.

230. Hawsers and warps

Every ship shall be provided with hawsers and warps which are sufficient in number and strength having regard to the size and the intended service of the ship.

Gas welding, flame cutting and domestic fuel installations

231. In every ship gas welding, flame cutting or domestic gaseous fuel installation shall be designed, constructed and installed so that the safety of the ship and of the persons on board is not impaired.

The use of asbestos

232. In every such ship asbestos or any material containing asbestos shall not be installed in any part of a ship.

PART III

CHAPTER I

GENERAL

Carriage of Passengers

232. Position of passenger accommodation

(1) The decks on which passengers are accommodated shall form part of the permanent structure of the ship and shall be of adequate strength. If any deck is constructed of wood, it shall be properly laid and caulked and shall be continuous from side to side of the space in which the passengers are carried. If the deck is not constructed of wood, it shall be fitted with sheathing made of wood of an approved non-conducting composition.

(2) Passengers shall not be carried on more than one deck below the load water line and within 10 per cent of the length of the ship from the forward perpendicular in any lower between deck.

(3) Lamp rooms, paint rooms and spaces used for the storage of inflammable oils shall not have a direct access to passenger accommodation by doors or passage ways or be so situated as to constitute a danger to passengers. Passengers shall not be accommodated in a space adjoining an oil fuel bunker unless the space is searated from the bunker by an additional steel vapour proof bulkhead so arranged that the space between the two bulkheads is well ventilated and accessible. If the bunker bulkhead is of all welded construction the additional bulkhead need not be fitted. Passenger accommodation may be situated on a deck forming the crown of an oil fuel space if --

(i) the deck is oil-tight

(ii) passenger space is well ventilated;

(iii) no manhole or other opening to oil fuel spaces exits in passenger spaces; and

(iv) flooring of passenger spaces is of a material and of a thickness approved by the Director General for the purpose.

(4) Passenger accommodation shall be separated from cargo spaces, coal bunkers, store rooms, lamp rooms and paint rooms and other spaces used for storage of inflammable oils by means of gas-tight steel bulkhead and decks.

233. Lighting and ventilation

All passenger accommodation spaces shall be efficiently ventilated and lighted during both day and night. Wherever possible, natural lighting shall be provided. Where natural lighting is not possible, efficient artificial lighting shall be provided.

234. Sheathing of steel or other metal decks

a). Steel or other material decks forming the floors of enclosed spaces in which passengers are accommodated shall be sheathed with wood or other composition of an approved type.

b). Steel or other material decks forming the crowns of passenger spaces which are exposed to weather shall be sheathed with wood of 57 mm thick or insulated with an equivalent insulation material on under side of the deck.

CHAPTER II

SPACE REQUIREMENTS FOR CABIN CLASS PASSENGERS

235. Application

This Chapter applies to ships of Classes I, II, III, IV, V, VI and VII.

236. Provision of cabin berths

(1) The number of fixed berths properly constructed and fitted shall determine the number of passengers that may be allowed to be carried in 'cabin class' accommodation provided in any ship.

(2) No cabin accommodating 'cabin class' passengers shall contain more than eight such berths.

(3) There shall not be more than two tiers of berths in any cabin and there shall be provided not less than 3.35 square metres of clear space for each 'cabin class' passenger. Where small berths are fitted for children, the total space allocated shall be 3.35 square metres for every pair of such berths.

(4) Where the voyages are of less than 6 hours duration, passengers may be accommodated in spaces where only sitting accommodation is provided. In such cases, every passenger shall be provided not less than 0.83 square metre of space. Seats or chairs of not less than 460 mm. in length shall be provided for all such passengers.

(5) Airing space shall be provided on the upper deck, bridge or poop deck for all cabin class passengers at the scale of 2.20 square metres for each passenger, such airing space shall be demarcated and separated from airing space referred to in rule 241.

CHAPTER III

SPACE REQUIREMENTS FOR ACCOMMODATION OF SPECIAL TRADE PASSENGERS

237. Application

This Chapter applies to ships of Classes III, IV, V, VI and VII.

238. Spaces unfit for passenger accommodation

(1) In ships to which this Chapter applies, accommodation for passengers shall not be provided in any of the following spaces, namely:-

(a) any deck lower than the one immediately below the deepest sub-division load-line;

(b) any part of the between deck where the clear headroom is less than 1.90 metres;

(c) forward of the collision bulkhead being the bulkhead complying with the requirements of rule 7 or the upward extension thereof;

(d) on lower between decks within 10 per cent of the length of the ship from the forward perpendicular; or

(e) any weather deck which is not sheathed to the satisfaction of the Director General.

(2) During seasons of foul weather, no space on the weather deck shall be measured as being available for passenger accommodation except that it may be measured as airing space.

239. Provision of bunks

(1) Where in any ship to which this Chapter applies bunks are provided for passengers as required by section 261A of MS Act, such bunks shall comply with the following requirements, namely:-

(a) the size of a bunk shall not be less than 1.90 metres long and 0.70 metres wide;

(b) every bunk shall give direct access to a passage-way and the passage-ways shall be so arranged as to give ready access to an escape route;

(c) the width of passage-ways shall be not less than 0.70 metre;

(d) bunks may be fitted in single or double tiers; where bunks are provided in double tiers, the following requirements shall be complied with, namely:-

(i) the distance between the deck and the base of the lower bunk shall not less than 0.45 metre;

(ii) the distance between the base of the lower bunk and the base of the upper bunk shall not be less than 0.90 metre;

(iii) the distance between the base of the upper bunk and the underside of any overhead obstruction shall not less than 0.90 metre; and

iv) suitable means shall be provided for access to upper bunks.

(e) bunks shall be fitted with leeboards or leerails and where bunks are fitted side by side suitable means of separation shall be provided;

(f) bunks and their fittings shall be constructed of metal and shall be of a type approved by, Director General;

(g) no bunk shall be fitted within 0.90 metre of any hatch opening except where such openings are trunked or otherwise protected to the satisfaction of , Director General ;

(h) the distance from the bunk on the approach side to the face of frames, sparing or linings at shipside shall not be than 0.6m;

(i) no bunk shall be fitted within 0.75 metre of the entrance of any stairway or ladderway, wash place, lavatory or battery or latrines or of any water tap or fire hydrant; and

(j) no bunk shall be fitted in space or part thereof which, in the opinion of the Director General is unsuitable for accommodation of special trade passengers.

(2) Total number of bunks provided in any ship shall be such as to ensure that the number of passengers carried in space does not exceed the gross volume of that space in cubic metres divided by 3.06 cubic metres.

240. Ships not fitted with bunks

(1) Where a ship to which this Chapter applies is not required by section 261A of MS Act to provide bunks for passengers, the following provisions shall be complied with.

(2) Subject to the provisions of sub-rules (3), (4) and (5), accommodation spaces in any such ship shall be measured on the scale set out in the table below, having regard to the location of accommodation space, the duration of the voyage and the incidence of seasons of fair and foul weather.

Location	Duration of Voyage	Minimum space allo-cation per passenger.
Weather deck (during seasons of fair weather only)	(i) Less than 24 hours. (ii)24 hours an over but than 72 hours.	0.74 m^2 1.12m^2
Upper deck (i)	Less than 24 hours (ii) 24 hours and over	0.74 m^2
	but less than 72 hours	1.12 m^2
Upper between deck.	(i) Less than 24 hours. (ii)24 hours and over but less than 72 hours.	0.88 m^2 1.12 m^2
Lower between deck	(i) Less than 24 hours (ii)24 hours and over but less than 72 hours	0.88 m^2 1.40 m^2

(3) Where means of egress from a ~~be~~tween deck or other enclosed space is through another passenger space, the space in the between deck shall be measured in accordance with scale laid down for lower between deck.

(4) Where duration of any voyage is 24 hours or over, the number of passengers accommodated in any space shall not exceed the gross volume of that space in cubic metres divided by 3.06 cubic metres.

(5) In calculating spaces for accommodation of passengers, the following deductions shall be made, namely:-

(a) an overall deduction of 5 per cent of the gross area of the space to allow for the accommodation of accompanied baggage;

(b) an area extending to a distance of 0.75 metre from the entrance to any stairway or ladderway, wash place, lavatory or battery of latrines or from any water tap or fire hydrant;

(c) areas required for working the lifeboats, liferafts and buoyant apparatus:

Provided that these areas may be included in airing space provided under section 261C of MS Act;

(d) the area of any hatchway; and

(e) any area which, in the opinion of the Central Government, is unsuitable for accommodation of passengers.

(6) Areas referred to in clauses (b), (c), (d) and (e) of sub-rule (5) shall be delineated by a white line 0.08 metre wide.

241. Airing space

Airing space reserved on the weather decks for use of passengers in pursuance of the provisions of section 261C of MS Act shall be marked conspicuously as "AIRING SPACE FOR SPECIAL TRADE PASSENGERS ONLY".

242. Marking of spaces

Any space intended for the accommodation of special trade passengers shall be conspicuously marked at or near the entrance to that space indicating the number of such passengers the space is certified to accommodate.

243. Hospital arrangements

(1) Every ship carrying more than 100 passengers and engaged on voyages the duration of which exceeds 48 hours in ordinary circumstances, shall be provided with permanent –

hospital arrangements. Such arrangement shall comply with the following provisions,

namely:-

(i) There shall be fitted on deck or decks above the between decks hospital accommodation for passengers which shall be clearly demarcated.

(ii) The area of the deck space provided for this purpose shall be not less than 9.3 sq. metres for the first five hundred passengers or less and in

addition, 2.3 sq. metres for every additional one hundred passengers or part thereof upto a maximum of 23 sq. metres :

Provided that the hospital accommodation shall be large enough to enable beds to be fitted in accordance with clause (vii).

(iii) There shall be separate hospitals for the exclusive use of members of each sex when passengers of both sexes are carried.

(iv) Every such hospital shall have at least two beds and a floor area of not less than 4.5 sq. metres.

(v) Every hospital shall be sufficiently ventilated and lighted and shall be provided with proper beds, bedding and necessary appliances.

(vi) Metal decks and overhead decks shall be sheathed with wood or other approved composition.

(vii) Every hospital shall have its own latrine and bathroom situated immediately adjacent to the hospital either in one compartment or separately.

(viii) Beds shall be of metal and shall be of a type approved for use in the hospital of a ship. Every hospital shall remain open at all times for the admission and treatment of passengers suffering from any ailment.

(ix) Hospital beds shall be fitted on the scale given below :

NO. OF PASSENGERS	**NUMBER OF BEDS**	
	Voyages of between 48 & 120 hrs.	**Voyages of over120 hrs.**
Upto 400 passengers	4	4
400 - 600 passengers	5	5
600-800 passengers	6	8
800-1000 passengers	8	10
Above 1000 passengers	10	12

(2) Every ship carrying special trade passengers shall be provided with hospital accommodation for not less than 1 % of the total number of special trade passengers the ship is certified to carry.

(3) In the case of ships certified to carry more than one hundred passengers and performing voyages the duration of which in ordinary circumstances does not exceed

48 hours there shall be carried materials for the erection of a temporary hospital. The area reserved for such hospital shall be not less than 7.4 sq. metres.

(4) The portion of the upper deck on which such temporary hospital may be erected shall be measured off and demarcated to the satisfaction of Director General The framework of the hospital may be of metal (in pieces that can be

easily fitted together) or of wooden spars or bamboos. The roof shall be tented and both side walls made of stout canvas or other suitable material and be perfectly watertight. Adequate provision shall be made for ventilation.

(5) To provide for the accommodation and treatment of such cases of illness such as, for example, small pox, cholera, yellow fever or plague, every ship carrying more than one hundred passengers and performing a voyage the duration of which exceeds 48 hours but does not exceed 120 hours shall carry on board material necessary for the construction of a temporary hospital and a part of the upper deck of an area not less than 14 sq. metres shall be set apart and demarcated for this purpose.

(6) Ships performing a voyage the duration of which in ordinary circumstances exceeds 120 hours shall be fitted with a permanent isolation hospital which shall be in as isolated a position as possible to the satisfaction of Director General . There shall be not less than two beds in an isolation hospital. Requirements of clauses (i), (iii), (iv), (v), (vi), (vii) and (viii) of sub-rule (1) shall apply to every such isolation hospital in the like manner as they apply to other hospitals.

(7) Every isolation hospital shall have a separate toilet and wash basin.

(8) Every special trade passenger ship shall be provided with space on upper deck for erection of a temporary hospital. The area of the temporary hospital together with that of the permanent hospital shall be sufficient for at least 4 per cent of the number of special trade passenger the ship is certified to carry.

244. Provision of medical stores

(1) Every ship carrying more than 100 passengers and every special trade passengers ship shall carry medicine, medical stores disinfectants, and surgical appliances prescribed by the Merchant Shipping (Medicines, Medical Stores and Appliances) Rules, 1966.

(2) The medical stores and surgical appliances shall be inspected once a year by the Port Health Officer, who, if satisfied that they are as prescribed and in good condition, shall issue a certificate to that effect to the master of the ship.

245.Water closet(WC)

(1) Every ship shall be provided with water closet(WC) for exclusive use of passengers in accordance with the following scale, namely:-

(i) In the case of ships performing voyages the duration of which in ordinary circumstances exceeds 48 hours, not less than four water closet(WC) shall be provided for every one hundred passengers or part thereof.

(ii) In the case of ships performing voyages the duration of which in ordinary circumstances exceeds 24 hours but does not exceed 48 hours, not less than

three water closet(WC) shall be provided for every one hundred passengers or part thereof upto six hundred passengers and two

additional water closet(WC) for every one hundred passengers or part thereof.

(iii) In the case of ships performing voyages the duration of which in ordinary circumstances exceeds 6 hours but does not exceed 24 hours, there shall be provided three water closet(WC) for the first hundred passengers and two water closet(WC) for every hundred passengers or part thereof in excess of the first hundred passengers.

(iv) In the case of ships performing voyages which do not exceed 6 hours in ordinary circumstances there shall be provided water closet(WC) at the scale of 2 water closet(WC) for every one hundred passengers or part thereof for the total number of passengers the ship is certified to carry.

(2) In every ship, small commode seats with back rest shall be made available for the use of children in the proportion of such commode for every two hundred passengers which the ship is certified to carry, upto a maximum of six such commodes. Such commode shall be placed adjacent to the water closet(WC) .

(3) Water closet(WC) shall be situated above the between decks, forward and aft, at convenient and easily accessible places in all weathers. Water closet(WC) shall not be provided in between decks unless an efficient systems of trunked mechanical ventilation and exhaust ventilation is provided in such spaces.

(4) All water closet(WC) shall be of a design approved for the purpose and shall be fitted with flushing devices. The toilet compartment shall be at least 900 millimetres by 1100 millimetres and shall be provided with two storm rails. Water closet(WC) situated in between decks shall be effectively shut off so as to prevent effluvia escaping therefrom into any passenger space.

(5) Every toilet shall be properly lighted and provided with a water tap, a pannikin and an adequate supply of water for purposes of ablution. Separate toilet shall be set apart for the exclusive use for male and female passengers and fitted with entirely separate entrances. All water closet(WC) shall be clearly marked and lighted to indicate whether they are intended for use of male or as the case may be female passengers.

(6) Every toilet shall be kept clean and in good order and shall, when the passengers are on board, be disinfected not less than thrice a day.

(7) Water closet(WC) provided for passengers shall not be used by the crew when passengers are on board.

(8) The toilet shall be enclosed by steel bulkheads and shall be provided with exhaust ventilation to the open air. Access to the water closet(WC) shall be from passage ways or open spaces. Wherever possible, a lobby shall be provided at the entrance. Where such arrangement is not practicable, a self-closing door shall be provided except where the entrance is from an open deck. The entrance shall be adequately screened to secure privacy.

(9) Every water closet shall be enclosed by bulkheads:

Provided that one water closet may be separated from another water closet or urinal by an opaque and rigid material open at the top and bottom.

(10) Every water closet shall be so constructed as to facilitate cleaning and not to harbour dirt or verain.

246. Wash places and baths

(1) In ships performing voyages the duration of which exceeds 48 hours, there shall be provided for the exclusive use of passengers washing facilities at the following scales, namely:-

(i) one wash basin or sink with running cold fresh water for every 25 passengers; and

(ii) one water tap or shower for bathing for every 25 passengers or part thereof. At least one tap or shower shall also be fitted to supply running hot water and so regulated as to prevent scaling.

(2) Every ship performing a voyage the duration of which in ordinary circumstances is less than 48 hours but not less than 24 hours shall be provided with wash basins, taps or showers at half the rate prescribed in sub-rule (1).

(3) Every ship performing a voyage the duration of which does not exceed 24 hours shall be provided with one wash place for male passengers and one for female passengers. Each such wash basin or sink shall be provided with running cold fresh water. Where the voyages exceed 12 hours duration, showers or taps with fresh running water shall be provided in each wash place.

(4) Every wash place provided in accordance with this rule shall be provided with direct access from the passenger accommodation and shall be adequately screened from public view. There shall be an adequate supply of water and taps and valves shall be marked indicating whether the water is fresh water or salt water and whether it is hot or cold. There shall be an adequate means of ventilation for each wash place.

(5) At least one wash place shall be set apart for the exclusive use of female passengers.

247. Dressing rooms

(1) In every ship performing a voyage the duration of which in ordinary circumstances exceeds 48 hours there shall be provided two dressing rooms, one for male passengers and the other for female passengers, fitted with mirrors and seats.

(2) The dressing rooms shall be adjacent to the wash places and shall be provided with an inter-communicating door or passage between the wash place and the dressing room.

(3) The superficial area of each dressing room shall be not less than 2.22 sq. metres. Where the dressing room is not immediately adjacent to the wash place, one wash basin shall be provided with a tap and an adequate supply of fresh water in the dressing room.

248. Supply of food, fuel and water

(1) Every passenger on voyages exceeding 24 hours shall be provided with adequate quantity of food. The article of food shall be of good quality.

(2) In no case a passenger shall be permitted to cook food on board.

(3) There shall be supplied to passengers fresh water of not less than 22.5 litres per day for all purposes inclusive of the quantity necessary for drinking.

(4) Fresh water may be carried in double bottom tanks or in other tanks fitted above the double bottoms or any other tanks fitted for this purpose.

(5) All fresh water tanks shall be cleaned, cement washed (or, if coated with bituminuous plastic or other proprietary composition, re-coated where necessary) and aired and disinfected at intervals not exceeding 12 months. In addition, the tanks shall be thoroughly pumped out, hosed and disinfected prior to refilling at six months' intervals. The disinfection shall, wherever possible, be carried out under the supervision of the Port Health Officer.

(6) There shall be provided on every deck used by passengers, efficient means for the regular supply of cold, fresh and potable drinking water suitably distributed in the passenger spaces. The minimum of such supply stations shall be as follows:-

LENGTH OF SHIP	MIN. NO. OF SUPPLY STATIONS
> 30 mtrs	2
30 mtrs & above but > 60 mtrs	3
60 mtrs & above but > 100 mtrs	4
100 mtrs & above but > 150 mtrs	8
150 mtrs & above	10 .

249. Distilling apparatus

(1) On every special trade passenger ship and every ship performing voyages in excess of 120 hours there shall be provided a distilling apparatus capable of producing 9 litres of fresh water per day for each person carried on board the ship subject to a minimum of 2250 litres.

(2) The condenser or distilling apparatus shall be separate from other machinery installations and under no circumstance shall this equipment be used for any other purpose.

(3) The distilling apparatus shall be tested at every annual survey to ensure its effective working.

250. Dining spaces

(1) Every ship performing voyages the duration of which in ordinary circumstances exceeds 48 hours shall be provided with a dining space or spaces equipped with sufficient number of tables having impervious taps and also with chairs or benches.

(2) The deck area of such dining spaces shall be not less than 0.18 sq. metres for every passenger which the ship is certified to carry.

(3) Suitable wash basins for the exclusive use of passengers screened off from dining spaces shall be provided.

251. Ventilation

(1) Ships which perform voyages the duration of which exceeds 48 hours in ordinary circumstances, shall be provided with a trunked mechanical ventilation system for every between deck space and other enclosed spaces in which passengers are carried. The system shall provide for atleast ten air changer per hour.

(2) Where a ship performs voyages of less than 48 hours duration, there shall be either a trunked mechanical ventilation system or a system of cowl ventilation providing not less than 62.5 sq. centimetres of ventilator area for each person accommodated in the compartment. Ventilators which are required to supply air to the lower between deck compartment shall have an aggregate area of not less than 94 sq. centimetres i.e. 47 sq. centimetres as inlet and an equal amount as outlet measured at the narrowest part of the air passage.

(3) The ventilators provided under sub-rule (2) shall be exclusive of side scuttles, doors, hatchways, skylights, and other apertures not built solely for ventilation. Suitable pedestal or other fans having a large sweep of not less than 75 centimetres shall be provided for every 28 sq. metres of deck space of passenger accommodation.

252. Disinfecting apparatus

Every special trade passenger ship shall be provided with an approved disinfecting apparatus. All articles contaminated by patients suffering from cholera, plague or dysentery or any other infectious disease shall be disinfected under the supervision of the medical officer.

253. Ladderways

(1) In every ship of Class V carrying 200 passengers or less, Class VI in each compartment in which passengers are carried, there shall be provided at least two sets of ladderways leading to the lifeboat or liferaft embarkation stations. Ladderways shall also be provided for direct and easy access to the weather or upperdecks on which airing space is provided for the passengers.

(2) The ladderways shall be adequate for the number of passengers likely to use them in an emergency. Ladderways shall have an aggregate width of not less than 0.05 metre for every five passengers carried in that space. No ladderway shall be less than 75 centimetres wide.

(3) The exits from each compartment shall be well lighted and clearly marked to enable the passengers to reach the lifeboat stations and open decks easily.

(4) Every ship of Class VII shall be provided with at least one ladderway for each compartment in which passengers are accommodated leading to the lifeboat stations and the weather deck. The minimum width of the ladder shall be 75 centimetres.

(5) Each ladderway shall be fitted with substantial rails or other protection.

254. Guard rails and stanchions

(1) All ships carrying passengers shall be provided with bulwarks or guard rails on every deck to which the passengers have access.

(2) Such bulwarks or guard rails shall be not less than 107 centimetres high, measured from the top of the uppermost rail. The rails shall be not more than 230 millimetres apart unless strong netting is provided.

(3) Where bulwarks are fitted, the freeing ports shall be fitted with suitable girders for protection of passengers.

255. Provision of Awnings

Every ship shall be provided with approved awnings providing protection from the weather to these portions of exposed decks which are appropriated for the use of passengers:

Provided that the Director General may, in addition, require any ship to provide awnings for such portions of exposed decks and housetops which are situated immediately above the spaces provided for accommodation of passengers.

PART IV

SURVEY OF PASSENGER SHIPS

256. Types and frequency of surveys

(1) Every passenger ship shall be subject to the following surveys, namely:-

(a) Initial survey before the ship is commissioned into service for the first time under Indian flag;

(b) Renewal survey; and

(c) Additional survey or surveys as may be necessary in the case of a particular ship.

(2) Initial survey shall be made in the case of a new construction or a ship acquired second hand. No ship shall be commissioned into service under Indian flag unless it is subjected to an initial survey.

(3) After commissioning into service every ship shall be subjected to a renewal survey once in every twelve months :

Provided that renewal survey may be made on the principle of continuous surveys in accordance with the provisions of rule 179.

(4) Where any passenger ship meets with any accident or where any defect is detected in its hull, machinery or equipment, it shall be subjected to additional survey or surveys after every such occurrence.

257. Ports of Survey

Surveys of passenger ships shall be conducted at the ports of Mumbai, Kolkata, Chennai, Kochi, Visakhapatnam, Marmugao, Jamnagar, Port Blair and Tuticorin. Provided that the Central Government may, by notification in the Official Gazette, declare additional ports of survey.

258. Application for survey

(1) Every such application shall be made not less than 72 hours before the time the ship is proposed to be surveyed. It shall be delivered to the Mercantile Marine Department office at the appropriate port of survey between 11.00 A.M. 10.00 A.M. and 4.00 P.M. 3.00 P.M. on any working day, not being a Sunday, second or a Saturday of every month or a holiday on which the office of the Mercantile Marine Department at the port remains closed.

259. Fees

(1) Every application shall be accompanied by a challan evidencing payment of fees in accordance with the scales set out in the **Sixth Schedule**. Where fees so paid in advance are found to be inadequate, the applicant shall, on demand, pay the balance amount of fees.

(2) No application for survey shall be entertained unless fees are paid in accordance with sub-rule (1).

260. Plans

Every application for survey shall be accompanied by such plans as will furnish requisite information relating to the structural strength of the ship, its hull, machinery and other equipment and fittings. Where necessary, the master of the ship shall furnish such additional plans, information and explanations as the surveyor may require.

261. Preparations for survey

Master of the ship shall make all requisite preparations for the conduct of survey. If such preparations are not made by the appointed time of survey, the surveyor may postpone the survey to some other time.

262. Conduct of survey

Where in respect of any application for survey of a ship appropriate fees have been paid and necessary preparation facilitating such survey are completed, the surveyor or surveyors nominated by the Principal officer or, as the case may be, by the surveyor-in-charge, shall survey the ship at the appointed time or at any other time, if any, appointed under rule 166.

263. Initial Surveys

The initial survey as set out in Part A of Seventh Schedule shall include a complete inspection of the ship's structure, machinery and equipment, including the outside of the ship's bottom and the inside and outside of the boilers. This survey shall be such as to ensure that the arrangements, materials and scantlings of the structure, boilers and other pressure vessels and their appurtenances, main and auxiliary machinery, electrical installation, radio installations including those used in life-saving appliances, and arrangements, shipborne navigational equipment, nautical publications, means of embarkation for pilots and other equipment fully comply with the requirements of the present rules, and of the laws decrees, orders and rules promulgated as a result thereof by the Director General for ships of the service for which it is intended. The survey shall also be such as to ensure that the workmanship of all parts of the ship and its equipment is in all respects satisfactory, and that the ship is provided with the lights, shapes, means of making sound signals and distress signals as required by the provisions of the present rules and the International Regulations for Preventing Collisions at Sea in force;

264. (1) **Renewal survey-**

The renewal survey as set out in Part B of Seventh Schedule shall include an inspection of the structure, boilers and other pressure vessels, machinery and equipment, including the outside of the ship's bottom. The survey shall be such as to ensure that the ship, as regards the structure, boilers and other pressure vessels

and their appurtenances, main and auxiliary machinery, electrical installation, radio installations including those used in life-saving appliances, fire protection, fire safety systems and appliances, life-saving appliances and arrangements, shipborne navigational equipment, nautical publications, means of embarkation for pilots and other equipment is in satisfactory condition and is fit for the service for which it is intended, and that it complies with the requirements of the present rules and of the laws, decrees, orders and rules promulgated as a result thereof by the Director General. The lights, shapes, means of making sound signals and distress signals carried by the ship shall also be subject to the above-mentioned survey for the purpose of ensuring that they comply with the requirements of the present rules and of the International Regulations for Preventing Collisions at Sea in force.

(2) Additional Survey :-

An additional survey either general or partial, according to the circumstances, shall be made after a repair resulting from investigations, maritime or whenever any important repairs or renewals are made. The survey shall be such as to ensure that the necessary repairs or renewals have been effectively made, that the material and workmanship of such repairs or renewals are in all respects satisfactory, and that the ship complies in all respects with the provisions of the present rules and of the International Regulations for Preventing Collisions at Sea in force, and of the laws, decrees, orders and rules promulgated as a result thereof by the Director General..

265. Inspection of Hull during renewal survey

(1) The hull of every passenger ship shall be examined in dry dock after it has been cleaned and before it is painted at the time of annual dry docking required under these rules as set out in Part B of Seventh Schedule . The propeller, rudder and all other outside fittings and their fastenings shall be examined at the same time. The propeller shaft, where required, shall be withdrawn for examination. All side scuttles, valves and other fittings for preventing the accidental admission of water into the ship shall be examined either in dry-dock or otherwise, as convenient, to ensure that they are in an efficient condition. The closing appliances of scuppers, sanitary and other discharges shall also be examined. In ships having a large number of scuppers and sanitary and other discharges, withdrawal of all the valves for examination at any one survey is not necessary except in the case of discharges from the main and auxiliary machinery. In all such cases, at least 25 per cent of the valves shall be examined at each annual survey in rotation. Every alternate year, inspection of underwater hull in dry-dock may be substituted by CTV examination afloat with surveyor in attendance during the examination.

(2) The interior structure shall be exposed sufficiently; ceilings, linings, deck coverings shall be removed to enable proper examination to be carried out.

Particular attention shall be paid to the structure under the boilers and main machinery and the forward and after ends of the ship. Twenty-five per cent of the interior structure including fresh and ballast water double bottom tanks shall be examined internally every year but double bottom tanks containing oil fuel shall be opened up for inspection in rotation so that all oil fuel tanks are examined in a period of ten years until the ship is twenty years old and thereafter in a period of four years. All double bottom, peak and deep tanks shall be pressure tested at least once in every four years.

(3) All watertight doors and the means of closing them shall be inspected and tested.

(4) The sub-division load line marking shall be verified.

266. Inspection of machinery during renewal survey

(1) In the case of a ship with only one set of propulsion engines, fifty per cent of the machinery shall be surveyed at each annual survey completing the survey of entire machinery once in two years.

(2) In the case of ships fitted with more than one set of engines, the engines shall be surveyed in rotation, the survey schedule being so arranged that the entire machinery shall be surveyed once in four years and not less fifty per cent machinery of one set of engines, together with its shafting and auxiliaries, being surveyed at each annual survey.

(3) In the case of any ship in which steam turbines are supplied with steam from high pressure water tube boilers, the turbines shall be examined once in four years if there are more than one set of turbines or once in two years where there is only one set of turbine.

(4) For the purpose of ensuring proper survey, shaft bearings, thrust surfaces shall be exposed and the shafts turned for a complete examination.

(5) All essential pumps, in-lets and discharge valves connected with the machinery shall be opened up and, where necessary, propeller shafts withdrawn.

267. Inspection of propelling machinery during renewal survey

At every renewal survey, the following parts of propelling machinery shall be opened up for survey, namely:-

(a) Internal Combustion Engines: Cylinders, pistons, valves, covers, piston rods, connecting rods, crossheads, valve gear, top and bottom ends, main bearings, fuel pumps, scavange pumps and blowers, superchargers, air compressors, coolers, air receivers, air pipe system, safety devices and transmission gears, cooling and lubricating oil systems and their pumps. Selected lengths of starting air pipes shall be removed and examined internally every four years.

(b) Steam Turbines: Turbine casings, relief valves, rotors and blading and transmission gears.

(c) Steam Reciprocating Engines: Cylinders, valve chests, piston valves, crossheads, piston rods, connecting rods, top and bottom ends, main bearings and valve gear.

268. Survey of electrical installation during renewal survey

At each renewal survey-

(a) the insulation resistence of various circuits, motors and generators shall be ascertained and scrutinised;

(b) the general condition of stators, rotors, wirings, electrical connections, control gear and safety devices shall be examined;

(c) the fittings of main and emergency switch boards, section boards and distribution boards shall be examined and protective devices tested for their efficiency;

(d) all electrical cables shall be examined, as far as practicable; and

(e) main and emergency lighting and circuits shall be examined under operating conditions.

269. Survey of boilers and other steam generators during renewal survey

(1) Water tube boilers supplying steam to main propulsion machinery and steam heated steam generators shall be examined internally and externally at intervals of not more than two years. All other boilers, exhaust gas generators and economisers shall be examined at intervals of two years until they are eight years old and thereafter annually. All boilers, superheaters, economisers and air heaters shall be examined internally and externally and where considered necessary, the pressure parts are to be tested by hydraulic pressure and the thickness of the plates and tubes ascertained. All the mountings on boilers, superheaters and economisers shall be opened up and examined and on completion of survey, the safety valves adjusted under steam to the approved working pressure.

(2) Where boilers are so placed in a ship that the bottom of the boiler cannot be examined, the boiler should be lifted out for inspection at least once in every four years.

(3) Where a boiler is of such dimension or form that a satisfactory internal examination cannot be made, it shall be examined as far practicable and subsequently tested by hydraulic pressure at each survey.

270. Survey of screw and tube shafts during renewal survey

Screw shafts and tube shafts fitted with continuous liners or running in oil shall be withdrawn for examination at intervals not exceeding four years. All other screw and tube shafts shall be examined at intervals of two years.

271. Survey of steering gear and windlass during renewal survey

Steering gear and windlass machinery shall be opened up for examination every two years. Where the steering gear is operated by hydraulic pumps, all pumps shall be opened for examination once in a four year's period.

272. Survey of auxiliary machinery during periodical renewal survey

All auxiliary machinery driving electric generators, air compressors and all essential pumps shall be opened up for examination once in a four years' period.

273. Survey of pumping arrangements during periodical renewal survey

All bilge pumping arrangements shall be tested under working condition and oil fuel, lubricating and ballast pumping arrangements shall be generally inspected and where necessary opened up or treated as considered necessary by the surveyor.

274. Running Continuous survey

(1) The hull and machinery of any ship may be surveyed on the "Continuous survey" principle; that is to say, all parts of hull, machinery, equipment, appliances and other parts of the ship which are required to be surveyed during renewal survey need not be opened up and surveyed on one occasion but may be opened up and surveyed at different occasions up to four quarters :

Provided that all parts of such ship shall be opened up and surveyed within the period specified in Rules 171 to 178 so that full survey of the ship is completed wi thin the period required by these rules.

(2) Continuous survey of different parts of a ship or its machinery, equipment and appliances shall be so arranged that in no case the interval between two surveys of the same part exceeds the period specified in Rules 171 to 178. For this purpose a proper schedule of Continuous surveys may be drawn up and approved by the Director-General.

275. Defects in hull, machinery and equipment of a ship

(1) If a surveyor finds that defects exist in the hull, machinery or equipment of a ship, he shall inform the Master or Owner of the ship in writing of such defects and the repairs necessary to make good the defects. In any such case, the surveyor, when advised by the owner or master of the ship that the requisite repairs are carried out, shall pay one or more visits to the ship, as necessary, to satisfy himself that the repairs and renewals have been executed satisfactorily.

(2) Where the Master or Owner of the ship does not carry out such repairs or renewals to the satisfaction of the surveyor, the surveyor may refuse to give a declaration of survey in respect of the ship.

276. Declaration of survey

(1) If on completion of survey the surveyor is satisfied that the ship complies with

all applicable requirements of these rules, he shall issue a declaration of survey in respect of that ship: Provided that declaration of survey may not be issued to any ship so surveyed unless the outside of its hull and fittings have been inspected in a dry dock or a shipway during twelve months preceding the date of survey.

(2) Declaration of survey granted under sub-rule (1) shall in no case be for a period exceeding twelve months from the date of last inspection of the outside of the hull and fittings of such ship in a dry dock or slipway . One year extension may be granted after an underwater inspection and record thereto examined by a surveyor.

277. Issue of Certificate of Survey

If, on completion of survey and scrutiny of the declaration of survey, the principal officer is satisfied that he can properly do so, he shall issue the certificate of survey and/or any other certificate or certificates as may be necessary having regard to the nature of voyages on which his ship is engaged.

THE FIRST SCHEDULE

Subdivision index

PART I

General

1. The subdivision of a ship is considered sufficient if the attained subdivision index A, determined in accordance with paragraph 3 to 6, is not less than the required
subdivision index R calculated in accordance with this paragraph 2 and if, in addition, the
partial indices A_s, A_p and A_l are not less than $0.9R$.

Required subdivision index R

2. The degree of subdivision to be provided shall be determined by the required subdivision index R, as follows:

$$R = 1 - \frac{5{,}000}{L_s + 2.5N + 15{,}225}$$

where:

L_s is the subdivision length defined in Part I

$N = N_1 + 2N_2$

N_1 = number of persons for whom lifeboats are provided

N_2 = number of persons (including officers and crew) the ship is permitted to carry in excess of N_1.

Where the conditions of service are such that compliance with this paragraph on the basis of $N = N_1 + 2N_2$ is impracticable and where the Director General considers that a suitably

reduced degree of hazard exists, a lesser value of N may be taken but in no case less than $N = N_1 + N_2$.

Attained subdivision index A

3. The attained subdivision index A is obtained by the summation of the partial indices A_s, A_p and A_l, (weighted as shown) calculated for the draughts d_s, d_p and d_l defined in regulation 2 in accordance with the following formula:

$A = 0.4A_s + 0.4A_p + 0.2A_l$

Each partial index is a summation of contributions from all damage cases taken in
consideration, using the following formula:

$A = \Sigma\, p_i\, s_i$

where:

i represents each compartment or group of compartments under consideration,

p_i accounts for the probability that only the compartment or group of compartments under consideration may be flooded, disregarding any horizontal subdivision, as defined in regulation 7-1,

s_i accounts for the probability of survival after flooding the compartment or group of compartments under consideration, and includes the effect of any horizontal subdivision, as defined in regulation 7-2.

4 In the calculation of A, the level trim shall be used for the deepest subdivision draught and the partial subdivision draught. The actual

service trim shall be used for the light service draught. If in any service condition, the trim variation in comparison with the calculated trim is greater than 0.5% of L_s, one or more additional calculations of A are to be submitted for the same draughts but different trims so that, for all service conditions, the difference in trim in comparison with the reference trim used for one calculation will be less than 0.5% of L_s.

5 When determining the positive righting lever (GZ) of the residual stability curve,
the displacement used should be that of the intact condition. That is, the constant
displacement method of calculation should be used.

6 The summation indicated by the above formula shall be taken over the ship's
subdivision length (L_s) for all cases of flooding in which a single compartment or two or
more adjacent compartments are involved. In the case of unsymmetrical arrangements,
the calculated A value should be the mean value obtained from calculations involving
.both sides. Alternatively, it should be taken as that corresponding to the side which
evidently gives the least favourable result.

7 Wherever wing compartments are fitted, contribution to the summation indicated
by the formula shall be taken for all cases of flooding in which wing compartments are

involved. Additionally, cases of simultaneous flooding of a wing compartment or group
of compartments and the adjacent inboard compartment or group of compartments, but
excluding damage of transverse extent greater than one half of the ship breadth B, may be
added. For the purpose of this regulation, transverse extent is measured inboard from
ship's side, at right angle to the centreline at the level of the deepest subdivision draught.

8 In the flooding calculations carried out according to the regulations, only one
breach of the hull and only one free surface need to be assumed. The assumed vertical
extent of damage is to extend from the baseline upwards to any watertight horizontal
subdivision above the waterline or higher. However, if a lesser extent of damage will
give a more severe result, such extent is to be assumed.

9 If pipes, ducts or tunnels are situated within the assumed extent of damage,
arrangements are to be made to ensure that progressive flooding cannot thereby extend to
compartments other than those assumed flooded. However, the Administration may permit minor progressive flooding if it is demonstrated that its effects can be easily
controlled and the safety of the ship is not impaired.

Calculation of the factor p_i

10 The factor p_i for a compartment or group of compartments shall be calculated in
accordance with paragraphs 10.1 and 10.2 using the following notations:

j = the aftmost damage zone number involved in the damage starting with No.1 at the stern;
n = the number of adjacent damage zones involved in the damage;
k = is the number of a particular longitudinal bulkhead as barrier for transverse penetration in a damage zone counted from shell towards the centre line. The shell has k = 0;
$x1$ = the distance from the aft terminal of L_s to the aft end of the zone in question;
$x2$ = the distance from the aft terminal of L_s to the forward end of the zone in question;

b = the mean transverse distance in metres measured at right angles to the centreline at the deepest subdivision loadline between the shell and an assumed vertical plane extended between the longitudinal limits used in calculating the factor p_i and which is a tangent to, or common with, all or part of the outermost portion of the longitudinal bulkhead under consideration. This vertical plane shall be so orientated that the mean
transverse distance to the shell is a maximum, but not more than twice the least distance between the plane and the shell. If the upper part of a longitudinal bulkhead is below the deepest subdivision loadline the vertical plane used for determination of b is assumed to extend upwards to the deepest subdivision waterline. In any case, b is not to be taken greater than $B/2$.

If the damage involves a single zone only:

$p_i = p(x1_j, x2_j) \cdot [r(x1_j, x2_j, b_k) - r(x1_j, x2_j, b_{k-1})]$

If the damage involves two adjacent zones:

$p_i = p(x1_j, x2_{j+1}) \cdot [r(x1_j, x2_{j+1}, b_k) - r(x1_j, x2_{j+1}, b_{k-1})]$

$- p(x1_j, x2_j) \cdot [r(x1_j, x2_j, b_k) - r(x1_j, x2_j, b_{k-1})]$

$- p(x1_{j+1}, x2_{j+1}) \cdot [r(x1_{j+1}, x2_{j+1}, b_k) - r(x1_{j+1}, x2_{j+1}, b_{k-1})]$

If the damage involves three or more adjacent zones:

$p_i = p(x1_j, x2_{j+n-1}) \cdot [r(x1_j, x2_{j+n-1}, b_k) - r(x1_j, x2_{j+n-1}, b_{k-1})]$

$- p(x1_j, x2_{j+n-2}) \cdot [r(x1_j, x2_{j+n-2}, b_k) - r(x1_j, x2_{j+n-2}, b_{k-1})]$

$- p(x1_{j+1}, x2_{j+n-1}) \cdot [r(x1_{j+1}, x2_{j+n-1}, b_k) - r(x1_{j+1}, x2_{j+n-1}, b_{k-1})]$

$+ p(x1_{j+1}, x2_{j+n-2}) \cdot [r(x1_{j+1}, x2_{j+n-2}, b_k) - r(x1_{j+1}, x2_{j+n-2}, b_{k-1})]$

and where $r(x1, x2, b_0) = 0$

10.1 The factor $p(x1, x2)$ is to be calculated according to the following formulae:

Overall normalized max damage length: $J_{max} = 10/33$

Knuckle point in the distribution: $J_{kn} = 5/33$

Cumulative probability at J_{kn}: $p_k = 11/12$

Maximum absolute damage length: $l_{max} = 60$ m

Length where normalized distribution ends: $L^* = 260$ m

Probability density at $J = 0$:

$$b_o = 2\left(\frac{p_k}{J_{kn}} - \frac{1 - p_k}{J_{max} - J_{kn}}\right)$$

When $L_s \leq L^*$:

$$J_m = \min \left\{ J_{max}, \frac{l_{max}}{L_s} \right\}$$

$$J_k = \frac{J_m}{2} + \frac{1 - \sqrt{1 + (1 - 2p_k) b_o J_m + \frac{1}{4} b_o^2 J_m^2}}{b_o}$$

$b_{12} = b_o$

When $L_s > L^*$:

$$J_m^* = \min \left\{ J_{max}, \frac{l_{max}}{L^*} \right\}$$

$$J_k^* = \frac{J_m^*}{2} + \frac{1 - \sqrt{1 + (1 - 2p_k) b_o J_m^* + \frac{1}{4} b_o^2 J_m^{*2}}}{b_o}$$

$$J_m = \frac{J_m^* . L^*}{L_s}$$

$$J_k = \frac{J_k^* . L^*}{L_s}$$

$$b_{12} = 2\left(\frac{p_k}{J_k} - \frac{1 - p_k}{J_m - J_k} \right)$$

$$b_{11} = 4\left(\frac{1 - p_k}{(J_m - J_k) J_k} - 2\frac{p_k}{J_k^2} \right)$$

$$b_{21} = -2\left(\frac{1 - p_k}{(J_m - J_k)^2} \right)$$

$b_{22} = -b_{21} J_m$

The non-dimensional damage length:

$$J = \frac{(x2 - x1)}{L_s}$$

The normalized length of a compartment or group of compartments:

J_n is to be taken as the lesser of J and J_m.

10.1.1 Where neither limit of the compartment or group of compartments under consideration coincides with the aft or forward terminals:

$J \leq J_k$:

$$p(x1, x2) = p_1 = (1/6)\ J^2\ (b_{11}J + 3b_{12})$$

$J > J_k$:

$$p(x1, x2) = p_2 = -(1/3)\ b_{11}\ J_k^3 + ½\ (b_{11}\ J - b_{12})\ J_k^2 + b_{12}\ JJ_k$$

$$-(1/3)\ b_{21}\ (J_n^3 - J_k^3) + ½\ (b_{21}\ J - b_{22})\ (J_n^2 - J_k^2)$$

$$+ b_{22}\ J(J_n - J_k)$$

10.1.2 Where the aft limit of the compartment or group of compartments under consideration coincides with the aft terminal or the forward limit of the compartment or group of compartments under consideration coincides with the forward terminal:

$J \leq J_k$:

$$p(x1, x2) = 1/2\ (p_1 + J)$$

$J \leq J_k$:

$$p(x1, x2) = 1/2\ (p_2 + J)$$

10.1.3 Where the compartment or groups of compartments considered extends over the entire subdivision length (L_s):

$$p\ (x1, x2) = 1$$

10.2 The factor r(x1, x2, b) shall be determined by the following formulae:

$$r(x1, x2, b) = 1 - (1 - C)\ .\ \left[1 - \frac{G}{p(x1, x2)}\right]$$

Where,

$C = 12\ .\ J_b\ .\ (-45\ .\ J_b + 4)$, where

$$J_b = \frac{b}{15.B}$$

10.2.1 Where the compartment or groups of compartments considered extends over the entire subdivision length (L_s);

$$G = G_1 = \tfrac{1}{2} b_{11} J_b^2 + b_{12} J_b$$

10.2.2 Where neither limit of the compartment or group of compartments under consideration coincides with the aft or forward terminals:

$$G = G_2 = -\tfrac{1}{3} b_{11} J_o^3 + \tfrac{1}{2} (b_{11} J - b_{12}) J_o^2 + b_{12} J J_o, \text{ where}$$

J_o = min. (J, J_b)

10.2.3 Where the aft limit of the compartment or group of compartments under consideration coincodes with the aft terminal or the forward limit of the compartment or group of compartments under consideration coincides with the forward terminal:

$$G = \tfrac{1}{2} (G_2 + G_1 . J)$$

Calculation of the factor s_i

11 The factor s_i shall be determined for each case of assumed flooding, involving a
compartment or group of compartments, in accordance with the following notations and
the provisions in this regulation.

θ_e is the equilibrium heel angle in any stage of flooding, in degrees;
θ_v is the angle, in any stage of flooding, where the righting lever becomes negative, or the angle at which an opening incapable of being closed weathertight becomes submerged;
GZ_{max} is the maximum positive righting lever, in metres, up to the angle θ_v
;
Range is the range of positive righting levers, in degrees, measured from the angle θ_e

. The positive range is to be taken up to the angle θ_v

;

Flooding stage is any discrete step during the flooding process, including the stage before equalization (if any) until final equilibrium has been reached.

11.1 The factor s_i, for any damage case at any initial loading condition, d_i, shall be obtained from the formula:

s_i = minimum { $s_{intermediate,i}$ or $s_{final,i} \cdot s_{mom,i}$ }

where:

$s_{intermediate,i}$ is the probability to survive all intermediate flooding stages until the final equilibrium stage, and is calculated in accordance with paragraph 11.2;

$s_{final,i}$ is the probability to survive in the final equilibrium stage of flooding. It is calculated in accordance with paragraph 11.3;

$s_{mom,i}$ is the probability to survive heeling moments, and is calculated inaccordance with paragraph 11. 4.

11. 2 The factor $s_{intermediate,i}$ is applicable only to passenger ships (for cargo ships

$s_{intermediate,i}$ should be taken as unity) and shall be taken as the least of the s-factors

obtained from all flooding stages including the stage before equalization, if any, and is to

be calculated as follows:

$$S_{intermediate,\ i} = \left[\frac{GZ_{max}}{0.05} \cdot \frac{Range}{7} \right]^{\frac{1}{4}}$$

where GZ_{max} is not to be taken as more than 0.05 m and *Range* as not more than 7°.

$s_{intermediate}$ = 0, if the intermediate heel angle exceeds 15°. Where cross-flooding fittings
are required, the time for equalization shall not exceed 10 min.

11.3 The factor $s_{final,i}$ shall be obtained from the formula:

$$s_{final,i} = K.\left[\frac{GZ_{max}}{0.12}.\frac{Range}{16}\right]^{\frac{1}{4}}$$

where,

GZ_{max} is not to be taken as more than 0.12 m;
Range is not to be taken as more than 16°'
K=1 if $\theta_e \leq \theta_{min}$
K = 0 if $\theta_e \geq \theta_{min}$

$$K = \sqrt{\frac{\theta_{max} - \theta_c}{\theta_{max} - \theta_{min}}} \text{ otherwise,}$$

where:

θ_{min} = 7° and θ_{max} = 15°

11.4 The factor $s_{mom,i}$ is applicable only to passenger ships (for cargo ships $s_{mom,i}$ shall
be taken as unity) and shall be calculated at the final equilibrium from the formula:

$$s_{mom,i} = \frac{(GZ_{max} - 0.04).Displacement}{M_{heel}}$$

where:

Displacement is the intact displacement at the subdivision draught;

M_{heel} is the maximum assumed heeling moment as calculated in accordance with
paragraph 11.4.1; and

$s_{mom,i} \leq 1$

11.4.1 The heeling moment M_{heel} is to be calculated as follows:
M_{heel} = maximum {$M_{passenger}$ or M_{wind} or $M_{Survivalcraft}$}

11. 4.1.1 $M_{passenger}$ is the maximum assumed heeling moment resulting from movement of
passengers, and is to be obtained as follows:

$M_{passenger} = (0.075 \cdot N_p) \cdot (0.45 \cdot B)$ (tm)

where:
N_p is the maximum number of passengers permitted to be on board in the service condition corresponding to the deepest subdivision draught under consideration;
and

B is the beam of the ship.

Alternatively, the heeling moment may be calculated assuming the passengers are

distributed with 4 persons per square metre on available deck areas towards one side of
the ship on the decks where muster stations are located and in such a way that they
produce the most adverse heeling moment. In doing so, a weight of 75 kg per passenger
is to be assumed.

11.4.1.2 M_{wind} is the maximum assumed wind force acting in a damage situation:

$M_{wind} = (P \cdot A \cdot Z) / 9806$ (tm)

where:

P = 120 N/ m_2;

A = projected lateral area above waterline;

Z = distance from centre of lateral projected area above waterline to $T/2$; and

T = ship's draught, d_i.

11.4.1.3 $M_{Survivalcraft}$ is the maximum assumed heeling moment due to the launching of all
fully loaded davit-launched survival craft on one side of the ship. It shall be calculated
using the following assumptions:

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

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

.iii) a fully loaded davit-launched liferaft attached to each davit on the side to which the ship has heeled after having sustained damage shall be assumed to be swung out ready for lowering;
.iv) persons not in the life-saving appliances which are swung out shall not provide either additional heeling or righting moment; and

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

11.5 Unsymmetrical flooding is to be kept to a minimum consistent with the efficient
arrangements. Where it is necessary to correct large angles of heel, the means adopted
shall, where practicable, be self-acting, but in any case where controls to equalization
devices are provided they shall be operable from above the bulkhead deck. These fittings
together with their controls shall be acceptable to the Administration.* Suitable
information concerning the use of equalization devices shall be supplied to the master of
the ship.
11.5.1 Tanks and compartments taking part in such equalization shall be fitted with air pipes or equivalent means of sufficient cross-section to ensure that the flow of water into
the equalization compartments is not delayed.

11.5.2 In all cases, s_i is to be taken as zero in those cases where the final waterline, taking

into account sinkage, heel and trim, immerses:
i) the lower edge of openings through which progressive flooding may take place and such flooding is not accounted for in the calculation of factor s_i. Such openings shall include air-pipes, ventilators and openings which are closed by means of weathertight doors or hatch covers; and
ii) any part of the bulkhead deck in passenger ships considered a horizontal evacuation route for compliance with chapter II-2.

11.5.3 The factor s_i is to be taken as zero if, taking into account sinkage, heel and trim,
any of the following occur in any intermediate stage or in the final stage of flooding:
.i) immersion of any vertical escape hatch in the bulkhead deck intended for compliance with chapter II-2;
ii) any controls intended for the operation of watertight doors, equalization devices, valves on piping or on ventilation ducts intended to maintain the integrity of watertight bulkheads from above the bulkhead deck become inaccessible or inoperable;

iii) immersion of any part of piping or ventilation ducts carried through a watertight boundary that is located within any compartment included in damage cases contributing to the attained index A, if not fitted with watertight means of closure at each boundary.

11.5.4 However, where compartments assumed flooded due to progressive flooding are taken into account in the damage stability calculations multiple values of $s_{intermediate,i}$ may be calculated assuming equalization in additional flooding phases.

11.5.5 Except as provided in paragraph 11.5.3.i), openings closed by means of watertight
manhole covers and flush scuttles, small watertight hatch covers, remotely operated
sliding watertight doors, side scuttles of the non-opening type as well as watertight access
doors and hatch covers required to be kept closed at sea need not be considered.

11. 6 Where horizontal watertight boundaries are fitted above the waterline under
consideration the s-value calculated for the lower compartment or group of compartments
shall be obtained by multiplying the value as determined in paragraph 1.1 by the
reduction factor v_m according to paragraph 6.1, which represents the probability that the
spaces above the horizontal subdivision will not be flooded.

11.6.1 The factor v_m shall be obtained from the formula:

$$v_m = v(H_{j,\,n,\,m},\, d) - v(H_{j,\,n,\,m-1},\, d)$$

where:

$H_{j,\,n,\,m}$ is the least height above the baseline, in metres, within the longitudinal
range of $x_{1(j)} \ldots x_{2(j+n-1)}$ of the m^{th} horizontal boundary which is assumed to limit the
vertical extent of flooding for the damaged compartments under consideration;

$H_{j,\ n,\ m-1}$ is the least height above the baseline, in metres, within the longitudinal
range of $x_{1(j)}...x_{2(j+n-1)}$ of the $(m-1)^{th}$ horizontal boundary which is assumed to limit
the vertical extent of flooding for the damaged compartments under consideration;

j signifies the aft terminal of the damaged compartments under consideration;
m represents each horizontal boundary counted upwards from the waterline under
consideration;
d is the draught in question as defined in regulation 2; and
x_1 and x_2 represent the terminals of the compartment or group of compartments
considered in regulation 7-1.

11.6.1.1 The factors $v(H_{j,\ n,\ m},\ d)$ and $v(H_{j,\ n,\ m-1},\ d)$ shall be obtained from the formulae:

$$v(H,d) = 0.8\frac{(H-d)}{7.8}, \text{if } (H_m - d) \text{ is less than, or equal to, 7.8 m;}$$

$$v(H,d) = 0.8 + 0.2\frac{(H-d)-7.8}{4.7}, \quad \text{in all other cases,}$$

where:
$v(H_{j,\ n,\ m},\ d)$ is to be taken as 1, if H_m coincides with the uppermost watertight
boundary of the ship within the range $(x1_{(j)}...x2_{(j+n-1)})$, and
$v(H_{j,\ n,\ 0},\ d)$ is to be taken as 0.

In no case is v_m to be taken as less than zero or more than 1.

11.6.2 In general, each contribution dA to the index A in the case of horizontal subdivisions is obtained from the formula:

$$dA = p_i \cdot [v_1 \cdot s_{min1} + (v_2 - v_1) \cdot s_{min2} + \ldots. + /(1\text{-}v_{m-1}) \cdot s_{minm}]$$

where:
v_m = the v-value calculated in accordance with paragraph 11.6.1;
s_{min} = the least s-factor for all combinations of damages obtained when the assumed damage extends from the assumed damage height H_m downwards.

Permeability

12.1 For the purpose of the subdivision and damage stability calculations of the regulations, the permeability of each general compartment or part of a compartment shall
be as follows:

Spaces	**Permeability**
Appropriated to stores	0.60
Occupied by accommodation	0.95
Occupied by machinery	0.85
Void spaces	0.95
Intended for liquids	0 or 0.95[1]

1 Whichever results in the more severe requirement.

12.2 For the purpose of the subdivision and damage stability calculations of the regulations, the permeability of each cargo compartment or part of a compartment shall
be as follows:

Spaces	Permeability at draught d_s	Permeabilityat draught d_p	Permeability at draught d_l
Dry cargo spaces	0.70	0.80	0.95
Container spaces	0.70	0.80	0.95
Ro-ro spaces	0.90	0.90	0.95
Cargo liquids	0.70	0.80	0.95

12.3 Other figures for permeability may be used if substantiated by calculations.

Special requirements concerning damage stability

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

13.2 A passenger ship intended to carry 36 or more persons is to be capable of withstanding damage along the side shell to an extent specified in paragraph 13.3.

Compliance with this regulation is to be achieved by demonstrating that s_i, as defined in
Paragraph 11, is not less than 0.9 for the three loading conditions on which is based the
calculation of the subdivision index.

13. 3 The damage extent to be assumed when demonstrating compliance with
paragraph 13.2, is to be dependent on both N as defined in regulation 6, and L_s as defined in Part I, such that:

i) the vertical extent of damage is to extend from the ship's moulded baseline to a position up to 12.5 m above the position of the deepest subdivision draught as defined in Part I, unless a lesser vertical extent of damage were to give a lower value of s_i, in which case this reduced extent is to be used;

ii) where 400 or more persons are to be carried, a damage length of $0.03L_s$ but not less than 3 m is to be assumed at any position along the side shell, in conjunction with a penetration inboard of $0.1B$ but not less than 0.75 m measured inboard from the ship side, at right angle to the centreline at the level of the deepest subdivision draught;

iii) where less than 400 persons are carried, damage length is to be assumed at any position along the shell side between transverse watertight bulkheads provided that the distance between two adjacent transverse watertight bulkheads is not less than the assumed damage length. If the distance between adjacent transverse watertight bulkheads is less than the assumed damage length, only

one of these bulkheads shall be considered effective for the purpose of demonstrating compliance with paragraph 13.2;

iv) where 36 persons are carried, a damage length of 0.015L_s but not less than 3 m is to be assumed, in conjunction with a penetration inboard of 0.05B but not less than 0.75 m; and
v) where more than 36, but fewer than 400 persons are carried the values of damage length and penetration inboard, used in the determination of the assumed extent of damage, are to be obtained by linear interpolation between the values of damage length and penetration which apply for ships carrying 36 persons and 400 persons as specified in subparagraphs iv) and .ii).

THE SECOND SCHEDULE

Construction of Watertight Bulkhead etc.

1. Strength and Construction:

(i) Every bulkhead and other portion of the internal structure forming part of the watertight sub-division of the ship shall be of such strength and so constructed as to be capable of supporting, with an adequate margin of resistance, the pressure due to the maximum head of water which it might have to sustain in the event of damage to the ship not being less than the pressure due to a head of water upto the margin line. Such maximum head shall include any additional head estimated, under these rules, to result from flooding or heeling.

(ii) Every such bulkhead and portion shall be constructed of approved shipbuilding steel and,

in case of a ship which is classed with a Certifying Authority, and built to its survey requirements, it shall be sufficient for compliance with the requirements of sub rule (i), if that Authority certifies that the watertight bulkheads and parts thereof are constructed in accordance with the requirements of its Rules.

2. (a) Watertight Bulkhead Plating:

(i) Every bulkhead required by these rules to be watertight shall be constructed with plating of adequate thickness to satisfy the requirements of sub rule (i) of Rule 1 of this schedule.

(b) Watertight Bulkhead Stiffeners:

(i) Every watertight bulkhead shall be fitted with stiffeners which shall have efficient brackets or lug end connections. The ends of each stiffener shall be attached to the shell plating or the inner bottom plating or the deck plating so as to ensure adequate rigidity in the bulkhead. In case of bracketed hold stiffeners, the bracket or its connecting angle shall either extend over the floor or beam adjacent to the bulkhead or other equally effective means to ensure adequate stiffness and rigidity.

(ii) Where stiffeners are cut in way of watertight doors in the lower part of a bulkhead, the opening shall be properly framed and bracketed and a tapered web plate or buttress, stiffened on its edge, shall be fitted at each side of the door from the base of the bulkhead to above the door opening.

(iv) Where frames or beams pass through a bulkhead required by these rules to be watertight, the bulkhead shall be made watertight without the use of wood or cement.

3. Watertight Decks, Steps and Flats:

(i) The horizontal plating of decks, steps and flats required by these rules to be watertight shall be constructed with plating of adequate thickness to satisfy the requirements of sub rule (i) of Rule 1 of this schedule

(ii) Adequate supports for such beams shall be provided by bulkheads, or by girders pillared where necessary.

(iii) Where frames pass through a deck, step or flat which is required by these rules to be watertight, such deck, step or flat shall be made watertight without the use of wood or cement.

4. Watertight Recesses and Trunkways: Every recess and trunkway required by these to be watertight shall be so constructed as to provide strength and stiffness at all parts not less than that required for watertight bulkheads at a corresponding level.

5. *Watertight Inner Skins*: Every inner skin required by these rules to be watertight shall be of such strength and construction as will enable it to withstand head of water upto the bulkhead deck. .

THE THIRD SCHEDULE

Stability of Ships

Information as to Stability of Ships

The information relating to the stability of a ship to be provided to the Master shall include particulars appropriate to the ship on the matters specified below. Such particulars shall be in the form of a statement unless the contrary is indicated.

1. The ship's name, name of builders and yard number, date of build/conversion, official number, port of registry, gross and register tonnage, particulars of classification, principal dimensions, displacement, deadweight and draught to the Summer Load Line.

2. A profile view and plan views of the ship drawn to scale showing, with their names, all compartments, tanks, storerooms and crew and passenger accommodation spaces, and also showing the mid-length position.

3. (a) The capacity and the centre of gravity (longitudinal, and transverse) of every compartment available for the carriage of cargo, fuel, stores, goods, water, domestic water or water ballast.

(b) In the case of a vehicle ferry, the vertical centre of gravity of compartments for the carriage of vehicles shall be based on the estimated centres of gravity of the vehicles and not on the volumetric centres of the compartments.

4. The estimated total weight of (a) passengers and their effects and (b) crew and their effects, and the centre of gravity (longitudinal and transverse) of each such total weight. In assessing such centres of gravity passengers and crew shall be assumed to be distributed about the ship in the spaces they will normally occupy, including the highest decks to which either or both have access. A weight of 75 Kg. should be assumed for each passenger and crew and the height of centre of gravity of passengers should be assumed at 1.0 metre above deck level of standing passengers and 0.3 metre above the seat in the case of seated passengers.

5. The estimated weight and the disposition and centre of gravity of the maximum amount of deck cargo which the ship may reasonably be expected to carry on an exposed deck. The estimated weight shall include in the case of deck cargo likely to absorb water the estimated weight of water likely to be so absorbed and allowed for in arrival conditions, such weight in the case of timber deck cargo being taken to be 10 per cent by weight.

6. A diagram or scale showing the load line mark and load lines with particulars of the corresponding freeboards, and also showing the displacement, ~~in~~ metric tons per centimetre immersion, and deadweight corresponding in each case to a range of mean draughts extending between the waterline representing the deepest load line and the waterline of the ship in light condition.

7. A diagram or tabular statement showing the hydrostatic particulars of the ship, including:

(a) extreme displacement,

(b) metric tons per centimeter immersion,

(c) the values of the moment to change trim by one centimeter,

(d) the heights of the transverse metacentre,

(e) longitudinal metacentric height,

(f) vertical center of buoyancy,

(g) longitudinal center of flotation,

(h) longitudinal center of buoyancy,

for a range of mean draughts extending at least between the water-line representing the deepest load-line and the waterline of the ship in light condition. Where operation of the ship results in loading conditions having trim exceeding +/- 0.5% of subdivision length L_S, additional hydrostatic particulars should be included for a suitable range of trim. Where a tabular statement is used, the intervals between such draughts shall be sufficiently close to permit accurate interpolation. In the case of ships having raked keels, the same datum for the heights of centres of buoyancy and metacentres shall be used as for the centres of gravity.

8. The effect on stability of free surface in each tank in the ship in which liquids may be carried, including an example to show how the metacentric height is to be corrected.

9. (a) A diagram showing cross curves of stability indicating the height of the assumed axis from which the Righting Levers are measured and the trim which has been assumed. In the case of ships having raked keels, where a datum other than the top of keel has been used, the position of the assumed axis shall be clearly defined.

(b) Subject to the following sub-paragraph, only (i) enclosed superstructures and (ii) efficient trunks as defined in the Merchant Shipping (Load Line) Rules, 1976 shall be taken into account in deriving such curves.

(c) The following structures may be taken into account in deriving such curves if it is shown to the satisfaction of the Director General that their location, integrity and means of closure will contribute to the ship's stability:

(i) Superstructures located above the superstructure deck;

(ii) Deckhouses on or above the freeboard deck, whether wholly or in part only;

(iii) Hatchway structures on or above the freeboard deck;

Additionally, in the case of a ship carrying timber deck cargo, the Director General may permit the volume of the timer deck cargo, or a part thereof to be taken into account in deriving a supplementary curve of stability appropriate to the ship when carrying such cargo. The volume permeability of timber deck cargoes shall be assumed to be 25 per cent.

(d) Superstructures and deck houses not regarded as closed may be taken into account in calculating stability upto the angle at which their openings are flooded. At this angle the statical stability curve should show one or more steps and in the subsequent computations the flooded spaces shall be considered non-existent.

In cases where the ship would sink due to flooding through any opening, the stability curve should be cut short at the corresponding angle of flooding and the ship shall be considered to have entirely lost her stability.

(e) Small openings such as scuppers, discharge and sanitary pipes or other such openings shall not be considered open if they submerge at an angle of inclination of more than 30^{o}. These openings where they submerge at an angle of 30^{o} or less shall be assumed to be open if progressive flooding can take place through them.

(f) An example shall be given showing how to obtain a curve of Righting Levers (GZ) from the cross curves of stability.

(g) Where the buoyancy of a superstructure is to be taken into account in the calculation of stability information to be supplied in the case of a vehicle ferry or similar ship having bow doors, ship's side doors or stern doors, there shall be included in the stability information a specific statement that such doors must be secured weathertight before the ship proceeds to sea and that the cross curves of stability are based upon the assumption that such doors have been so secured.

10. (a) The diagram and statements referred to in sub-paragraph (b) of this paragraph shall be provided separately for each of the following conditions of the ship :-

(i) Light condition: If the ship has permanent ballast, such diagram and statements shall be provided for the ship in light condition both (1) with such ballast, and (2) without such ballast.

(ii) Ballast condition: Both (1) on departure, and (2) on arrival, it being assumed for the purpose of the latter in this and the following sub-paragraphs that oil fuel, fresh water, consumable stores and the like are reduced to 10 per cent of their capacity.

(iii) Both (1) on departure, and (2) on arrival, when loaded to the Summer Load Line with cargo filling all spaces available for cargo, cargo for this purpose being taken to be homogeneous cargo except where this is clearly inappropriate, for example, in the case of cargo spaces in a ship which are intended to be used exclusively for the carriage of vehicles or of containers.

(iv) Service loaded conditions: Both (1) on departure and (2) on arrival.

(b) (i) A profile diagram of the ship drawn to a suitable small scale showing the disposition of all components of the deadweight.

(ii) A statement showing the lightweight, the disposition and the total weights of all components of the deadweight, the displacement, the corresponding positions of the centre of gravity, draughts, trim, the metacentre and also the metacentric height (GM).

(iii) A diagram showing a curve of Righting Levers (GZ) derived from the cross curves of stability referred to in paragraph (9). Where credit is shown for the buoyancy of a timber deck cargo the curve of Righting Levers (GZ) must be drawn both with and without this credit.

(c) The metacentric height and the curve of Righting Levers (GZ) shall be corrected for liquid free surface.

(d) Where there is a trim exceeding +/- 0.5% of subdivision length L_S in any of the conditions referred to in sub-paragraph (a) the metacentric height and the curve of Righting Levers (GZ) may be required to be determined from the trimmed waterline.

(e) If in the opinion of the Central Government the stability characteristics in either or both of the conditions referred to in sub-paragraph (a)(iii) are not satisfactory, such conditions shall be marked accordingly and an appropriate warning to the Master shall be endorsed on the relevant diagrams or statements.

11. Where special procedures such as partly filling or completely filling particular spaces designed for cargo, fuel, fresh water or other purposes are necessary to maintain adequate stability, a statement of instruction as to the appropriate procedure in each case.

12. A copy of the report on the inclining test and the calculation therefrom of the light condition particulars.

13. The information should include the following to enable the master to obtain accurate guidance as to the stability of the ship in varying conditions of service:

(a) curves or tables of minimum operational metacentric height (*GM*) versus draught which assures compliance with the relevant intact and damage stability requirements, alternatively corresponding curves or tables of the maximum allowable vertical centre of gravity (*KG*) versus draught, or with the equivalents of either of these curves;
(b) instructions concerning the operation of cross-flooding arrangements; and
(c) all other data and aids which might be necessary to maintain the required intact stability and stability after damage.

The stability information shall show the influence of various trims in cases where the operational trim range exceeds +/- 0.5% of L_s.

14. Information referred to in paragraph 13 are to be determined from considerations related to the subdivision index, in the following manner: Minimum required *GM* (or maximum permissible vertical position of centre of gravity *KG*) for the three draughts d_s, d_p and d_l are equal to the *GM* (or *KG* values) of corresponding loading cases used for the calculation of survival factor s_i. For intermediate draughts, values to be used shall be obtained by linear interpolation applied to the *GM* value only between the deepest subdivision draught and the partial subdivision draught and between the partial load line and the light service draught respectively. Intact stability criteria will also be taken into account by retaining for each draft the maximum among minimum required *GM* values or the minimum of maximum permissible *KG* values for both criteria. If the subdivision index is calculated for different trims, several required *GM* curves will be established in the same way.

15. When curves or tables of minimum operational metacentric height (*GM*) versus draught are not appropriate, the master should ensure that the operating condition does not deviate from a studied loading condition in paragraph 10, or verify by calculation that the stability criteria are satisfied for this loading condition.

Standard of intact stability

13. (a) All ships shall unless specifically permitted otherwise comply with the following minimum standards of stability

(i) The area under the Righting Lever curve (GZ) shall be not less than 0.055 metre radians upto 30^o angle of heel and not less than 0.09 metre radians upto 40^o or the angle of flooding if that be less than 40^o. Additionally, the area under the Righting Lever curve (GZ) between the angles of heel of 30^o and 40^o or between 30^o and the angle of flooding, if that be less than 40^o, shall not be less than 0.03 metre radians.

(ii) The Righting Lever (GZ) shall be at least 0.20 metre at an angle of heel of 30^{o} or more.

(iii) The maximum Righting arm should occur at an angle of heel of not less than 30^{o}.

(iv) The initial metacentric height (GM) shall be not less than 0.15 metre.

(b) Passenger ships shall comply with the following additional requirements :-

(i) The angle of heel on account of crowding passengers on one side of the ship shall not exceed 10^{o}.

(ii) The angle of heel on account of turning of the ship at service speed when calculated by the formula given below shall not exceed 10^{o}—

$$MR = 0.02 (V^2 /L) \Delta \{KG - (d/2)\}$$

where MR = heeling moment in metric tons-metre;

V = service speed in m/sec;

L = length of ship at waterline in metres;

Δ = displacement in metric tons;

d = mean draught;

KG = height of centre of gravity above keel in metres.

THE FOURTH SCHEDULE

(See rules 47(2), 67(2), 72(5), 73(4))

AUTOMATIC SPRINKLER, FIRE DETECTION AND FIRE ALARM SYSTEMS

1. General

(1) Type of sprinkler systems:- The automatic sprinkler systems shall be of the wet pipe type, but small exposed sections may be of the dry pipe type where this is considered a necessary precaution, e.g. within refrigerated chambers. Saunas shall be fitted with a dry pipe system, with sprinkler heads having an operating temperature up to 140°C.

(2) The Director General may approve Sprinkler systems equivalent to those specified in rules 2 to 4 of this schedule.

2. Sources of power supply

There shall be not less than two sources of power supply for the sea water pump and automatic alarm and detection system. Where the sources of power for the pump are electrical, these shall be a main generator and an emergency source of power. One supply for the pump shall be taken from the main switchboard, and one from the emergency switchboard by separate feeders reserved solely for that purpose. The feeders shall be so arranged as to avoid galleys, machinery spaces and other enclosed spaces of high fire risk except in so far as it is necessary to reach the appropriate switchboards, and shall be run to an automatic changeover switch situated near the sprinkler pump. This switch shall permit the supply of power from the main switchboard so long as a supply is available therefrom, and be so designed that upon failure of that supply it will automatically change over to the supply from the emergency switchboard. The switches on the main switchboard and the emergency switchboard shall be clearly labelled and normally kept closed. No other switch shall be permitted in the feeders concerned. One of the sources of power supply for the alarm and detection system shall be an emergency source. Where one of the sources of power for the pump is an internal combustion engine, it shall, in addition to complying with the provisions of sub rule (3) of rule 4 of this schedule, be so situated that a fire in any protected space will not affect the air supply to the machinery.

3. Component requirements

(1) Sprinklers

(a) The sprinklers shall be resistant to corrosion by marine atmosphere. In accommodation and service spaces the sprinklers shall come into operation within the temperature range from 68° to 79°C, except that in locations such as drying rooms, where high ambient temperatures might be expected, the operation temperature may be increased by not more than 30°C above the maximum deckhead temperature.

(b) A quantity of spare sprinkler heads shall be provided for all types and ratings installed on the ship as follows:

Total number of heads	Required number of spares
<300	6
300 to 1000	12
>1000	24

The number of spare sprinkler heads of any type need not exceed the total number of heads installed of that type.

(2) Pressure tanks

(a) A pressure tank having a volume equal to at least twice that of the charge of water specified herein is to be provided. The tank is to contain a standing charge of fresh water, equivalent to the amount of water which would be

(b) discharged in one minute by the pump referred to in sub rule (3)(b), and the arrangements shall provide for maintaining an air pressure in the tank such as to ensure that where the standing charge of fresh water in the tank has been used the pressure will be not be less than the working pressure of the sprinkler, plus the pressure exerted by a head of water measured from the bottom of the tank to the highest sprinkler in the system. Suitable means of replenishing the air under pressure and of replenishing the fresh water charge in the tank shall be provided. A glass gauge shall be provided to indicate the correct level of the water in the tank.

(b) Means shall be provided to prevent the passage of sea water into the tank.

(3) Sprinkler pumps

(a) An independent power pump shall be provided solely for the purpose of continuing automatically the discharge of water from the sprinklers. The pump shall be brought into action automatically by the pressure drop in the system before the standing fresh water charge in the pressure tank is completely exhausted.

(b) The pump and the piping system shall be capable of maintaining the necessary pressure at the level of the highest sprinkler to ensure a continuous output of water sufficient for the simultaneous coverage of a minimum area of 280 [m^2] at the application rate specified in sub rule (5)(c). The hydraulic capability of the system shall be confirmed by the review of hydraulic calculations, followed by a test of the system, if deemed necessary by the Director General .

(c) The pump shall be fitted with on the delivery side, a test valve with a short open-ended discharge pipe. The effective area through the valve and pipe shall be adequate to

permit the release of the required pump output while maintaining the pressure in the system specified in sub rule (2)(a).

4. Installation requirements

(1) General

Any parts of the system which may be subjected to freezing temperatures in service shall be suitably protected against freezing.

(2) Piping arrangements

(a) Sprinklers shall be grouped into separate sections, each of which shall contain not more than 200 sprinklers. Any section of sprinklers shall not serve more than two decks and shall not be situated in more than one main vertical zone. However, a section of sprinklers to serve more than two decks or situated in more than one main vertical zone, may be permitted, if it is shown that the protection of the ship against fire will not thereby be reduced.

(b) Each section of sprinklers shall be capable of being isolated by one stop valve only. The stop valve in each section shall be readily accessible in a location outside the associated section or in cabinets within stairway enclosures. The valve's location shall be clearly and permanently indicated. Means shall be provided to prevent the operation of the stop valves by any unauthorized person.

(c) A test valve shall be provided for testing the automatic alarm for each section of sprinklers by a discharge of water equivalent to the operation of one sprinkler. The test valve for each section shall be situated near the stop valve for that section.

(d) The sprinkler system is to have a connection from the ship's fire main by way of a lockable screw-down non-return valve at the connection which will prevent a backflow from the sprinkler system to the fire main.

(e) A gauge indicating the pressure in the system shall be provided at each section stop valve and at a central station.

(f) The sea inlet to the pump wherever possible shall be in the space containing the pump and shall be so arranged that when the ship is afloat it will not be necessary to shut off the supply of sea water to the pump for any purpose other than the inspection or repair of the pump.

(3) Location of systems

The sprinkler pump and tank shall be situated in a position reasonably remote from any machinery space of category

A and shall not be situated in any space required to be protected by the sprinkler system.

5. System control requirements

(1) Ready availability

(a) Any required automatic sprinkler, fire detection and fire alarm system shall be capable of immediate operation at all times and no action by the crew shall be necessary to set it in operation.

(b) The automatic sprinkler system shall be kept charged at the necessary pressure and shall have provision for a continuous supply of water as required in this chapter.

(2) Alarm and indication

(a) Each section of sprinklers shall include means for giving a visual and audible alarm signal automatically at one or more indicating units whenever any sprinkler comes into operation. Such alarm systems shall be such as to indicate if any fault occurs in the system. Such units shall indicate in which section served by the system a fire has occurred and shall be centralised on the navigating bridge or in the continuously manned central control station and, in addition, visible and audible alarms from the unit also shall be placed in a position other than on the aforementioned spaces to ensure that the indication of fire is immediately received by the crew.

(b) Switches shall be provided at one of the indicating positions referred to in paragraph (a) of this sub rule which will enable the alarm and the indicators for each section of sprinklers to be tested.

(c) Sprinklers shall be placed in an overhead position and spaced in a suitable pattern to maintain an average application rate of not less than 5 [litres/m^2] per minute over the nominal area covered by the sprinklers. The use of sprinklers providing other amounts of water suitably distributed will be considered provided they are shown to be not less effective.

(d) A list or plan shall be displayed at each indicating unit showing the spaces covered and the location of the zone in respect of each section. Suitable instructions for testing and maintenance shall be available.

(3) Testing

Means shall be provided for testing the automatic operation of the pump on reduction of pressure in the system.

THE FIFTH SCHEDULE

(See rules 52, 55(2), 55(3))

FIXED FIRE DETECTION AND FIRE ALARM SYSTEMS

1. General

(1) Any required fixed fire detection and fire alarm system with manually operated call points shall be capable of immediate operation at all times.

(2) The fixed fire detection and fire alarm system shall not be used for any other purpose, except that closing of fire doors and similar functions may be permitted at the control panel.

(3) The system and equipment shall be suitably designed to withstand supply voltage variation and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships.

(4) Zone address identification capability: Fixed fire detection and fire alarm systems with a zone address identification capability shall be so arranged that:

(a) means are provided to ensure that any fault (e.g. power break, short circuit, earth, etc.) occurring in the loop will not render the whole loop ineffective;

(b) all arrangements are made to enable the initial configuration of the system to be restored in the event of failure (e.g. electrical, electronic, informatics, etc.);

(c) the first initiated fire alarm will not prevent any other detector from initiating further fire alarms; and

(d) no loop will pass through a space twice. When this is not practical (e.g. for large public spaces), the part of the loop which by necessity passes through the space for a second time shall be installed at the maximum possible distance from the other parts of the loop.

2. Sources of power supply:

There shall be not less than two sources of power supply for the electrical equipment used in the operation of the fire detection and fire alarm system, one of which shall be an emergency source. The supply shall be provided by separate feeders reserved solely for that purpose. Such feeders shall run to an automatic change over switch situated in or adjacent to the control panel for the fire detection system.

3. Component requirements:

(1) Detectors

(a)Detectors shall 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 no less sensitive than such detectors. Flame detectors shall only be used in addition to smoke or heat detectors.

(b)Smoke detectors required in all stairways, corridors and escape routes within accommodation spaces shall be certified to operate before the smoke density exceeds 12.5% obscuration per metre, but not until the smoke density exceeds 2% obscuration per metre. Smoke detectors to be installed in other spaces shall operate within sensitivity limits to the satisfaction of the Director General having regard to the avoidance of detector insensitivity or over-sensitivity.

(c) Heat detectors shall be certified to operate before the temperature exceeds 78°C but not until the temperature exceeds 54°C, when the temperature is raised to those limits at a rate less than 1°C per minute. At higher rates of temperature rise, the heat detector shall operate within temperature limits to the satisfaction of the Director General , having regard to the avoidance of detector insensitivity or oversensitivity.

(d) The operation temperature of heat detectors in drying rooms and similar spaces of a normal high ambient temperature may be up to 130°C, and up to 140°C in saunas.

(e) All detectors shall be of a type such that they can be tested for correct operation and restored to normal surveillance without the renewal of any component.

4. Installation requirements

(1) Sections

(a) Detectors and manually operated call points shall be grouped into sections.

(b) A section of fire detectors which covers a control station, a service space or an accommodation space shall not include a machinery space of category A. For fixed fire detection and fire alarm systems with remotely and individually identifiable fire detectors, a loop covering sections of fire detectors in accommodation, service spaces and control station shall not include sections of fire detectors in machinery spaces of category A.

(c) If the fixed fire detection and fire alarm system is not capable of remotely and individually identifying each detector, a section of detectors shall not serve spaces on both sides of the ship nor on more than one deck and neither it be situated in more than one main vertical zone except that the same section of detectors may serve spaces on more than one deck if those spaces are located in the fore or aft end of the ship or if they protect common spaces on different decks (e.g. fan rooms, galleys, public spaces, etc.). In ships of less than 20 [m] in breadth, the same section of detectors may serve spaces on both sides of the ship. In ships fitted with individually

identifiable fire detectors, a section may serve spaces on both sides of the ship and on several decks but shall not be situated in more than one main vertical zone.

(2) Positioning of detectors

(a) Detectors shall 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 is likely shall be avoided. Detectors which are located on the overhead shall be a minimum distance of 0.5 [m] away from bulkheads, except in corridors, lockers and stairways.

(b) The maximum spacing of detectors shall be in accordance with the following table:

Spacing of detectors			
Type of detector	**Max. floor area per detector**	**Max. distance apart between centres**	**Max. distance away from bulkheads**
Heat	37 $[m]^2$	9 [m]	4.5 [m]
Smoke	74 $[m]^2$	11 [m]	5.5 [m]

The Director General may require or permit different spacing to that specified in the above table if based upon test data which demonstrate the characteristics of the detectors.

(3) Arrangement of electric wiring

(a) Electrical wiring which forms part of the system shall be so arranged as to avoid galleys, machinery spaces of category A, and other enclosed spaces of high fire risk except where it is necessary to provide for fire detection or fire alarm in such spaces or to connect to the appropriate power supply.

(b) A loop of fire detection systems with a zone address identification capability shall not be damaged at more than one point by a fire.

5. System control requirements:

(1) Visual and audible fire signals:

(a) The activation of any detector or manually operated call point shall initiate a visual and audible fire signal at the control panel and indicating units. If the signals have not received attention within 2 min an audible alarm shall be automatically sounded throughout the crew accommodation and service spaces, control stations and machinery spaces of category A. This alarm sounder system need not be an integral part of the detection system.

(b) The control panel shall be located on the navigating bridge or in the continuously manned central control station.

(c) Indicating units shall as a minimum, denote the section in which a detector or manually operated call point has operated. At least one unit shall be so located that it is easily accessible to responsible members of the crew at all times. One indicating unit shall be located on the navigating bridge if the control panel is located in the main fire control station.

(d) Clear information shall be displayed on or adjacent to each indicating unit about the spaces covered and the location of the sections.

(e) Power supplies and electric circuits necessary for the operation of the system shall be monitored for loss of power or fault conditions as appropriate. Occurrence of a fault condition shall initiate a visual and audible fault signal at the control panel which shall be distinct from a fire signal.

(2) Testing

Suitable instructions and component spares for testing and maintenance shall be provided.

THE SIXTH SCHEDULE

Fees for Passenger Ships Survey

I. Fees for passenger ships surveys shall be payable at the rates specified in the Table given herebelow.

	Gross Tonnage of Ship	Fees for the First Passenger Ship Survey or Survey under construction	Fees for annual Renewal survey
1.	Below 100	Rs. 10,000	Rs. 3,000
2.	100 and above but less than 500	Rs.20,000	Rs.8,000
3.	500 tons and above but less than 1000.	Rs.30,000	Rs.10,000
~~4.~~	1000 tons and above but less then 3000	Rs.30,000 for the first 1000 GT plus Rs.1000 for every additional 100 GT or part thereof.	Rs.10,000 for the first 1000 tons plus Rs.100 Rs.500 for every additional 100 GT or part thereof
5	3000 and above but less than 5000 .	Rs.50,000 for the First 3000 tons GT plus Rs.1000 for every additional 1000 tons or part thereof	Rs.20,000 for the first 3000 GT plus Rs.75. Rs.500 every additional 100 or part thereof.
6	5000 and above but less than 10000.	Rs 70,000 for the first 5000 tons plus Rs.200 Rs.1000 for every additional 100 tons GT or part thereof.	Rs.30,000 for the first 5000 plus Rs.60 Rs.500 for every

			Additional 100 GT Or part thereof.
7	10000 and above but less than 15000	Rs. 1,50,000 for the first 10000 tons plus . Rs.1000 for every additional 100 tons or part Thereof.	Rs.55,000 for the first 10000 tons plus Rs.50. Rs.500 for every additional 100 GT or part Thereof.
8	15000 and above	Rs. 2,00,000 for the first 15000 tons plus Rs.1000 for every additional 100 tons GT.	Rs.80,000 for the first 15000 GT and Rs.600 for every additional 100 GT tons or part thereof.

Provided that-

(a) The minimum fee shall be one-fourth of the annual fee

(b) The full fee shall be payable whatever the nature of survey-

(i) in the case of a ship coming under survey for the first time, or

(ii) if a ship has been fully surveyed but the owner or master is for any reason unwilling or unable to execute the repairs recommended by the Surveyor, or

(iii) When the survey is completed with the exception of minor details.

III. The fee specified in sub-para (i) shall be deemed to cover any number of visits which a Surveyor may have to make for granting of declaration of survey.

IV. Where ships are surveyed on the "running survey" principle, an additional fee equivalent to one-third of the fees as may be payable in respect of survey under these rules shall be paid.

V. The charging of **overtime fees** in respect of surveys or inspections wholly or partially carried out outside office hours shall be regulated as follows:-

(a) Where, on the application of the owner or master of a ship, the surveyor is called upon to undertake the survey or inspection of the ship after 6 P.M but before 8 P.M. or between 6 A.M. and 9 A.M. an additional fee of Rs.1000 /- shall be payable.

(b) Where a surveyor is called upon to undertake the survey or inspection between 8 P.M. and 6 A.M., an additional fee of Rs. 1500/- shall be payable.

(c) Where a surveyor is detained at the request of the owner or agent after 6 P.M. to complete a survey undertaken between 9 A.M. and 6 P.M. an additional fee of Rs. 1000/- shall be payable if the surveyor is released from duty at or before 8 P.M. and Rs.1500/- if he is detained later than 8 P.M.

(d) Where the owner or master of the ship has asked for survey between the hours of 9 A.M. and 6 P.M and official arrangements have not allowed for the work being done between these hours, no additional fee shall be chargeable for any work done between 8.00 P.M. and 9.00 A.M.

(e) Where a Surveyor is called upon to undertake the survey or inspection of a ship on any Sunday, Second Saturday or any other Public Holiday observed by the office of the Mercantile Marine Department at the respective place an additional fee of Rs. 3 000/- shall be payable.

(f) Where a Surveyor has been called upon as specified in clause (a), (b) & (e) or detained as specified in clause (c) the owner or master of the ship shall give information of the fact in writing to the Principal Officer, or as the case may be, the Surveyor-in-Charge of the Mercantile Marine Department of the port concerned stating the hours during which the Surveyor was in attendance

SEVENTH SCHEDULE

PART A

Initial surveys –

1. **For the hull, machinery and equipment of passenger ships, the examination of plans and designs should consist of :**

.1 examining the subdivision and stability ;

.2 examining the ballasting arrangements;

.3 examining the arrangement of the bulkheads, their constructions and the openings therein, including the disposition and means of operation of the watertight doors;

.4 examining the arrangements for the double bottoms ;

.5 examining the arrangements for the openings in the shell plating below the bulkhead deck, the construction of the watertight doors, sidescuttles, watertight decks, trunks, etc., and the watertight integrity above the bulkhead deck ;

.6 examining the plans for the bilge pumping system ;

.7 examining, when appropriate, the means of indicating the status of any bow doors and the leakage therefrom ;

.8 examining the plans for the machinery installation ;

.9 examining the plans for the electrical installation;

.10 checking, when appropriate, the provision of supplementary emergency lighting;

.11 examining the arrangements for oil fuel, lubricating oil and other flammable oils;

.12 examining the plans for the structural fire protection, including the means of escape;

.13 examining the plans for the protection of special-category, spaces and other cargo spaces ;

.14 examining the plans for the fixed fire-detection and alarm system, the crew alarm and the public address system or other effective means of communication;

.15 examining the plans for the lighting of the muster and embarkation stations and the alleyways, stairways and exits giving access to the muster and embarkation stations, including the supply from the emergency source of power ;

. .16 checking the provision and specification of the daylight signaling lamp and, as appropriate, the magnetic compass, transmitting heading device, gyro-compass, gyrocompass

repeaters, radar installation, automatic identification system, electronic plotting aid, automatic tracking aid, automatic radar plotting aid, echo-sounding device, speed and distance indicator, rudder angle indicator, propeller rate of revolution indicator, variable pitch propeller pitch and operational mode indicator, rate-of-turn indicator, heading or track control system, GNSS receiver, terrestrial radio navigation system and sound reception system, ECDIS including back up arrangements, pelorus or compass bearing device and means for correcting headings and bearings. .

.17. Checking the provision and specification of the voyage data recorder

.18 checking for the provision and specification of the long range identification and tracking system

2.<u>For the hull, machinery and equipment of passenger ships, the survey during construction and after installation should consist of:</u>

.1 examining the outside of the ship's bottom, including the bottom and bow plating, keel, bilge keels, stem, stern frame, the rudder, sea-chests and strainers;

.2 confirming the arrangements for the subdivision, including the ship's stability in the damaged condition, and checking the subdivision load lines;

.3 checking the ballasting arrangements;

.4.Confirming that dedicated sea water ballast tanks have an approved coating system when appropriate

.5 confirming the arrangement of the bulkheads, their construction and the openings therein, confirming that the collision bulkhead is watertight up to the freeboard deck, that the valves fitted on the pipes piercing the collision bulkhead are operable from above the freeboard deck and that there are no doors, manholes, ventilation ducts or any other openings, confirming that the other bulkheads, as required for the ship's subdivision, are watertight up to the bulkhead deck and confirming the construction of the watertight doors and that they have been tested;

.6 confirming that the watertight integrity has been maintained where pipes, scuppers, etc., pass through watertight subdivision bulkheads;

.7 confirming that a diagram is provided on the navigating bridge showing the location of the watertight doors together with indicators showing whether the doors are open or closed and confirming that the watertight doors and their means of operation have been installed in accordance with the approved plans;

.8 testing the operation of the watertight doors both from the navigating bridge in the event of an emergency and locally at the door itself; and, in particular, that:

.8.1 they are operable locally from each side of the bulkhead;

.8.2 they are provided with devices giving an indication of whether the door is open or closed at all remote operating positions;

.8.3 they are provided with an audible alarm that is distinct (from any other alarm in the area and, when appropriate, an intermittent visual signal;

.8.4 control handles are provided on each side of the bulkhead so that a person may hold both handles in the open position and pass safety through the watertight door without accidentally setting the power closing mechanism into operation;

.9 confirming that the watertight doors and their indicating devices are operable in the event of a failure of the main and emergency sources of power;

.10 checking, when appropriate, any watertight doors, that are not required to be closed remotel, fitted in watertight bulkheads dividing ‘tween-deck spaces and confirming that a notice is affixed concerning their closure;

.11 confirming that a notice is affixed to any portable plates on bulkheads in machinery spaces concerning their closure and, if appropriate, testing any power-operated watertight door fitted in lieu ;

.12 confirming the arrangements for closing side scuttles and their deadlights, also scuppers sanitary discharges and similar openings and other inlets and discharges in the shell plating below the bulkhead deck;

.13 confirming that valves for closing the main and auxiliary sea inlets and discharges in the machinery spaces are readily accessible and indicators showing the status of the valves are provided;

.14 confirming that gangway, cargo and coaling ports fitted below the bulkhead deck may be effectively closed and that the inboard ends of any ash or rubbish chutes are fitted with an effective cover;

.15 confirming by a hose or flooding test the water tightness of watertight decks and trunks, tunnels and ventilators;

.16 confirming the arrangements to maintain the watertight integrity above the bulkhead deck;

.17 confirming the arrangements for bilge pumping and that each bilge pump and the bilge pumping system provided for each watertight compartment is working efficiently ;

.18 confirming that the drainage system of enclosed cargo spaces situated on the freeboard deck is working efficiently;

.19 conducting an inclining test;

.20 checking, when appropriate, the means of indicating the status of any bow doors and any leakage therefrom;

.21 confirming that the arrangement for monitoring special category spaces or ro-ro spaces, when fitted, is satisfactory

.22 confirming that the machinery, boilers and other pressure vessels, associated piping systems and fittings are so installed and protected as to reduce to a minimum any danger to persons on board, due regard being given to moving parts, hot surfaces and other hazards;

.22 confirming that the normal operation of the propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative;

.23 confirming that means are provided so that the machinery can be brought into operation from the dead ship condition without external aid ;

.24 confirming that the boilers, all parts of the machinery, all steam, hydraulic, pneumatic and other systems and their associated fitting which are under internal pressure have been subjected to the appropriate tests, including a pressure test;

.25 confirming that means are provided to ensure that the safe speed is not exceeded where there is the risk of machinery over speeding ;

.26 confirming that, where practicable, means are provided to protect against overpressure in the parts of main, auxiliary and other machinery that are subject to internal pressure and may be subject to dangerous overpressure;

.27 confirming that, when required, crankcase explosion-relief devices are fitted to internal-combustion engines and that they are arranged so as to minimize the possibility of injury to personnel;

.28 confirming that main turbine propulsion machinery and, where applicable, main internal-combustion propulsion machinery and auxiliary machinery are provided with automatic shut-off arrangements in the case of failure, such as lubricating oil supply failure, which could rapidly lead to a complete breakdown, serious damage or explosion;

.29 confirming and recording the ability of the machinery to reverse the direction of the thrust of the propeller in sufficient time and to bring the ship to rest within a reasonable distance, including the effectiveness of any supplementary means of manoeuvring or stopping the ship;

.30 confirming that the main and auxiliary steering gear are so arranged that the failure of one of them does not render the other inoperative;

.31 confirming that, where appropriate, essential components of the steering gear are permanently lubricated or provided with lubrication fittings;

.32 confirming that relief valves are fitted to any part of a steering gear hydraulic system which can be isolated and in which pressure can be generated from the power source or from external forces and that these relief valves are set to a pressure not exceeding the design pressure ;

.33 confirming that the main steering gear is capable of steering the ship at maximum ahead service speed and is capable of putting the rudder over from 35º on one side to 35º on the other side with the ship at its deepest seagoing draught and running ahead at maximum ahead service speed and, under the same conditions, from 35º on either side to 30º on the other side in not more than 28 seconds.

.34 confirming that the auxiliary steering gear is capable of steering the ship at navigable speed and of being brought speedily into action in an emergency and that it is capable of putting the rudder over from 15º on one side to 15º on the other side in not more than 60 seconds with the ship at its deepest seagoing draught and running ahead at one half of the maximum ahead service speed or 7 knots, whichever is the greater;

.35 confirming that the main or auxiliary steering gear power units restart automatically when power is restored after a power failure, that they are capable of being brought into operation from a position on the navigating bridge and that, in the event of a power failure to anyone of the steering gear power units, an audible and visual alarm is given on the navigating bridge;

.36 confirming that, where the main steering gear comprises two or more identical power units and an auxiliary steering gear is not fitted, a defect can be isolated so that steering capability

can be maintained or speedily regained after a single failure in its piping system or in one of the power units;

.37 confirming that the control systems for the main steering gear from both the navigating bridge and the steering gear compartment are operating satisfactorily;

.38 confirming that, where the main steering gear comprises two or more identical power units and an auxiliary steering gear is not fitted, the two independent control systems from the navigating bridge are operating satisfactorily ;

.39 confirming that the control system for the auxiliary steering gear in the steering gear compartment and, if this gear is power-operated, from the navigating bridge is operating satisfactorily and that the latter is independent of the control system for the main steering gear;

.40 confirming that the control system for any main and auxiliary steering gear control system operable from the navigating bridge is capable of being brought into operation from a position on the navigating bridge, that means are provided in the steering gear compartment for disconnecting it from the steering gear that it serves and that an audible and visual alarm is given on the navigating bridge in the event of a failure of electrical power supply;

.41 confirming that the electric power circuits and steering gear control system, together with their associated components, cables and pipes, are separated, as far as practicable, throughout their length;

.42 confirming that the means of communication between the bridge and the steering gear is operating satisfactorily and that, with ships having emergency steering positions, a telephone or other means of communication for relaying heading information and supplying visual compass readings to the emergency steering position is provided;

.43 confirming that the angular position of the rudder is indicated independently of the steering control system on the navigating bridge if the main steering gear is power-operated and that this angular position is given in the steering gear compartment;

.44 confirming that with a hydraulic power-operated steering gear the audible and visual low-level alarms on the navigating bridge and in the machinery space for each hydraulic fluid reservoir are operating satisfactorily and that at least one power actuating system, including the reservoir, can be recharged from a position within the steering gear compartment by means of a fixed storage tank to which a contents gauge is fitted with fixed piping ;

.45 confirming that the steering gear compartment is readily accessible, that it is separated, as far as practicable, from machinery spaces and is provided with suitable arrangements to ensure working access to steering gear machinery and controls under safe conditions;

.46 confirming that with electric and electro-hydraulic steering gear the means for indicating on the navigating bridge and at a main machinery control position that the motors are running and that the overload alarm and alarm for the loss of a phase in a three-phase supply located at the main machinery control position are operating satisfactorily;

.47 confirming that the main and auxiliary machinery essential for propulsion and the safety of the ship are provided with the effective means for its operation and control;

.48 confirming that appropriate means are provided where it is intended that the propulsion machinery should be remotely controlled from the navigating bridge;

.49 confirming that arrangements to operate main and other machinery from a machinery control room are satisfactory;

.50 confirming that, in general, means are provided for manually overriding automatic controls and that a failure does not prevent the use of the manual override;

.51 confirming that oil-fired and exhaust gas boilers, unfired steam generators, steam pipe systems and air pressure systems are fitted with the appropriate safety features ;

.52 confirming the operation of the ventilation for the machinery spaces;

.53 confirming that the measures to prevent noise in machinery spaces are effective;

.54 confirming that the engine-room telegraph, giving visual indication of the orders and responses both in the machinery space and on the navigating bridge, is operating satisfactorily;

.55 confirming that the second means of communication between the navigation bridge and machinery space is also operating satisfactorily and that appropriate means are provided to any other positions from which the engines are controlled;

.56 confirming that the engineer’s alarm is clearly audible in the engineers’ accommodation;

.57 confirming that precautions taken to prevent any oil that may escape under pressure from any pump, filter or heater from coming into contact with heated surfaces are efficient;

.58 confirming that the means of ascertaining the amount of oil contained in any oil tank are in good working condition;

.59 confirming that the devices provided to prevent overpressure in any oil tank or in any part of the oil system, including the filling pipes, are in good working condition;

.60 confirming that forepeak tanks are not intended for carriage of oil fuel, lubrication oil and other flammable oils;

.61 confirming that the electrical installations, including the main source of power and lighting systems are installed in accordance with the approved plans;

.62 confirming that a self-contained emergency source of electrical power has been provided and that the appropriate systems are satisfactorily supplied;

.63 confirming that starting arrangements of each emergency generating set are satisfactory;

.64 checking, when appropriate, the disposition of and testing the supplementary emergency lighting;

.65 confirming that precautions have been provided against shock, fire and other hazards of electrical origin;

.66 confirming when appropriate, that the arrangements for the machinery spaces being periodically unattended are satisfactory;

.67 examining the fire pumps and fire main and the disposition of the hydrants, hoses and nozzles and the international shore connection and checking that each fire pump, including the emergency fire pump, can be operated separately so that two jets of water are produced simultaneously from different hydrants at any part of the ship whilst the required pressure is maintained in the fire main ;

.68 examining the provision and disposition of the fire extinguishers and the fire men's outfits;

.69 checking the operational readiness and maintenance of fire-fighting systems;

.70 examining the fixed fire-fighting system for the machinery and cargo spaces, as appropriate, and confirming that the installation tests have been satisfactorily completed and that its means of operation are clearly marked;

.71 examining the fire extinguishing and special arrangements in the machinery spaces and confirming as far as practicable and as appropriate, the operation of the remote means of control provided for the opening and closing of the skylights, the release of smoke, the closure of the funnel and ventilation openings, the closure of power-operated and other doors, the stopping of ventilation and boiler forced and induced draught fans and the stopping of oil fuel and other pumps that discharge flammable liquids;

.72 examining the arrangements for oil fuel, lubricating oil and other flammable oils and confirming, as far as practicable and as appropriate, the operation of the remote means of closing the valves on the tanks that contain oil fuel, lubricating oil and other flammable oils;

.73 examining any fire-detection and alarm system and confirming that installation tests have been satisfactorily completed;

.74 confirming that all aspects of the installation of the structural fire protection, including the structure, fire integrity, protection of stairways and lifts, cabin balconies, openings in 'A' and 'B' class divisions, ventilation systems and windows and side scuttles, and the use of combustible material are in accordance with the approved plans;

.75 testing any manual and automatic fire doors, including the means of closing the openings in 'A' and 'B' class divisions;

.76 testing the means of closing the main inlets and outlets of all ventilation systems and proving that the power ventilation is capable of being stopped from outside the space served;

.77 confirming that stairways and ladders are so arranged to provide a means of escape to the lifeboat and life raft embarkation deck from all passenger and crew spaces and from those spaces in which the crew is normally employed ; and in particular that:

.77.1 below the bulkhead deck there are two means of escape from each watertight compartment, one being independent of watertight doors:

.77.2 above the bulkhead deck there two means of escape from each vertical zone or similar such area, one leading directly to a stairway forming a vertical escape;

.77.3 the radiotelegraph station, if provided, has direct access to the open deck or is provided with two means of access or egress, one of which is a porthole or window of sufficient size;

.78 confirming that the means of escape from any special-category spaces are generally in accordance with above paragraph.

.79 confirming that in the machinery spaces there are two widely separated means of escape leading to the lifeboat and life raft embarkation decks, including, when from a space below the bulkhead deck, a continuous fire shelter;

.80 confirming the fire-protection arrangements for special-category spaces and other cargo spaces and testing, as appropriate, the operation of the means for closing the various openings;

.81 confirming and testing, as appropriate, the fixed fire-detection and alarm system, the special alarm and the public address system or other effective means of communication;

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.82 checking the lighting of the muster and embarkation stations and the alleyways, stairways and exits giving access to the muster and embarkation stations, including when supplied from the emergency source of power;

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.83 checking the provision and specification of a daylight signaling lamp;

.84 checking as appropriate, the provision and operation of the following ;

.84.1 the magnetic compass, including examining the siting, movement, illumination and a pelorus or compass bearing device;

.84.2 echo sounder, including examining the display for good access, viewing and lighting;

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.84.3 Nautical charts and nautical publications necessary for the intended voyage are available and have been updated and where electronic systems are used (ECDIS), the electronic charts have been updated and required back-up system is provided and updated;

.84.3 global navigation satellite receiver or terrestrial radionavigation system;

.84.4 sound reception system, when bridge is totally enclosed;

.84.5 means of communication to emergency steering position, where provided;

84.6 spare magnetic compass;

84.7 gyro compass, including examining the alignment of the master and all repeaters;

84.8 radar, including examining the waveguide and cable runs for routeing and protection, and the display unit, confirming lighting, plotting facilities, correct operation of all controls, functions and the true-motion facility, if provided;

.84.9 electronic plotting aid, automatic tracking aid or automatic radar plotting aid (ARPA), including examining the performance using the appropriate test facilities;

.84.10 speed and distance indicator;

.84.11 rudder angle indicator;

.84.12 propeller rate of revolution indicator;

.84.13 variable propeller pitch and operational mode indicator;

.84.15 rate-of-turn indicator;

.84.16 transmitting heading device providing heading information to radar, plotting aids and automatic identification system equipment and distance devices;

.84.17 automatic identification system;

.84.18 heading or track control system;

85. Checking the provision and operation of the voyage data recorder;

86. Checking that a valid conformance test report of the long-range identification and tracking system is available on board;

3. <u>For the hull, machinery and equipment of passenger ships, the check that the required documentation has been placed on board should consist of:</u>

.1 confirming that the stability information and damage control plans have been provided ;

.2 confirming that the maneuvering booklet has been provided and that the maneuvering information has been displayed on the navigating bridge ;

.3 confirming that documented operating procedures for closing and securing the openings in special category spaces and ro-ro spaces are available on board;

.4 confirming that the fire control plans are permanently exhibited or, alternatively, emergency booklets have been provided and that a duplicate of the plans or the emergency booklet are available in a prominently marked enclosure external to the ship's deck-house ;

.5 confirming that the maintenance plans have been provided;

.6 confirming that training manuals and fire safety operational booklets have been provided;

.7 confirming that a table or curve of residual deviation for the magnetic compass and, as appropriate, fixed corrections for the radio direction finder have been provided, and that a diagram of the radar installation's shadow sectors is displayed ;

.8 checking that operational and, where appropriate, maintenance manuals for all navigational equipment are provided ;

.9 checking that the charts and nautical publications necessary for the intended voyage are available and have been updated ;

.10 confirming that a list showing the operational limitations imposed to the ship is kept on board;

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PART B

RENEWAL SURVEY

For the hull, machinery and equipment of passenger ships, the renewal survey should consist of:

.1 examining the outside of the ship's bottom, including the bottom and bow plating, keel, bilge keels, stem stern frame, the rudder, sea-chests and strainers, noting the clearance measured in the rudder bearings, examining the propeller and shaft seals, as far as practicable, and noting the clearance measured in the propeller shafts ;

.2 examining the arrangements for the subdivision, including the ship's stability in the damaged condition, and checking the subdivision loadlines ;

.3 checking the ballasting arrangements;

.4 confirming that dedicated sea water ballast tanks have been coated in accordance with resolution MSC,215(82) when appropriate;

.5 confirming when appropriate, that the maintenance of the protective coating is included in the overall ship's maintenance system;

.6 examining the collision and other watertight bulkheads required for the ship's subdivision;

.7 confirming that the watertight integrity has been maintained where pipes, scuppers, etc., pass through watertight subdivision bulkheads;

.8 confirming that a diagram is provided on the navigating bridge showing the location of the watertight doors together with indicators showing whether the doors are open or closed ;

.9 testing the operation of the watertight doors both from the navigating bridge in the event of an emergency and locally at the door itself and, in particular, that:

.9.1 they are operable locally from each side of the bulkhead;

.9.2 they are provided with devices giving an indication of whether the door is open or closed at all remote operating positions;

.9.3 they are provided with an audible alarm that is distinct from any other alarm in the area and, when appropriate, an intermittent visual signal;

.9.4 control handles are provided on each side of the bulkhead so that a person may hold both handles in the open position and pass safely through the watertight door without accidentally setting the power closing mechanism into operation;

.10 confirming that the watertight doors and their indicating devices are operable in the event of a failure of the main and emergency sources of power ;

.11 checking, when appropriate, any watertight doors that are not required to be closed remotely, fitted in watertight bulkheads dividing 'tween-deck spaces and confirming that a notice is affixed concerning their closure;

.12 confirming that a notice is affixed to any portable plates on bulkheads in machinery spaces concerning their closure and, if appropriate, testing any power-operated watertight door fitted in lieu ;

.13 examining the arrangements for closing sidescutttles and their deadlights, also scuppers, sanitary discharges and similar openings and other inlets and discharges in the shell plating below the bulkhead deck ;

.14 confirming that valves for closing the main and auxiliary sea inlets and discharges in the machinery spaces are readily accessible and indicators showing the status of the valves are provided;

.15 confirming that gangway, cargo and coaling ports fitted below the bulkhead deck may be effectively closed and that the inboard ends of any ash or rubbish chutes are fitted with an effective cover;

.16 examining the arrangements to maintain the watertight integrity above the bulkhed deck ;

.17 examining the arrangements for bilge pumping and confirming that each bilge pump and the bilge pumping system provided for each watertight compartment is working efficiently ;

.18 confirming that the drainage system of enclosed cargo spaces situated on the freeboard deck is working efficiently ;

.19 confirming that the arrangement for monitoring special category spaces or ro-ro spaces, when fitted, is satisfactory;

.20 examining, when appropriate, the means of indicating the status of any bow doors and any leakage there from;

.21 confirming that the machinery, boilers and other pressure vessels, associated piping systems and fittings are being maintained so as to reduce to a minimum any danger to persons on board, due regard being given to moving parts, hot surfaces and other hazards ;

.22 confirming that the normal operation of the propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative ;

.23 confirming that means are provided so that the machinery can be brought into operation from the dead ship condition without external aid ;

.24 examining where practicable, the means provided to protect against overpressure in the parts of main, auxiliary and other machinery that are subject to internal pressure and may be subject to dangerous overpressure ;

.25 examining when appropriate, the crankcase explosion-relief devices fitted to internal combustion engines and confirming that they are arranged so as to minimize the possibility of injury to personnel;

.26 confirming that the automatic shut-off arrangements fitted to the main turbine propulsion machinery and, where applicable, main internal-combustion propulsion machinery and auxiliary machinery are being properly maintained;

.27 confirming, as far as practicable, the ability of the machinery to reverse the direction of the thrust of the propeller in sufficient time, including the effectiveness of any supplementary means of manoeuvring or stopping the ship ;

.28 confirming that the main and auxiliary steering gear are being properly maintained, are arranged so that the failure of one does not render the other inoperative and that the auxiliary steering gear is capable of being brought speedily into action in an emergency;

.29 confirming that, where appropriate, essential components of the steering gear are permanently lubricated or provided with lubrication fittings;

.30 confirming that relief valves fitted to the steering gear hydraulic system which can be isolated and in which pressure can be generated from the power source or from external forces are being maintained and are set to a pressure not exceeding the design pressure;

.31 confirming that the main or auxiliary steering gear power units restart automatically when power is restored after a power failure, that they are capable of being brought into operation from a position on the navigating bridge and that, in the event of a power failure to anyone of the steering gear power units, an audible and visual alarm is given on the navigating bridge;

.32 confirming that the control systems for the main steering gear from both the navigating bridge and the steering gear compartment are operating satisfactorily ;

.33 confirming that, where the main steering gear comprises two or more identical power units and an auxiliary steering gear is not fitted, the two independent control systems from the navigating bridge are operating satisfactorily ;

.34 confirming that the control system for the auxiliary steering gear in the steering gear compartment and, if this gear is power-operated, from the navigating bridge are operating satisfactorily and that the latter is independent of the control system for the main steering gear ;

.35 confirming that an audible and visual alarm is given on the navigating bridge in the event of a failure of electrical power supply ;

.36 confirming that the means of communication between the bridge and the steering gear is operating satisfactorily and that, with ships having emergency steering positions, a telephone or other means of communication for relaying heading information and supplying visual compass readings to the emergency steering position is provided;

.37 confirming that the angular position of the rudder is indicated independently of the steering control system on the navigating bridge if the main steering gear is power-operated and that this angular position is given in the steering gear compartment;

.38 confirming that with a hydraulic power-operated steering gear the audible and visual low-level alarms on the navigating bridge and in the machinery space for each hydraulic fluid reservoir are operating satisfactorily and that at least one power actuating system, including the reservoir, can be recharged from a position within the steering gear compartment by means of a fixed storage tank to which a contents gauge is fitted with fixed piping ;

.39 confirming that the steering gear compartment is readily accessible and is provided with suitable arrangements to ensure working access to steering gear machinery and controls under safe conditions;

.40 confirming that with electric and electro-hydraulic steering gear the means for indicating on the navigating bridge and at a main machinery control position that the motors are running and, as far as practicable, that the overload alarm and alarm for the loss of a phase in a three-phase supply located at the main machinery control position are operating satisfactorily;

.41 confirming that the effective means of operation and control of the main and auxiliary machinery essential for propulsion and the safety of the ship are being maintained, including, when appropriate, any means for remotely controlling the propulsion machinery from the navigating bridge;

.42 confirming that arrangements to operate main and other machinery from a machinery control room are satisfactory;

.43 confirming that the means provided for manually overriding automatic controls are being maintained and that a failure does not prevent the use of the manual override;

.44 confirming that the appropriate safety features fitted to the oil-fired and exhaust gas boilers, unfired steam generators, steam pipe systems and air pressure systems are being maintained;

.45 confirming the operation of the ventilation for the machinery spaces;

.46 confirming that the measures to prevent noise in machinery spaces are effective;

.47 confirming that the engine-room telegraph giving visual indication of the orders and answers both in the machinery space and on the navigating bridge is operating satisfactorily ;

.48 confirming that the second means of communication between the navigation bridge and machinery space is also operating satisfactorily, including any appropriate means provided to any other positions from which the engines are controlled;

.49 confirming that the engineer's alarm is clearly audible in the engineers' accommodation;

.50 confirming that precautions taken to prevent any oil that may escape under pressure from any pump, filter or heater from coming into contact with heated surfaces are efficient;

.51 confirming that the means of ascertaining the amount of oil contained in any oil tank are in good working condition;

.52 confirming that the devices provided to prevent overpressure in any oil tank or in any part of the oil system, including the filling pipes, are in good working condition;

.53 confirming that the electrical installations, including the main source of power and lighting systems, are being maintained ;

.54 confirming that the self-contained emergency source of electrical power and its associated systems are operating satisfactorily ;

.55 confirming that the starting arrangements of each emergency generating set are satisfactory;

.56 checking, when appropriate, the disposition of and testing the supplementary emergency lighting ;

.57 confirming that precautions provided against shock, fire and other hazards of electrical origin are being maintained ;

.58 confirming when appropriate, that the arrangements for the machinery spaces being periodically unattended are satisfactory ;

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.59 confirming, as far as practicable and as appropriate, the operation of the remote means of control provided for the opening and closing of the skylights, the release of smoke, the closure of the funnel and ventilation openings, the closure of power-operated and other doors, the stopping of ventilation and boiler forced and induced draught fans and the stopping of oil fuel and other pumps that discharge flammable liquids ;

.60 examining the arrangements for oil fuel , lubricating oil and other flammable oils and confirming, as far as practicable and as appropriate, the operation of the remote means of closing the valves on the tanks that contain oil fuel, lubricating oil and other flammable oils ;

.61 examining and testing, as far as practicable, any fire-detection and alarm system requirements;

.62 confirming that the emergency escape breathing devices are complete and in good condition;;

.63 confirming, as far as practicable, that no changes have been made in the structural fire protection, including the structure, fire integrity, protection of stairways and lifts, openings in 'A' and 'B' class divisions, ventilation systems and windows and sidescuttles, and the use of combustible material ;

.64 examining and testing any manual and automatic fire doors, including the means of closing the openings in 'A' and 'B' class divisions ;

.65 examining and testing the main inlets and outlets of all ventilation systems and proving that the power ventilation is capable of being stopped from outside the space served ;

.66 confirming that the stairways and ladders arranged to provide a means of escape to the lifeboat and liferaft embarkation deck from all passenger and crew spaces and from those spaces in which the crew is normally employed are being maintained ;

.67 confirming that the means of escape from any special-category spaces are satisfactory ;

.68 confirming that the means of escape from the machinery spaces are satisfactory ;

.69 examining the fire protection arrangements for special-category spaces and other cargo spaces and testing, as far as practicable and as appropriate, the operation of the means for closing the various opening;

.70 examining and testing, as appropriate and as far as practicable, the fixed fire detection and alarm system, the special alarm and the public address system or other effective means of communication ;

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.71 checking the lighting of the muster and embarkation stations and the alleyways, stairways and exits giving access to the muster and embarkation stations, including when supplied from the emergency source of power ;

..72 checking that the daylight signaling lamp and, as appropriate, the magnetic compass, transmitting heading device, gyro-compass, radar installation, automatic identification system, electronic plotting aid, automatic tracking aid or automatic radar plotting aid, echo-sounding device, speed and distance indicator, rudder angle indicator, propeller rate of revolution indicator, variable pitch propeller pitch and operational mode indicator, rate-of-turn indicator, heading or track conrol system, GNSS receiver, terrestrial radio navigation system and sound reception system, means of communication with emergency steering position, ECDIS including back-up arrangements, a pelorus or compass bearing device and means of correcting heading and bearings are in working order. Items that cannot be checked with the ship in port should be verified from records;

.73 Checking that a valid conformance test report of the long-range identification and tracking system is available on board, where fitted.

3 <u>For the hull, machinery and equipment of passenger ships, the completion of the renewal survey should consist of</u>:

.1 after a satisfactory survey, issuing the ‘ Certificate of Survey’ and Certificate ‘A’ for Indian Coastal operation or the Passenger Ship Safety Certificate and its associated Record of Equipment (Form P) for International operations.

THE EIGHTH SCHEDULE

(See Rule 88(12) & 89(5))

EMERGENCY ESCAPE BREATHING DEVICES

1. General.

(1) An EEBD is a supplied air or oxygen device only used for escape from a compartment that has a hazardous atmosphere and shall be of an approved type.

(2) EEBDs shall not be used for fighting fires, entering oxygen deficient voids or tanks, or worn by fire-fighters. In these events, a self-contained breathing apparatus, which is specifically suited for such applications, shall be used.

2. Definitions.

(1) Face piece means a face covering that is designed to form a complete seal around the eyes, nose and mouth which is secured in position by a suitable means.

(2) Hood means a head covering which completely covers the head, neck, and may cover portions of the shoulders.

(3) Hazardous atmosphere means any atmosphere that is immediately dangerous to life or health.

3. Particulars.

(1) The EEBD shall have a service duration of at least 10 min.

(2) The EEBD shall include a hood or full face piece, as appropriate, to protect the eyes, nose and mouth during escape. Hoods and face pieces are to be constructed of flame resistant materials and include a clear window for viewing.

(3) An inactivated EEBD shall be capable of being carried hands-free.

(4) An EEBD, when stored, shall be suitably protected from the environment.

(5) Brief instructions or diagrams clearly illustrating their use shall be clearly printed on the EEBD. The donning procedures shall be quick and easy to allow for situations where there is little time to seek safety from a hazardous atmosphere.

4. Markings

Maintenance requirements, manufacturer's trademark and serial number, shelf life with accompanying manufacture date and name of approving authority shall be printed on each EEBD. All EEBD training units shall be clearly marked.

THE NINTH SCHEDULE

(See rules 52(2), 56(1), 121(2))

SAMPLE EXTRACTION SMOKE DETECTION SYSTEMS

1. General

(1) Wherever in the text of following requirements the word "system" appears, it means "sample extraction smoke detection system".

(2) Any required system shall be capable of continuous operation at all times except that systems operating on a sequential scanning principle may be accepted, provided that the interval between scanning the same position twice gives an overall response time to the satisfaction of the Director General .

(3) The system shall be designed, constructed and installed so as to prevent the leakage of any toxic or flammable substance or fire-extinguishing media into any accommodation and service space, control station or machinery space.

(4) The system and equipment shall be suitably designed to withstand supply voltage variations and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships and to avoid the possibility of ignition of flammable gas/air mixture.

(5) The functioning of the system is to be periodically tested to the satisfaction of the Director General . The system is to be of a type that can be tested for correct operation and restored to normal surveillance without the renewal of any component.

(6) An alternative power supply for the electrical equipment used in the operation of the system shall be provided.

2. Component requirements

(1) The sensing unit shall be certified to operate before the smoke density within the sensing chamber exceeds 6.65 per cent obscuration per metre.

(2) Duplicate sample extraction fans shall be provided. The fans shall be of sufficient capacity to operate under normal ventilation conditions in the protected area and shall give an overall response time to the satisfaction of the Director General .

(3) The control panel shall permit observation of smoke in the individual sampling pipe.

(4) Means shall be provided to monitor the airflow through the sampling pipes so designed as to ensure that as far as practicable equal quantities are extracted from each interconnected accumulator.

(5) Sampling pipes shall be a minimum of 12 [mm] internal diameter except when used in conjunction with fixed gas fire-extinguishing systems when the minimum size of pipe shall be sufficient to permit the fire-extinguishing gas to be discharged within the appropriate time.

(6) Sampling pipes shall be provided with an arrangement for periodically purging with compressed air.

3. Installation requirements

(1) Smoke accumulators

(a) At least one smoke accumulator shall be located in every enclosed space for which smoke detection is required. However, where a space is designed to carry oil or refrigerated cargo alternatively with cargoes for which a smoke sampling system is required, means may be provided to isolate the smoke accumulators in such compartments for the system. Such means are to be to the satisfaction of the Director General .

(b) Smoke accumulators shall be located for optimum performance and shall be spaced so that no part of the overhead deck area is more than 12 [m] measured horizontally from an accumulator. Where systems are used in spaces which may be mechanically ventilated, the position of the smoke accumulators shall be considered having regard to the effects of ventilation.

(c) Smoke accumulators shall be positioned where impact or physical damage is unlikely to occur.

(d) Not more than four accumulators shall be connected to each sampling point.

(e) Smoke accumulators from more than one enclosed space shall not be connected to the same sampling point.

(2) Sampling pipes

(a) The sampling pipe arrangements shall be such that the location of the fire can be readily identified.

(b) Sampling pipes shall be self-draining and suitably protected from impact or damage from cargo working.

4. System control requirements

(1) Visual and audible fire signals

(a) The control panel shall be located on the navigating bridge or in the continuously manned central control station.

(b) Clear information shall be displayed on or adjacent to the control panel designating the spaces covered.

(c) The detection of smoke or other products of combustion shall initiate a visual and audible signal at the control panel and the navigating bridge or continuously manned central control station.

(d) Power supplies necessary for the operation of the system shall be monitored for loss of power. Any loss of power shall initiate a visual and audible signal at the control panel and the navigating bridge which shall be distinct from a signal indicating smoke detection.

(2) Testing

Suitable instructions and component spares shall be provided for the testing and maintenance of the system.

THE TENTH SCHEDULE

(See rules 88(9))

ARRANGEMENT OF MEANS OF ESCAPE

1. Width of stairways

Stairways shall not be less than 900 [mm] in clear width. The minimum clear width of stairways shall be increased by 10 mm for every one person provided for in excess of 90 persons. The total number of persons to be evacuated by such stairways shall 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 shall not be inferior to those determined by rule 2.

2. Calculation method of stairway width:

(1) Basic principles of the calculation

(a) This calculation method determines the minimum stairway width at each deck level, taking into account the consecutive stairways leading into the stairway under consideration.

(b) It is the intention that the calculation method shall 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.

(c) For each main vertical zone the calculation shall 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.

(d) The calculation of stairway widths shall be based upon the crew and passenger load on each deck. Occupant loads shall 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 shall be defined by either of the following two values:

- the number of seats or similar arrangements, or

- the number obtained by assigning 2 [m^2] of gross deck surface area to each person.

(2) Calculation method for minimum value

(a) Basic formulae

In considering the design of stairway widths for each individual case which allow for the timely flow of persons evacuating to the muster stations from adjacent decks above and below, the following calculation methods shall be used (See Figures I and II):

when joining two decks:	$W=(N_1+N_2)x\ 10$ [mm];
when joining three decks:	$W=(N_1+N_2+0.5N_3)x\ 10$ [mm];

when joining four decks:	$W=(N_1+N_2+0.5N_3+0.25N_4)x$ 10 [mm];
when joining five decks or more decks, the width of the stairways shall 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:

$P = S \times 3.0$ persons/m^2 ; and $P_{max} = 0.25Z$

where:

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 [m^2] 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 Fig. I);

N = the total number of persons expected to use the stairway from each consecutive deck under consideration; N_1 is for the deck with the largest number of persons using that stairway; N_2 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 Fig. II). These decks are assumed to be on or upstream (i.e. away from the embarkation deck) of the deck being considered.

(b) Distribution of persons

(i) The dimensions of the means of escape shall be calculated on the basis of the total number of persons expected to escape by the stairway and through doorways, corridors and landings (See Fig.III). Calculations shall 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 shall not be 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.

(ii) The maximum number of persons contained in a vertical zone, including persons entering stairways from another main vertical zone, shall not be assumed to be higher than the maximum number of persons authorized to be carried on board for the calculation of stairway width only.

3. Prohibition of decrease in width in the direction to the assembly station

The stairway shall not decrease in width in the direction of evacuation to the assembly station, except in the case of several assembly stations in one main vertical zone the stairway width shall not decrease in the direction of the evacuation to the most distant assembly station.

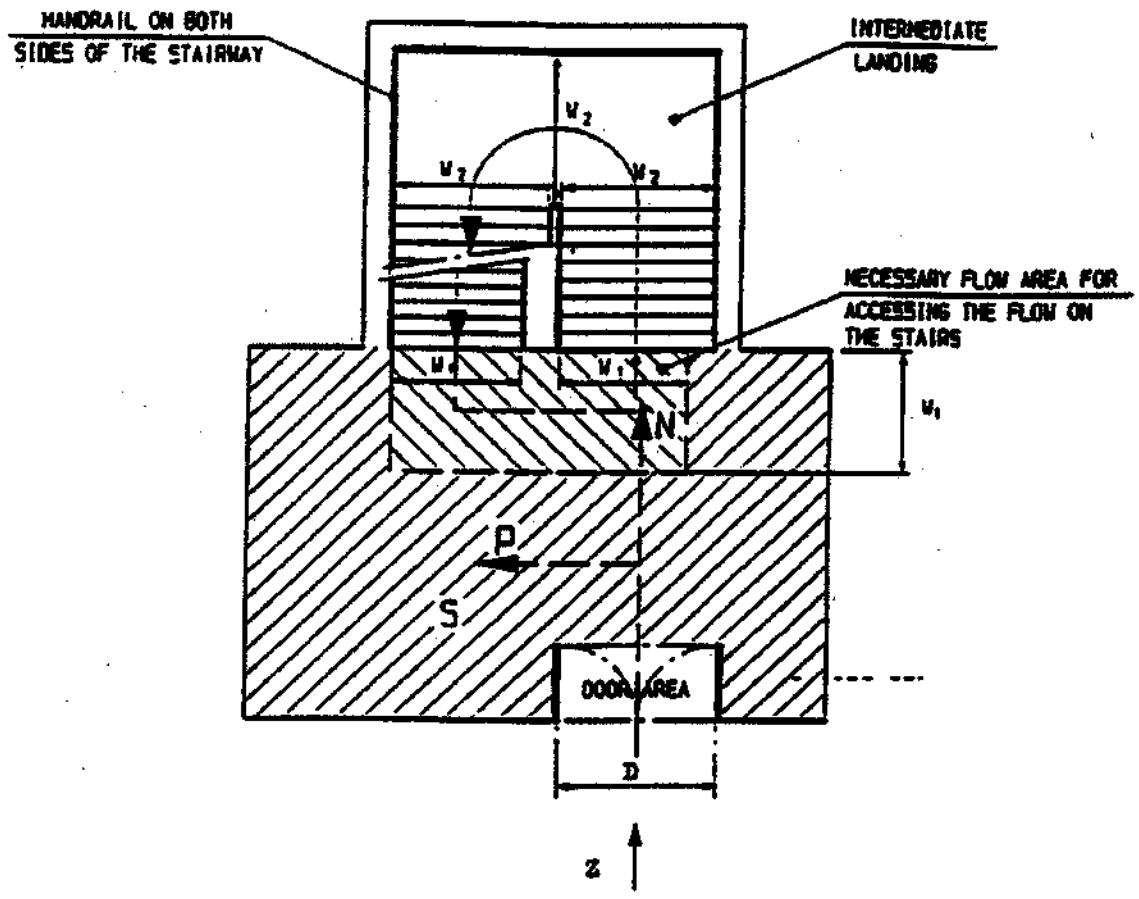

Fig. I

4. Details of stairways

(1) Handrails:

Stairways shall be fitted with handrails on each side. The maximum clear width between handrails shall be 1,800 [mm].

(2) Alignment of stairways

All stairways sized for more than 90 persons shall be aligned fore and aft.

(3) Vertical rise and inclination

Stairways shall not exceed 3.5 [m] in vertical rise without the provision of a landing and shall not have an angle of inclination greater than 45°.

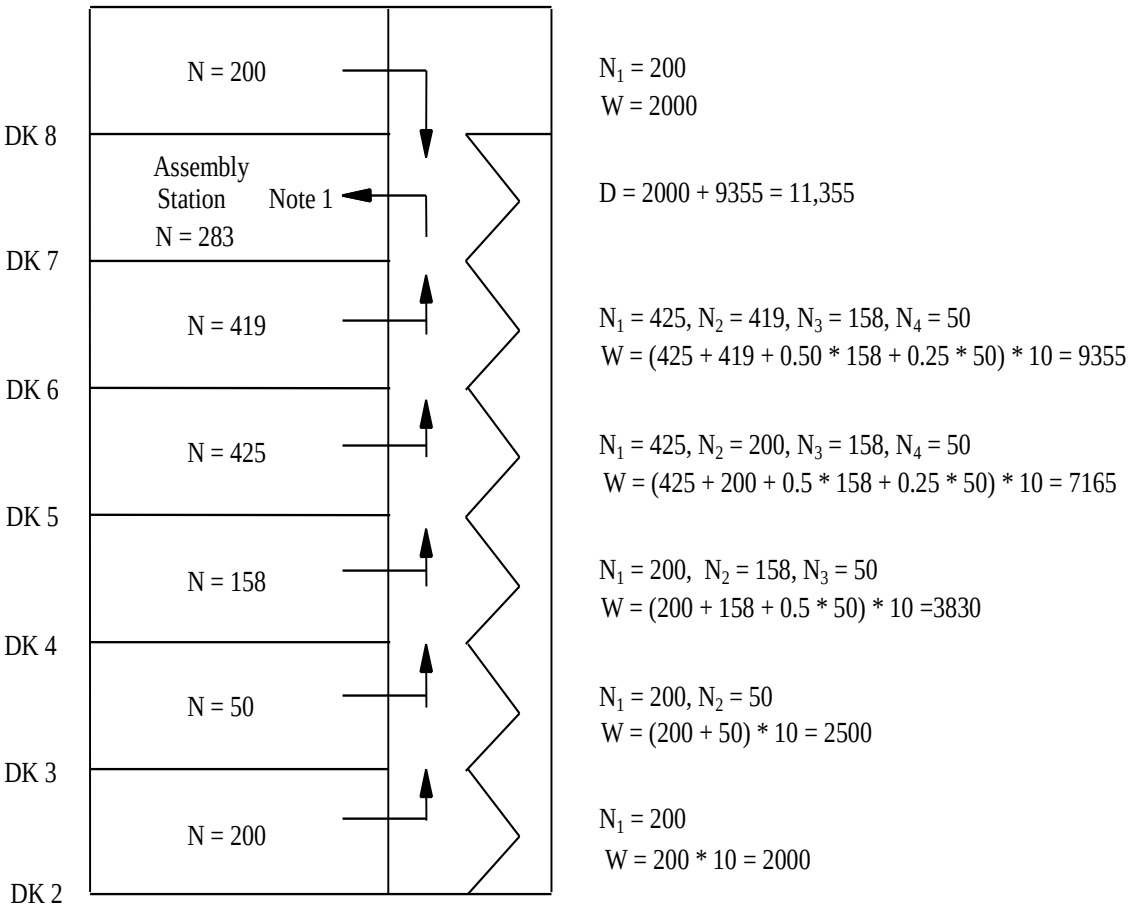

Fig.II

Z(pers)	=	number of persons expected to evacuate through the stairway
N(pers)	=	number of persons directly entering the stairway flow from a given deck
W(mm)	=	$(N_1 + N_2 + 0.5 \times N_3 + 0.25 \times N_4) \times 10$ = calculated width of stairway
D(mm)	=	width of exit doors

$N_1 > N_2 > N_3 > N_4$ where:

N_1(pers) = the deck with the largest number of persons N entering directly the stairway

N_2(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 11,355 [mm].

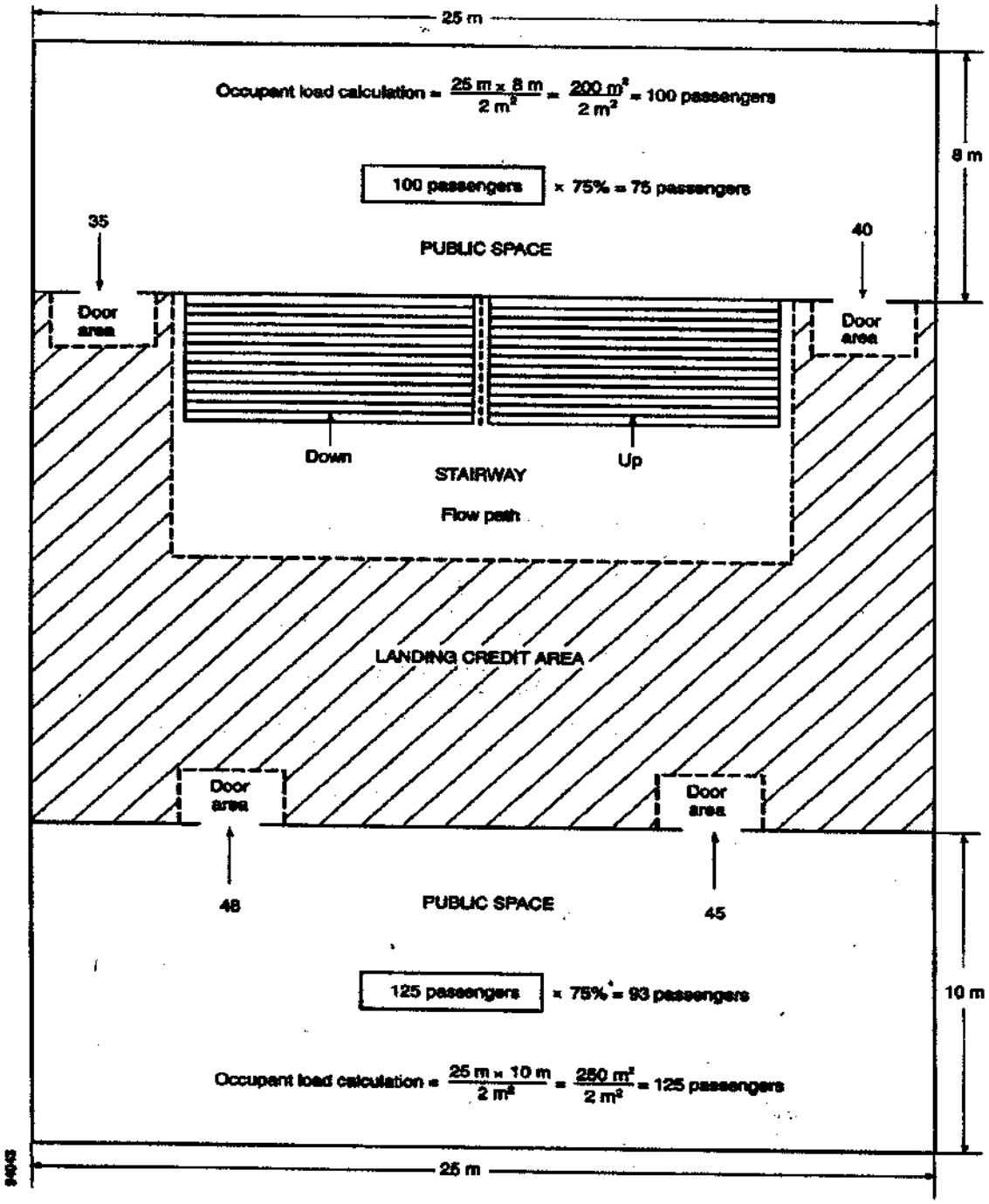
25 m
Occupant load calculation = 25 m × 8 m / 2 m² = 200 m² / 2 m² = 100 passengers
8 m
100 passengers × 75% = 75 passengers
35
40
PUBLIC SPACE
Door area
Door area
Down
Up
STAIRWAY
Flow path
LANDING CREDIT AREA
Door area
Door area
48
45
PUBLIC SPACE
125 passengers × 75% = 93 passengers
10 m
Occupant load calculation = 25 m × 10 m / 2 m² = 250 m² / 2 m² = 125 passengers
25 m

Fig.III

(4) Landings

Landings at each deck level shall not be less than 2 [m^2] in area and shall increase by 1 [m^2] for every 10 persons provided for in excess of 20 persons but need not exceed 16 [m^2], except for those landings servicing public spaces having direct access onto the stairway enclosure.

5. Doorways and corridors

(1) Doorways and corridors and intermediate landings included in means of escape shall be sized in the same manner as stairways.

(2) The aggregate width of stairway exit doors to the assembly station shall not be less than the aggregate width of stairways serving this deck.

6. Evacuation routes to the embarkation deck

(1) Assembly station

It shall be recognized that the evacuation routes to the embarkation deck may include an assembly station. In this case consideration shall be given to the fire-protection requirements and sizing of corridors and doors from the stairway enclosure to the assembly station and from the assembly station to the embarkation deck, noting that evacuation of persons from assembly stations to embarkation positions shall be carried out in small control groups.

(2) Routes from the assembly station to the survival craft embarkation position

Where the passengers and crew are held at an assembly station which is not at the survival craft embarkation position, the dimension of stairway width and doors from the assembly station to this position shall not be based on the number of persons in the controlled group. The width of these stairways and doors need not exceed 1,500 mm unless larger dimensions are required for evacuation of these spaces under normal conditions.

7. Means of escape plans

(1) Means of escape plans shall be provided indicating the following:

(a) the number of the crew and passengers in all normally occupied spaces;

(b) the number of crew and passengers expected to escape by stairway and through doorways, corridors and landings;

(c) assembly stations and survival craft embarkation positions;

(d) primary and secondary means of escape; and

(e) width of stairways, doors, corridors and landing areas.

(2) Means of escape plans shall be accompanied by detailed calculation for determining the width of escape stairways, doors, corridors and landing areas.