# JABATAN LAUT MALAYSIA
***MARINE DEPARTMENT MALAYSIA***

# MALAYSIAN SHIPPING NOTICE

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Notis kepada pemilik kapal serta orang yang mempunyai kepentingan kepada kebenaran pengeluaran sijil-sijil statutory.
*Notice to ship owners and persons with interest toward the delegation of statutory certification*.

## IMPLEMENTATION OF THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA (SOLAS) 1974/78 AS AMENDED

**1.** International Convention for the Safety of Life at Sea (SOLAS) 1974/78 came into effect for Malaysia since 19th January 1984. The enforcement of the SOLAS for Malaysia is done by way of the Merchant Shipping Ordinance 1952.

**2.** Pursuant to the above, the detail requirements and standards for the implementation of the SOLAS 74/78 **Chapter II-1 Construction - Structure, subdivision and stability, machinery and electrical installations** for Malaysian Ship as attached in **Appendix 1**

3. This notice is applicable throughout Malaysia and to all Malaysian ships and all ships while in Malaysian waters.

**Ketua Pengarah Laut/ *Director General of Marine***
**Tarikh/*Date*: 24 DECEMBER 2008**

**Appendix 1**

## Chapter II-1

## Construction - Structure, subdivision and stability, machinery and electrical installations

### Part A - *General*

### Regulation 1 - *Application*

*1.1*. Unless expressly provided otherwise, this chapter shall apply to ships th e keels of which are laid or which are at a similar stage of construction on or after 1 July 1986.

*1.2*. For the purpose of this chapter, the term *a similar stage of construction* means the stage at which:

*.1*. construction identifiable with a specific ship begins; and

*.2*. assembly of that ship has commenced comprising at least 50 tonnes or one per cent of the estimated mass of all structural material, whichever is less.

*1.3*. For the purpose of this chapter:

*.1*. the expression *ships constructed* means ships the keels of which are laid or which are at a similar stage of construction;

*.2*. the expression *all ships* means ships constructed before, on or after 1 July 1986;

*.3*. a cargo ship, whenever built, which is converted to a passenger ship shall be treated as a passenger ship constructed on the date on which such a conversion commences.

*2*. Unless expressly provided otherwise, for ships constructed before 1 July 1986 the Surveyor General 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 resolution MSC.1(XLV), are complied with.

*3.1*. 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 1 July 1986 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 undergoi ng such repairs, alterations, modifications or outfitting. Repairs, alterations and modifications of a major character and outfitting related thereto shall meet the requirements for ships constructed on or after 1 July 1986 in so far as the Surveyor Genera l deems reasonable and practicable.

*3.2*. Notwithstanding the provisions of paragraph 3.1, passenger ships which undergo repairs, alterations and modifications to meet the requirements of regulation 8-1 shall not be deemed to have undergone repairs, alterations and modifications of a major character.

*4*. The Surveyor General of a State may, if it considers that the sheltered n ature and conditions of the voyage are such as to render the application of any specific requirements of this chapter unreasonable or unnecessary, exempt from those requirements individual ships or classes of ships entitled to fly the flag of that State wh ich, in the course of their voyage, do not proceed more than 20 miles from the nearest land.

*5*. In the case of passenger ships which are employed in special trades for the carriage of large numbers of special trade passengers, such as the pilgrim trade, the Surveyor General of the State whose flag such ships are entitled to fly, if satisfied that it is impracticable to enforce compliance with the requirements of this chapter, may exempt such ships from those requirements, provided that they comply fully with the provisions of:

*.1*. the rules annexed to the Special Trade Passenger Ships Agreement, 1971; and

*.2*. the rules annexed to the Protocol on Space Requirements for Special Trade Passenger Ships, 1973.

**Regulation 2 - *Definitions***

For the purpose of this chapter, unless expressly provided otherwise:

*1.1*. *Subdivision load line* is a waterline used in determining the subdivision of the ship.

*1.2*. *Deepest subdivision load line* is the waterline which corresponds to the greatest draught permitted by the subdivision requirements which are applicable.

*2*. *Length of the ship* is the length measured between perpendiculars taken at the extremities of the deepest subdivision load line.

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

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

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

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

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

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

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

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

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

*12*. An *oil tanker* is the oil tanker defined in regulation 1 of Annex I of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973.

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

*14*. *Bulk carrier* means a bulk carrier as defined in regulation XII/1.1.

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

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

*1*. *Steering gear control system* is the equipment by which orders are transmitted from the navigation bridge to the steering gear power units. Steering gear control systems comprise transmitters, receivers, hydraulic control pumps and their associated motors, motor controllers, piping and cables.

*2*. *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.

*3*. *Steering gear power unit is:*

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

.*2*. in the case of electrohydraulic steering gear, an electric motor and its associated electrical equipment and connected pump;

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

*4*. *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.

*5*. *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.

*6*. *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.

*7*. *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 condition.

*8*. *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.

*9*. *Main generating station* is the space in which the main source of electrical power is situated.

*10*. *Main switchboard* is a switchboard which is directly supplied by the main source of electrical power and is intended to distribute electrical energy to the ship's services.

*11*. *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.

*12*. *Emergency source of electrical power* is a source of electrical power, intended to supply the emergency switchboard in the event of failure of the supply from the main source of electrical power.

*13*. *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.

*14*. *Maximum ahead service speed* is the greatest speed which the ship is designed to maintain in service at sea at the deepest seagoing draught.

*15*. *Maximum astern speed* is the speed which it is estimated the ship can attain at the designed maximum astern power at the deepest seagoing draught.

*16*. *Machinery spaces* 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.

*17*. *Machinery spaces of category A* are those spaces and trunks to such spaces which contain:

*.1*. internal combustion machinery used for main propulsion; or

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

*.3*. any oil-fired boiler or oil fuel unit.

*18*. *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.

*19*. *Chemical tanker* is a cargo ship constructed or adapted and used for the carriage in bulk of any liquid product listed in either:

*.1*. chapter 17 of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk adopted by the Maritime Safety Committee by resolution MSC.4(48), hereinafter referred to as "the International Bulk Chemical Code", as may be amended by the International Maritime Organization; or

*.2*. chapter VI of the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk adopted by the Assembly of the International Maritime Organization by resolution A.212(VII), hereinafter referred to as "the Bulk Chemical Code", as has been or may be amended by the International Maritime Organization;

whichever is applicable.

*20*. *Gas carrier* is a cargo ship constructed or adapted and used for the carriage in bulk of any liquefied gas or other products listed in either:

.1. chapter 19 of the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk adopted by the Maritime Safety Committee by resolution MSC.5(48) hereinafter referred to as "the International Gas Carrier Code", as may be amended by the International Maritime Organization; or

.2. chapter XIX of the Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk adopted by the International Maritime Organization by resolution A.328 (IX), hereinafter referred to as "the Gas Carrier Code", as has been or may be amended by the International Maritime Organization;

whichever is applicable.

*21*. *Deadweight* is the difference in tonnes between the displacement of a ship in water of a specific gravity of 1.025 at the load waterline corresponding to the assigned summer freeboard and the lightweight of the ship.

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

**Part A-1 - *Structure of ships***

**Regulation 3-1 - *Structural, mechanical and electrical requirements for ships***

In addition to the requirements contained elsewhere in the present regulations, ships shall be designed, constructed and maintained in compliance with the structural, mechanical and electrical requirements of a classification society which is recognized by the Surveyor General in accordance with the provisions of regulation XI-1/1, or with applicable national standards of the Surveyor General which provide an equivalent level of safety.

**Regulation 3-2 - *Corrosion prevention of seawater ballast tanks in oil tankers and bulk carriers***

(This regulation applies to oil tankers and bulk carriers constructed on or after 1 July 1998)

All dedicated seawater ballast tanks shall have an efficient corrosion prevention system, such as hard protective coatings or equivalent. The coatings should preferably be of a light colour. The scheme for the selection, application and maintenance of the system shall be approved by the Surveyor General or Recognized Organizations, based on the guidelines adopted by the International Maritime Organization. Where appropriate, sacrificial anodes shall also be used

**Regulation 3-3 - *Safe access to tanker bows***

*1*. For the purpose of this regulation and regulation 3-4, tankers include oil tankers as defined in regulation 2, chemical tankers as defined in regulation VII/8.2 and gas carriers as defined in regulation VII/11.2.

*2*. Every tanker shall be provided with the means to enable the crew to gain safe access to the bow even in severe weather conditions. Such means of access shall be approved by the Surveyor General or Recognized Organizations based on the guidelines developed by the International Maritime Organization.

**Regulation 3-4 - *Emergency towing arrangements on tankers***

*1*. Emergency towing arrangements shall be fitted at both ends on board every tanker of not less than 20,000 tonnes deadweight.

*2*. For tankers constructed on or after 1 July 2002:

*.1*. the arrangements shall, at all times, be capable of rapid deployment in the absence of main power on the ship to be towed and easy connection to the towing ship. At least one of the emergency towing arrangements shall be pre-rigged ready for rapid deployment; and

*.2*. emergency towing arrangements at both ends shall be of adequate strength taking into account the size and deadweight of the ship, and the expected forces during bad weather conditions. The design and construction and prototype testing of the emergency towing arrangements shall make by referring to the Guidelines on emergency towing arrangements for tankers adopted by the Maritime Safety Committee by resolution MSC.35(63), as may be amended and shall be approved by the Recognized Organization.

*3*. For tankers constructed before 1 July 2002, the design and construction of emergency towing arrangements shall make by referring to the Guidelines on emergency towing arrangements for tankers adopted by the Maritime Safety Committee by resolution MSC.35(63), as may be amended and shall be approved by the Recognized Organization.

**Regulation 3-5 - *New installation of materials containing asbestos***

*1*. This regulation shall apply to materials used for the structure, machinery, electrical installations and equipment covered by the present Convention.

*2*. For all ships, new installation of materials which contain asbestos shall be prohibited except for:

*.1*. vanes used in rotary vane compressors and rotary vane vacuum pumps;

*.2*. watertight joints and linings used for the circulation of fluids when, at high temperature (in excess of 350°C) or pressure (in excess of $7 \times 10^6$ Pa), there is a risk of fire, corrosion or toxicity; and

*.3*. supple and flexible thermal insulation assemblies used for temperatures above 1000°C.

**Regulation 3-6 - *Access to and within spaces in, and forward of, the cargo area of oil tankers and bulk carriers***

**1 Application**

*1.1*. Except as provided for in paragraph 1.2, this regulation applies to oil tankers of 500 gross tonnage and over and bulk carriers, as defined in regulation IX/1, of 20,000 gross tonnage and over, constructed on or after 1 January 2006.

*1.2*. Oil tankers of 500 gross tonnage and over constructed on or after 1 October 1994 but before 1 January 2005 shall comply with the provisions of regulation II-1/12-2 adopted by resolution MSC.27(61).

**2 Means of access to cargo and other spaces**

*2.1*. Each space shall be provided with means of access to enable, throughout the life of a ship, overall and close-up inspections and thickness measurements of the ship's structures to be carried out by the Surveyor General, the company, as defined in regulation IX/1, and the ship's personnel

and others as necessary. Such means of access shall comply with the requirements of paragraph 5 and with the Technical provisions for means of access for inspections, adopted by the Maritime Safety Committee by resolution MSC.133(76), as may be amended by the International Maritime Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the Annex other than chapter I.

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

*2.3*. The construction and materials of all means of access and their attachment to the ship's structure shall be in accordance with the rules and regulations of the respective Recognized Organization. The means of access shall be subject to survey prior to, or in conjunction with, its use in carrying out surveys in accordance with regulation I/10.

**3 Safe access to cargo holds, cargo tanks, ballast tanks and other spaces**

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

*3.2*. Tanks, and subdivisions of tanks, having a length of 35 m or more, shall be fitted with at least two access hatchways and ladders, as far apart as practicable. Tanks less than 35 m in length shall be served by at least one access hatchway and ladder. When a tank is subdivided by one or more swash bulkheads or similar obstructions which do not allow ready means of access to the other parts of the tank, at least two hatchways and ladders shall be fitted.

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

**4 Ship structure access manual**

*4.1*. A ship's means of access to carry out overall and close-up inspections and thickness measurements shall be described in a Ship structure access manual in accordance with the Rules and Regulations of the respective Recognized Organizations and shall be approved by them, an updated copy of which shall be kept on board. The Ship structure access manual shall include the following for each space:

*.1*. plans showing the means of access to the space, with appropriate technical specifications and dimensions;

*.2*. plans showing the means of access within each space to enable an overall inspection to be carried out, with appropriate technical specifications and dimensions. The plans shall indicate from where each area in the space can be inspected;

.3. plans showing the means of access within the space to enable close-up inspections to be carried out, with appropriate technical specifications and dimensions. The plans shall indicate the positions of critical structural areas, whether the means of access is permanent or portable and from where each area can be inspected;

.4. instructions for inspecting and maintaining the structural strength of all means of access and means of attachment, taking into account any corrosive atmosphere that may be within the space;

.5. instructions for safety guidance when rafting is used for close-up inspections and thickness measurements;

.6. instructions for the rigging and use of any portable means of access in a safe manner;

.7. an inventory of all portable means of access; and

.8. records of periodical inspections and maintenance of the ship's means of access.

*4.2*. For the purpose of this regulation "critical structural areas" are locations which have been identified from calculations to require monitoring or from the service history of similar or sister ships to be sensitive to cracking, buckling, deformation or corrosion which would impair the structural integrity of the ship.

**5 General technical specifications**

*5.1*. For access through horizontal openings, hatches or manholes, the dimensions shall be sufficient to allow a person wearing a self-contained air-breathing apparatus and protective equipment to ascend or descend any ladder without obstruction and also provide a clear opening to facilitate the hoisting of an injured person from the bottom of the space. The minimum clear opening shall not be less than 600 mm x 600 mm. When access to a cargo hold is arranged through the cargo hatch, the top of the ladder shall be placed as close as possible to the hatch coaming. Access hatch coamings having a height greater than 900 mm shall also have steps on the outside in conjunction with the ladder.

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

*5.3*. For oil tankers of less than 5,000 tonnes deadweight, the Surveyor General may approve, in special circumstances, smaller dimensions for the openings referred to in paragraphs 5.1 and 5.2, if the ability to traverse such openings or to remove an injured person can be proved in accordance with the rules and regulations of the respective Recognized Organization.

**Regulation 3-7 - *Construction drawings maintained on board and onshore***

*1*. A set of as-built construction drawings and other plans showing any subsequent structural alterations shall be kept on board a ship constructed on or after 1 January 2007.

*2*. An additional set of such drawings shall be kept ashore by the Company, as defined in regulation IX/1.2.

**Regulation 3-8 - *Towing and mooring equipment***

*1*. This regulation applies to ships constructed on or after 1 January 2007, but does not apply to emergency towing arrangements provided in accordance with regulation 3-4.

*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*. Arrangements, equipment and fittings provided in accordance with paragraph 2 shall meet the appropriate requirements of the Surveyor General or an organization recognized by the Surveyor General under regulation I/6.

*4*. 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.

**Part B - *Subdivision and stability***

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

**Regulation 4 - *Floodable length in passenger ships***

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

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

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

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

**Regulation 5 - *Permeability in passenger ships***

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

*1.2*. In determining the floodable length, a uniform average permeability shall be used throughout the whole length of each of the following portions of the ship below the margin line:

.*1*. the machinery space as defined in regulation 2;

.*2*. the portion forward of the machinery space; and

.3. the portion abaft the machinery space.

*2.1*. The uniform average permeability throughout the machinery space shall be determined from the formula:

$$85 + 10\left[\frac{a-c}{v}\right]$$

where:

*a* = the volume of the passenger spaces, as defined in regulation 2, which are situated below the margin line within the limits of the machinery space;

*c* = the volume of between-deck spaces below the margin line within the limits of the machinery space which are appropriated to cargo, coal or stores;

*v* = the whole volume of the machinery space below the margin line.

*2.2*. Where it is shown to the satisfaction of the Surveyor General that the average permeability as determined by detailed calculation is less than that given by the formula, the detailed calculated value may be used. For the purpose of such calculation, the permeability of passenger spaces, as defined in regulation 2, shall be taken as 95, that of all cargo, coal and store spaces as 60, and that of double bottom, oil fuel and other tanks at such value as may be approved in each case.

*3*. Except as provided in paragraph 4, the uniform average permeability throughout the portion of the ship forward of or abaft the machinery space shall be determined from the formula:

$$63 + 35\frac{a}{v}$$

where:

*a* = the volume of the passenger spaces, as defined in regulation 2, which are situated below the margin line, forward of or abaft the machinery space; and

*v* = the whole volume of the portion of the ship below the margin line forward of or abaft the machinery space.

*4.1*. In the case of special subdivision required in regulation 6.5, the uniform average permeability throughout the portion of the ship forward of or abaft the machinery space shall be:

$$95 - 35\frac{b}{v}$$

where:

*b* = the volume of the spaces below the margin line and above the tops of floors, inner bottom, or peak tanks, as the case may be, which are appropriated to and used as cargo spaces, coal or oil fuel bunkers, store-rooms, baggage and mail rooms, chain lockers and fresh water tanks, forward of or abaft the machinery space; and

*v* = the whole volume of the portion of the ship below the margin line forward of or abaft the machinery space.

*4.2*. In the case of ships engaged on services where the cargo holds are not generally occupied by any substantial quantities of cargo, no part of the cargo spaces is to be included in calculating *b*.

*5*. In the case of unusual arrangements the Surveyor General may allow, or require, a detailed calculation of average permeability for the portions forward of or abaft the machinery space. For the purpose of such calculation, the permeability of passenger spaces as defined in regulation 2

shall be taken as 95, that of spaces containing machinery as 85, that of all cargo, coal and store spaces as 60, and that of double bottom, oil fuel and other tanks at such value as may be approved in each case.

*6*. Where a between-deck compartment between two watertight transverse bulkheads contains a ny passenger or crew space, the whole of that compartment, less any space completely enclosed within permanent steel bulkheads and appropriated to other purposes, shall be regarded as passenger space. Where, however, the passenger or crew space in question is completely enclosed within permanent steel bulkheads, only the space so enclosed need be considered as passenger space.

**Regulation 6 - *Permissible length of compartments in passenger ships***

*1*. Ships shall be as efficiently subdivided as is possible hav ing regard to the nature of the service for which they are intended. The degree of subdivision shall vary with the length of the ship and with the service, in such manner that the highest degree of subdivision corresponds with the ships of greatest length, primarily engaged in the carriage of passengers.

**2 Factor of subdivision**

*2.1*. The maximum permissible length of a compartment having its centre at any point in the ship's length is obtained from the floodable length by multiplying the latter by an approp riate factor called the factor of subdivision.

*2.2*. The factor of subdivision shall depend on the length of the ship, and for a given length shall vary according to the nature of the service for which the ship is intended. It shall decrease in a regular and continuous manner,

*.1*. as the length of the ship increases, and

*.2*. from a factor *A*, applicable to ships primarily engaged in the carriage of cargo, to a factor *B*, applicable to ships primarily engaged in the carriage of passengers.

*2.3*. The variations of the factors *A* and *B* shall be expressed by the following formulae (1) and (2) where *L* is the length of the ship as defined in regulation 2:

$$A = \frac{53.2}{L-60} + 0.18 \quad \text{(where L = 131m and upwards)} \qquad (1)$$

$$B = \frac{30.3}{L-42} + 0.18 \quad \text{(where L = 79m and upwards)} \qquad (2)$$

**3 Criterion of service**

*3.1*. For a ship of given length the appropriate factor of subdivision shall be determined by the criterion of service numeral (hereinafter called the criterion numeral) as given by the following formulae (3) and (4) where:

$C_s$ = the criterion numeral;

*L* = the length of the ship (metres), as defined in regulation 2;

*M* = the volume of the machinery space (cubic me tres), as defined in regulation 2; with the addition thereto of the volume of any permanent oil fuel bunkers which may be s ituated above the inner bottom and forward of or abaft the machinery space;

*P* = the whole volume of the passenger spaces below the margin line (cubic metres), as defined in regulation 2;

*V* = the whole volume of the ship below the margin line (cubic metres);

$P_1 = KN$

where:

*N* = the number of passengers for which the ship is to be certified, and

*K* = 0.056*L*

*3.2*. Where the value of *KN* is greater than the sum of *P* and the whole volume of the actual passenger spaces above the margin line, the figure to be taken as $P_1$ is that sum or two-thirds *KN*, whichever is the greater.

When $P_1$ is greater than *P*:

$$C_s = 72 \frac{M+2P_1}{V+P_1-P} \quad (3)$$

and in other cases:

$$C_s = 72 \frac{M+2P}{V} \quad (4)$$

*3.3*. For ships not having a continuous bulkhead deck the volumes are to be taken up to the actual margin lines used in determining the floodable lengths.

**4 Rules for subdivision of ships other than those covered by parag raph 5**

*4.1*. The subdivision abaft the forepeak of ships of 131 m in length and upwards having a criterion numeral of 23 or less shall be governed by the factor *A* given by formula (1); of those having a criterion numeral of 123 or more by the factor *B* given by formula (2); and of those having a criterion numeral between 23 and 123 by the factor *F* obtained by linear interpolation between the factors *A* and *B*, using the formula:

$$F = A - \frac{(A-B)(Cs-23)}{100} \quad (5)$$

Nevertheless, where the criterion numeral is equal to 45 or more and simultaneously the computed factor of subdivision as given by formula (5) is 0.65 or less, but more than 0.5, the subdivision abaft the forepeak shall be governed by the factor 0.5.

*4.2*. Where the factor *F* is less than 0.4 and it is shown in accordance with the Rules and Regulations of the respective Recognized Organization to be impracticable to comply with the factor *F* in a machinery compartment of the ship, the subdivision of such compartment may be governed by an increased factor, which, however, shall not exceed 0.4.

*4.3*. The subdivision abaft the forepeak of ships of less than 131 m but not less than 79 m in length having a criterion numeral equal to *S*, where:

$$S = \frac{3574-25L}{13}$$

shall be governed by the factor unity; of those having a criterion numeral of 123 or more by the factor *B* given by the formula (2); of those having a criterion numeral between *S* and 123 by the factor *F* obtained by linear interpolation between unity and the factor *B* using the formula:

$$F = 1 - \frac{(1-B)(C_S-S)}{123-S} \qquad (6)$$

*4.4*. The subdivision abaft the forepeak of ships of less than 131 m but not less than 79 m in length and having a criterion numeral less than *S*, and of ships of less than 79 m in length shall be governed by the factor unity, unless, in either case, it is shown in accordance with the Rules and Regulations of the respective Recognized Organization to be impracticable to comply with this factor in any part of the ship, in which case the Surveyor General may allow such relaxation as may appear to be justified, having regard to all the circumstances.

*4.5*. The provisions of paragraph 4.4 shall apply also to ships of whatever length, which are to be certified to carry a number of passengers exceeding 12 but not exceeding:

$\frac{L^2}{650}$, or 50, whichever is the less

**5 Special subdivision standards for ships complying with regulation III/21.1.2**

*5.1.1*. In the case of ships primarily engaged in the carriage of passengers, the subdivision abaft the forepeak shall be governed by a factor of 0.5 or by the factor determined according to paragraphs 3 and 4, if less than 0.5.

*5.1.2*. In the case of such ships of less than 91.5 m in length, if the Surveyor General is satisfied that compliance with such factor would be impracticable in a compartment, it may allow the length of that compartment to be governed by a higher factor provided the factor used is the lowest that is practicable and reasonable in the circumstances.

*5.2*. Where, in the case of any ship whether of less than 91.5 m or not, the necessity of carrying appreciable quantities of cargo makes it impracticable to require the subdivision abaft the forepeak to be governed by a factor not exceeding 0.5, the standard of subdivision to be applied shall be determined in accordance with the following subparagraphs .1 to .5, subject to the condition that where the Surveyor General is satisfied that insistence on strict compliance in any respect would be unreasonable, it may allow such alternative arrangement of the watertight bulkheads as appears to be justified on merits and will not diminish the general effectiveness of the subdivision.

.1. The provisions of paragraph 3 relating to the criterion numeral shall apply with the exception that in calculating the value of $P_1$ for berthed passengers *K* is to have the value defined in paragraph 3, or 3.5 $m^3$, whichever is the greater, and for unberthed passengers *K* is to have the value 3.5 $m^3$.

.2. The factor *B* in paragraph 2 shall be replaced by the factor *BB* determined by the following formula:

$$BB = \frac{17.6}{L-33} + 0.20 \qquad (L = 55\text{m and upwards})$$

.3. The subdivision abaft the forepeak of ships of 131 m in length and upwards having a criterion numeral of 23 or less shall be governed by the factor *A* given by formula (1) in

paragraph 2.3; of those having a criterion numeral of 123 or more by the factor *BB* given by the formula in paragraph 5.2.2; and of those having a criterion numeral between 23 and 123 by the factor *F* obtained by linear interpolation between the factors *A* and *BB*, using the formula:

$$F = A - \frac{(A-BB)(Cs-23)}{100}$$

except that if the factor *F* so obtained is less than 0.5 the factor to be used shall be either 0.5 or the factor calculated according to the provisions of paragraph 4.1, whichever is the smaller.

*.4*. The subdivision abaft the forepeak of ships of less than 131 m but not less than 55 m in length having a criterion numeral equal to $S_1$ where:

$$S_1 = \frac{3712-25L}{19}$$

shall be governed by the factor unity; of those having a criterion numeral of 123 or more by the factor *BB* given by the formula in paragraph 5.2.2; of those having a criterion numeral between $S_1$ and 123 by the factor *F* obtained by linear interpolation between unity and the factor *BB* using the formula:

$$F = 1 - \frac{(1-BB)(Cs-S_1)}{123-S_1}$$

except that in either of the two latter cases if the factor so obtained is less than 0.5 the subdivision may be governed by a factor not exceeding 0.5.

*.5*. The subdivision abaft the forepeak of ships of less than 131 m but not less than 55 m in length and having a criterion numeral less than $S_1$ and of ships of less than 55 m in length shall be governed by the factor unity, unless it is shown in accordance with the Rules and Regulations of the respective Recognized Organization to be impracticable to comply with this factor in particular compartments, in which event the Surveyor General may allow such relaxations in respect of those compartments as appear to be justified, having regard to all the circumstances, provided that the aftermost compartment and as many as possible of the forward compartments (between the forepeak and the after end of the machinery space) shall be kept within the floodable length.

*5.3*. The special provisions regarding permeability given in regulation 5.4 shall be employed when calculating the floodable length curves.

*5.4*. Where the Surveyor General is satisfied that, having regard to the nature and conditions of the intended voyages compliance with the other provisions of this chapter and of chapter II-2 is sufficient, the requirements of this paragraph need not be complied with.

**Regulation 7 - *Special requirements concerning passenger ship subdivision***

*1*. Where in a portion or portions of a ship the watertight bulkheads are carried to a higher deck than in the remainder of the ship and it is desired to take advantage of this higher extension of the bulkheads in calculating the floodable length, separate margin lines may be used for each such portion of the ship provided that:

.1 the sides of the ship are extended throughout the ship's length to the deck corresponding to the upper margin line and all openings in the shell plating below this deck throughout the length of the ship are treated as being below a margin line, for the purposes of regulation 17; and

.2 the two compartments adjacent to the "step" in the bulkhead deck are each within the permissible length corresponding to their respective margin lines, and, in addition, their combined length does not exceed twice the permissible length based on the lower margin line.

*2.1* A compartment may exceed the permissible length determined by the rules of regulation 6 provided the combined length of each pair of adjacent compartments to which the compartment in question is common does not exceed either the floodable length or twice the permissible length, whichever is the less.

*2.2* If one of the two adjacent compartments is situated inside the machinery space, and the second is situated outside the machinery space, and the average permeability of the portion of the ship in which the second is situated differs from that of the machinery space, the combined length of the two compartments shall be adjusted to the mean average permeability of the two portions of the ship in which the compartments are situated.

*2.3* Where the two adjacent compartments have different factors of subdivision, the combined length of the two compartments shall be determined proportionately.

*3* In ships of 100 m in length and upwards, one of the main transverse bulkheads abaft the forepeak shall be fitted at a distance from the forward perpendicular which is not greater than the permissible length.

*4* A main transverse bulkhead may be recessed provided that all parts of the recess lie inboard of vertical surfaces on both sides of the ship, situated at a distance from the shell plating equal to one fifth the breadth of the ship, as defined in regulation 2, and measured at right angles to the centreline at the level of the deepest subdivision load line. Any part of a recess which lies outside these limits shall be dealt with as a step in accordance with paragraph 5.

*5* A main transverse bulkhead may be stepped provided that it meets one of the following conditions:

.1 the combined length of the two compartments, separated by the bulkhead in question, does not exceed either 90% of the floodable length or twice the permissible length, except that, in ships having a factor of subdivision greater than 0.9, the combined length of the two compartments in question shall not exceed the permissible length;

.2 additional subdivision is provided in way of the step to maintain the same measure of safety as that secured by a plane bulkhead;

.3 the compartment over which the step extends does not exceed the permissible length corresponding to a margin line taken 76 mm below the step.

*6* Where a main transverse bulkhead is recessed or stepped, an equivalent plane bulkhead shall be used in determining the subdivision.

*7* If the distance between two adjacent main transverse bulkheads, or their equivalent plane bulkheads, or the distance between the transverse planes passing through the nearest stepped portions of the bulkheads, is less than 3 m plus 3% of the length of the ship, or 11 m, whichever is

the less, only one of these bulkheads shall be regarded as forming part of the subdivision of the ship in accordance with the provisions of regulation 6.

*8*. Where a main transverse watertight compartment contains local subdivision and it can be shown in accordance with the Rules and Regulations of the respective Recognized Organization that, after any assumed side damage extending over a length of 3 m plus 3% of the length of the ship, or 11 m, whichever is the less, the whole volume of the main compartment will not be flooded, a proportionate allowance may be made in the permissible length otherwise required for such compartment. In such a case the volume of effective buoyancy assumed on the undamaged side shall not be greater than that assumed on the damaged side.

*9*. Where the required factor of subdivision is 0.5 or less, the combined length of any two adjacent compartments shall not exceed the floodable length.

**Regulation 8 - *Stability of passenger ships in damaged condition***

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

**1**

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

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

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

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

**2**

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

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

*2.3*. The stability required in the final condition after damage, and after equalization where provided, shall be determined as follows:

*2.3.1*. The positive residual righting lever curve shall have a minimum range of 15° beyond the angle of equilibrium. This range may be reduced to a minimum of 10°, in the case where

the area under the righting lever curve is that specified in paragraph 2.3.2, increased by the ratio:

$$\frac{15}{Range}$$

where the range is expressed in degrees.

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

*.1*. the angle at which progressive flooding occurs;

*.2*. 22° (measured from the upright) in the case of one-compartment flooding, or 27° (measured from the upright) in the case of the simultaneous flooding of two or more adjacent compartments.

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

*.1*. the crowding of all passengers towards one side;

*.2*. the launching of all fully loaded davit-launched survival craft on one side;

*.3*. due to wind pressure;

as calculated by the formula:

$$\text{GZ (in meter)} = \frac{heeling\ moment}{displacement} \times 0.04$$

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

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

*.1*. Moments due to crowding of passengers:

*.1.1*. four persons per square metre;

*.1.2*. a mass of 75 kg for each passenger;

*.1.3*. passengers shall be distributed on available deck areas towards one side of the ship on the decks where muster stations are located and in such a way that they produce the most adverse heeling moment.

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

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

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

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

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

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

.3. Moments due to wind pressure:

.3.1. a wind pressure of 120 N/m $^2$ to be applied;

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

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

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

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

| Spaces | Permeability |
|---|---|
| Appropriated to cargo, coal or stores | 60 |
| Occupied by accommodation | 95 |
| Occupied by machinery | 85 |
| Intended for liquids | 0 or 95 |

Higher surface permeabilities are to be assumed in respect of spaces which, in the vicinity of the damage waterplane, contain no substantial quantity of accommodation or machinery and spaces which are not generally occupied by any substantial quantity of car go or stores.

4. Assumed extent of damage shall be as follows:

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

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

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

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

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

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

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

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

*.3*. in no case shall the margin line be submerged in the final stage of flooding. If it is considered that the margin line may become submerged during an intermediate stage of flooding, the Surveyor General may require such investigations and arrangements as it considers necessary for the safety of the ship.

**7**

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

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

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

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

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

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

**Regulation 8-1 - *Stability of ro-ro passenger ships in damaged condition***

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

| **Value of $A/A_{max}$** | **Date of compliance** |
|---|---|
| less than 85% | 1 October 1998 |
| 85% or more but less than 90% | 1 October 2000 |
| 90% or more but less than 95% | 1 October 2002 |
| 95% or more but less than 97.5% | 1 October 2004 |
| 97.5% or more | 1 October 2005 |

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

Notwithstanding the provisions of regulations 8 and 8-1:

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

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

| **Value of $A/A_{max}$** | **Date of compliance** |
|---|---|
| less than 85% | 1 October 1998 |
| 85% or more but less than 90% | 1 October 2000 |
| 90% or more but less than 95% | 1 October 2002 |
| 95% or more but less than 97.5% | 1 October 2004 |

| | |
|---|---|
| 97.5% or more | 1 October 2010 |

.*2.2*. **Number of persons permitted to be carried**

| | |
|---|---|
| 1500 or more | 1 October 2002 |
| 1000 or more but less than 1500 | 1 October 2006 |
| 600 or more but less than 1000 | 1 October 2008 |
| 400 or more but less than 600 | 1 October 2010 |

.*2.3*. **Age of the ship equal to or greater than 20 years,**

Where the age of the ship means the time counted from the date on which the keel was laid or the date on which it was at a similar stage of construction or from the date on which the ship was converted to a ro-ro passenger ship.

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

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

**Regulation 9 -** ***Ballasting of passenger ships***

*1*. Water ballast should not in general be carried in tanks intended for oil fuel. In ships in which it is not practicable to avoid putting water in oil fuel tanks, oily-water separating equipment in accordance with the Rules and Regulations of the respective Recognized Organization shall be fitted, or other alternative means, such as discharge to shore facilities, acceptable to the Surveyor General shall be provided for disposing of the oily-water ballast.

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

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

*1*. A forepeak or collision bulkhead shall be fitted which shall be watertight up to the bulkhead deck. This bulkhead shall be located at a distance from the forward perpendicular of not less than 5% of the length of the ship and not more than 3 m plus 5% of the length of the ship.

*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 paragraph 1 shall be measured from a point either:

.*1*. at the mid-length of such extension; or

.*2*. at a distance 1.5% of the length of the ship forward of the forward perpendicular; or

.*3*. 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 the bulkhe ad 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 paragraph 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 paragraph 1 or paragraph 2. However, in ships constructed before 1 July 1997:

*.1*. where a sloping ramp forms part of the extension, the part of the extension, which is more than 2.3 m above the bulkhead deck, may extend no more than 1 m forward of the forward limits specified in paragraph 1 or paragraph 2; and

*.2*. where the existing ramp does not comply with the requirements for acceptance as an extension to the collision bulkhead and the position of the ramp prevents the siting of such extension within the limits specified in paragraph 1 or paragraph 2 , the extension may be sited within a limited distance aft of the aft limit specified in paragraph 1 or paragraph 2. The limited distance aft should be no more than is necessary to ensure non interference with the ramp. The extension to the collision bulkhead shall open forward and comply with the requirements of paragraph 3 and shall be so arranged as to preclude the possibility of the ramp causing damage to it in the case of damage to, or detachment of, the r amp.

*5*. Ramps not meeting the above requirements shall be disregarded as an extension of the collision bulkhead.

*6*. In ships constructed before 1 July 1997, the requirements of paragraphs 3 and 4 shall apply not later than the date of the first periodica l survey after 1 July 1997.

*7*. An afterpeak bulkhead, and bulkheads dividing the machinery space, as defined in regulation 2, from the cargo and passenger spaces forward and aft, shall also be fitted and made watertight up to the bulkhead deck. The afterpeak bulkhead may, however, be stepped below the bulkhead deck, provided the degree of safety of the ship as regards subdivi sion is not thereby diminished.

*8*. In all cases 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 margin line will not be submerged.

**Regulation 11 - *Peak and machinery space bulkheads and stern tubes in cargo ships***

*(Paragraphs 8 and 9 of this regulation apply to ships constructed on or after 1 February 1992)*

*1*. For the purpose of this regulation *freeboard deck, length of ship* and *forward perpendicular* have the meanings as defined in the International Convention on Load Lines in force.

*2*. A collision bulkhead shall be fitted which sh all be watertight up to the freeboard deck. This bulkhead shall be located at a distance from the forward perpendicular of not less than 5 % of the length of the ship or 10 m, whichever is the less, and, except as may be permitted by the Surveyor General, not more than 8% of the length of the ship.

*3*. Where any part of the ship below the waterline extends forward of the forward perpendicular, e.g. a bulbous bow, the distances stipulated in paragraph 2 shall be measured from a point either:

.1. at the mid-length of such extension; or

.2. at a distance 1.5% of the length of the ship forward of the forward perpendicular; or

.3. at a distance 3 m forward of the forward perpendicular;

whichever gives the smallest measurement.

4. The bulkhead may have steps or recesses provided they are within the limits prescribed in paragraph 2 or 3. Pipes piercing the collision bulkhead shall be fitted with suitable valves operable from above the freeboard deck and the valve chest shall be secured at the bulkhead inside the forepeak. The valves may be fitted on the after side of the collision bulkhead provided that the valves are readily accessible under all service conditions and the space in which they are located is not a cargo space. All valves shall be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable. No door, manhole, ventilation duct or any other opening shall be fitted in this bulkhead.

5. Where a long forward superstructure is fitted the collision bulkhead shall be extended weathertight to the deck next above the freeboard deck. The extension need not be fitted directly above the bulkhead below provided it is located within the limits prescribed in paragraph 2 or 3 with the exemption permitted by paragraph 6 and the part of the deck which forms the step is made effectively weathertight.

6. Where bow doors are fitted and a sloping loading ramp forms part of the extension of the collision bulkhead above the freeboard deck the part of the ramp which is more than 2.3 m above the freeboard deck may extend forward of the limit specified in paragraph 2 or 3 . The ramp shall be weathertight over its complete length.

7. 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.

8. Bulkheads shall be fitted separating the machinery space from cargo and passenger spaces forward and aft and made watertight up to the freeboard deck.

9. Stern tubes shall be enclosed in a watertight space (or spaces) of moderate volume. Other measures to minimize the danger of water penetrating into the ship in case of damage to stern tube arrangements may be taken at the discretion of the Surveyor General.

**Regulation 12 - *Double bottoms in passenger ships***

1. A double bottom shall be fitted extending from the forepeak bulkhead to the afterpeak bulkhead as far as this is practicable and compatible with the design and proper working of the ship.

.1. In ships of 50 m and upwards but less than 61 m in length a double bottom shall be fitted at least from the machinery space to the forepeak bulkhead, or as near thereto as practicable.

.2. In ships of 61 m and upwards but less than 76 m in length a double bottom shall be fitted at least outside the machinery space, and shall extend to the fore and after peak bulkheads, or as near thereto as practicable.

.3. In ships of 76 m in length and upwards, a double bottom shall be fitted amidships, and shall extend to the fore and after peak bulkheads, or as near thereto as practicable.

*2*. Where a double bottom is required to be fitted its depth shall be in accordance with the rules and regulations of the respective Recognized Organization and the inner bottom shall be continued out to the ship's sides in such a manner as to protect the bottom to the turn of the bilge. Such protection will be deemed satisfactory if the line of intersection of the outer ed ge of the margin plate with the bilge plating is not lower at any part than a horizontal plane passing through the point of intersection with the frame line amidships of a transverse diagonal line inclined at 25° to the base line and cutting it at a point one half the ship's moulded breadth from the middle line.

*3*. Small wells constructed in the double bottom in connection with drainage arrangements of holds, etc., shall not extend downwards more than necessary. The depth of the well shall in no case be more than the depth less 460 mm of the double bottom at the centreline, nor shall the well extend below the horizontal plane referred to in paragraph 2. A well extending to the outer bottom is, however, permitted at the after end of the shaft tunnel. Other w ells (e.g. for lubricating oil under main engines) may be permitted by the Surveyor General if satisfied that the arrangements give protection equivalent to that afforded by a double bottom complying with this regulation.

*4*. A double bottom need not be fi tted in way of watertight compartments of moderate size used exclusively for the carriage of liquids, provided the safety of the ship, in the event of bottom or side damage, is not, in the opinion of the Surveyor General, thereby impaired.

*5*. In the case of ships to which the provisions of regulation 1.5 apply and which are engaged on regular service within the limits of a sh ort international voyage as defined in regulation III/3.22, the Surveyor General may permit a double bottom to be dispensed with in any part of the ship which is subdivided by a factor not exceeding 0.5, 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.

**Regulation 12-1 -** ***Double bottoms in carg o ships other than tankers***

*(This regulation applies to ships constructed on or after 1 February 1992)*

*1*. A double bottom shall be fitted extending from the collision bulkhead to the afterpeak 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, its depth shall be in accordance with the rules and regulations of the respective Recognized Organization and the inner bottom shall be continued out to the ship's side in such a manner as to protect the bottom to the turn of the bilge.

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

*4*. A double bottom need not be fitted in way of watertight compartments used exclusively for the carriage of liquids, provided the safety of the ship in the event of bottom damage is not, in the opinion of the Surveyor General, thereby imp aired.

**Regulation 13 -** ***Assigning, marking and recording of subdivision load lines for passenger ships***

*1*. In order that the required degree of subdivision shall be maintained, a load line corresponding to the approved subdivision draught shall be assigned and marked on the ship's sides. A ship having spaces which are specially adapted for the accommodation of passengers and the carriage of cargo alternatively may, if the owners desire, have one or more additional load lines assigned and

marked to correspond with the subdivision draughts which the Surveyor General may approve for the alternative service conditions.

*2*. The subdivision load lines assigned and marked shall be recorded in the Passenger Ship Safety Certificate, and shall be distinguished by the notation C.1 for the principal passenger condition, and C.2, C.3, etc., for the alternative conditions.

*3*. The freeboard corresponding to each of these load lines shall be measured at the same position and from the same deck line as the freeboards determined in accordance with the International Convention on Load Lines in force.

*4*. The freeboard corresponding to each approved subdivision load line and the conditions of service for which it is approved, shall be clearly indicated on the Passenger Ship Safety Certificate.

*5*. In no case shall any subdivision load line mark be placed above the deepest load line in salt water as determined by the strength of the ship or the International Convention on Load Lines in force.

*6*. Whatever may be the position of the subdivision load line marks, a ship shall in no case be loaded so as to submerge the load line mark appropriate to the season and locality as determined in accordance with the International Convention on Load Lines in force.

*7*. A ship shall in no case be so loaded that when it is in salt water the subdivision load line mark appropriate to the particular voyage and condition of service is submerged.

**Regulation 14 - *Construction and initial testing of watertight bulkheads, etc., in passenger ships and cargo ships***

*1*. Each watertight subdivision bulkhead, whether transverse or longitudinal, shall be constructed in such a manner that it shall be capable of supporting, with a proper 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 but at least the pressure due to a head of water up to the margin line. The construction of these bulkheads shall be in accordance with the rules and regulations of the respective Recognized Organization.

*2.1*. Steps and recesses in bulkheads shall be watertight and as strong as the bulkhead at the place where each occurs.

*2.2*. Where frames or beams pass through a watertight deck or bulkhead, such deck or bulkhead shall be made structurally watertight without the use of wood or cement.

*3*. Testing main compartments by filling them with water is not compulsory. When testing by filling with water is not carried out, a hose test shall be carried out where practicable. This test shall be carried out in the most advanced stage of the fitting out of the ship. Where a hose test is not practicable because of possible damage to machinery, electrical equipment insulation or outfitting items, it may be replaced by a careful visual examination of welded connections, supported where deemed necessary by means such as a dye penetrant test or an ultrasonic leak test or an equivalent test. In any case, a thorough inspection of the watertight bulkheads shall be carried out.

*4*. The forepeak, double bottoms (including duct keels) and inner skins shall be tested with water to a head corresponding to the requirements of paragraph 1.

*5*. Tanks which are intended to hold liquids, and which form part of the subdivision of the ship, shall be tested for tightness with water to a head up to the deepest subdivision load line or to a head

corresponding to two thirds of the depth from the top of keel to the margin line in way of the tanks, whichever is the greater; provided that in no case shall the test head be less than 0.9 m above the top of the tank.

*6*. The tests referred to in paragraphs 4 and 5 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.

**Regulation 15 - *Openings in watertight bulkheads in passenger ships***

*(This regulation applies to ships constructed on or after 1 February 1992)*

*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.

*2.1*. Where pipes, scuppers, electric cables, etc., are carried through watertight subdivision bulkheads, arrangements shall be made to ensure the watertight integrity of the bulkheads.

*2.2*. Valves not forming part of a piping system shall not be permitted in watertight subdivision bulkheads.

*2.3*. 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.

*3.1*. No doors, manholes, or access openings are permitted:

*.1*. in the collision bulkhead below the margin line;

*.2*. in watertight transverse bulkheads dividing a cargo space from an adjoining cargo space or from a permanent or reserve bunker, except as provided in paragraph 10.1 and in regulation 16.

*3.2*. Except as provided in paragraph 3.3, the collision bulkhead may be pierced below the margin line 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 Surveyor 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.

*3.3*. If the forepeak is divided to hold two different kinds of liquids the Surveyor General may allow the collision bulkhead to be pierced below the margin line by two pipes, each of which is fitted as required by paragraph 3.2, provided the Surveyor 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.

*4.1*. Watertight doors fitted in bulkheads between permanent and reserve bunkers shall always be accessible, except as provided in paragraph 9.4 for between-deck bunker doors.

*4.2*. Satisfactory arrangements shall be made by means of screens or otherwise to prevent the coal from interfering with the closing of watertight bunker doors.

*5*. Subject to paragraph 11, not more than one door, apart from the doors to bunkers and 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 and all per manent bunkers. 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 containi ng the machinery.

*6.1*. Watertight doors, except as provided in paragraph 10.1 or regulation 16, shall be power-operated sliding doors complying with the requirements of paragraph 7 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.

*6.2*. 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 w hen 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.

*6.3*. Watertight door controls, including hydraulic piping and electric cables, shall be kept as clos e 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 susta ins damage within one fifth of the breadth of the ship, as defined in regulation 2, such distance being measured at right a ngles 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.

*6.4*. All power-operated sliding watertight doors shall be provided with means of ind ication 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 paragraph 7.1.5 and at the location where hand operation above the bulkhead dec k is required by paragraph 7.1.4.

*6.5*. In ships constructed before 1 February 1992, doors which do not comply with paragraphs 6.1 to 6.4 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 into the log-book.

*7.1*. Each power-operated sliding watertight door:

*.1*. shall have a vertical or horizontal motion;

*.2*. shall, subject to paragraph 11, be normally limited to a maximum clear opening width of 1.2 m. The Surveyor 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:

*.2.1*. special consideration shall be given to the strength of the door and its closing appliances in order to prevent leakages;

*.2.2*. the door shall be located outside the damage zone ;

*.2.3*. the door shall be kept closed when the ship is at sea, except for limited periods when absolutely necessary as determined by the Surveyor General;

*.3*. 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 S urveyor General;

*.4*. 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 Surveyor General. Direction of rotation or other movement is to be clearly indicated at all operating positions. The time necessary for the com plete closure of the door, when operating by hand gear, shall not exceed 90 s with the ship in the upright position;

*.5*. 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;

*.6*. 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 pas senger areas and areas of high ambient noise the Surveyor General may require the audible alarm to be supplemented by an intermittent visual signal at the door; and

*.7*. shall have an approximately uniform rate of closure under power. The closure time, fro m 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.

*7.2*. 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 dire ctly 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 regulation 42.3.1.3 in the event of failure of either the main or emergency source of electrical power.

*7.3*. Power-operated sliding watertight doors shall have either:

*.1*. 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 doo rs 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 li able 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 s ystem 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

*.2*. an independent hydraulic system for each door with each power source consisting of a motor and pump capable of opening and closing the door. In 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

*.3*. an independent electrical system and motor for each door with each power source consisting of a motor capable of opening and closing the door. The power source shall be capable of being automatically supplied by the transitional source of emergency electrical power as required by regulation 42.4.2 - 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 7.3.1, 7.3.2 and 7.3.3, 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.

*7.4*. 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.

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

*7.6*. The enclosures of electrical components necessarily situated below the bulkhead deck shall provide suitable protection against the ingress of water.

*7.7*. 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.

*7.8*. 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 paragraph 7.3. Loss of any such power supply should activate an audible and visual alarm at the central operating console at the navigating bridge.

*8.1*. The central operating console at the navigating 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.

*8.2*. 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.

*8.3*. It shall not be possible to remotely open any door from the central operating console.

*9.1*. All watertight doors shall be kept closed during navigation except that they may be opened during navigation as specified in paragraphs 9.2, 9.3 and 9.4. Watertight doors of width of more than 1.2 m permitted by paragraph 11 may only be opened in the circumstances detailed in that paragraph. Any door which is opened in accordance with this paragraph shall be ready to be immediately closed.

*9.2*. 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.

*9.3*. 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 Surveyor 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.

*9.4*. Sliding watertight doors fitted between bunkers in the between-decks below the bulkhead deck may sometimes be open at sea for the purpose of trimming coal. The opening and closing of these doors shall be recorded in such log-book as may be prescribed by the Surveyor General.

*10.1*. If the Surveyor 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 regulation 2, such distance being measured at right angles to the centreline at the level of the deepest subdivision load line.

*10.2*. 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 Surveyor General.

*11*. 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 Surveyor General may permit not more than one power-operated sliding watertight door in each main transverse bulkhead larger than those specified in paragraph 7.1.2 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 paragraph 7.1.4 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.

*12.1*. 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 regulation 19. 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 margin line. 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.

*12.2*. Where it is proposed to fit tunnels piercing main transverse watertight bulkheads, these shall receive the special consideration of the Surveyor General.

*12.3*. 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.

**Regulation 16 - *Passenger ships carrying goods vehicles and accompanying personnel***

*1*. This regulation 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, other than those specified in regulation I/2(e) (i) and (ii), 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 regulation 15.10 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 regulation.

*4*. In applying regulation 8 for the worst operating conditions, the permeability for cargo spaces intended for the stowage of goods vehicles and containers shall be derived by calculation in which the goods vehicles and containers shall be assumed to be non-watertight and their permeability taken as 65. For ships engaged in dedicated services the actual value of permeability for goods vehicles or containers may be applied. In no case shall the permeability of the cargo spaces in which the goods vehicles and containers are carried be taken as less than 60.

**Regulation 17 - *Openings in the shell plating of passenger ships below the margin line***

*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 in accordance with the rules and regulations of the respective Recognized Organization.

*3.1*. Subject to the requirements of the International Convention 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.

*3.2*. All sidescuttles the sills of which are below the margin line, as permitted by paragraph 3.1 shall be of such construction as will effectively prevent any person opening them without the consent of the master of the ship.

*3.3.1*. Where in a between-decks, the sills of any of the sidescuttles referred to in paragraph 3.2 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 paragraph the appropriate allowance for fresh water may be made when applicable.

*3.3.2*. 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 Surveyor General.

*3.3.3*. For any ship that has one or more sidescuttles so placed that the requirements of paragraph 3.3.1 would apply when it was floating at its deepest subdivision load line, the Surveyor 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 2.5% 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 International Convention on Load Lines in force, this limiting draught may be increased by 0.3 m.

*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 International Convention 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.

*6.1*. No sidescuttles shall be fitted in any spaces which are appropriated exclusively to the carriage of cargo or coal.

*6.2*. 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.

*6.3*. 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 such log-book as may be prescribed by the Surveyor General.

*7*. Automatic ventilating sidescuttles shall not be fitted in the shell plating below the margin line without the special sanction of the Surveyor General.

*8*. 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.

*9.1*. 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.

*9.2.1*. Subject to the requirements of the International Convention on Load Lines in force, and except as provided in paragraph 9.3, each separate discharge led through the shell plating from spaces below the margin line 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. 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.

*9.2.2*. The requirements of the International Convention on Load Lines in force shall apply to discharges led through the shell plating from spaces above the margin line.

*9.3*. 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.

*9.4*. All shell fittings and valves required by this regulation 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 regulation refers shall be of steel or other equivalent material in accordance with the Rules and Regulations of the respective Recognized Organization.

*10.1*. Gangway, cargo and coaling ports fitted below the margin line 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.

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

*11.1*. The inboard opening of each ash-chute, rubbish-chute, etc., shall be fitted with an efficient cover.

*11.2*. If the inboard opening is situated below the margin line, 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.

**Regulation 17-1 -** ***Openings in the shell plating below the bulkhead deck of passenger ships and the freeboard deck of cargo ships***

Notwithstanding the requirements of regulation 17, ships constructed on or after 1 July 1998 shall comply with the requirements of regulation 17 where a reference to "margin line" shall be deemed to mean a reference to the bulkhead deck of passenger ships and the freeboard deck of cargo ships.

**Regulation 18 -** ***Construction and initial tests of watertight doors, sidescuttles, etc., in passenger ships and cargo ships***

*1*. In passenger ships:

*.1*. the design, materials and construction of all watertight doors, sidescuttles, gangway, cargo and coaling ports, valves, pipes, ash-chutes and rubbish-chutes referred to in these regulations shall be in accordance with the rules and regulations of the respective Recognized Organization;

*.2*. the frames of vertical watertight doors shall have no groove at the bottom in which dirt might lodge and prevent the door closing properly.

*2*. In passenger ships and cargo ships watertight doors shall be tested by water pressure to a head up to the bulkhead deck or freeboard deck respectively. 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 with a test pressure corresponding at least to the head required for the intended location. 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.

**Regulation 19 -** ***Construction and initial tests of watertight decks, trunks, etc., in passenger ships and cargo ships***

*1*. Watertight decks, trunks, tunnels, duct keels and ventilators shall be of the same strength as watertight bulkheads at corresponding levels. The means used for making them watertight, and the arrangements adopted for closing openings in them, shall be in accordance with the Rules and Regulations of the respective Recognized Organization. Watertight ventilators and trunks shall be carried at least up to the bulkhead deck in passenger ships and up to the freeboard deck in cargo ships.

*2*. In ro-ro passenger ships 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 regulation 8.5.

*3*. In ro-ro passenger ships 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.

*4*. In ro-ro passenger ships constructed before 1 July 1997, the requirements of paragraphs 2 and 3 shall apply not later than the date of the first periodical survey after 1 July 1997 .

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

**Regulation 20 - *Watertight integrity of passenger ships above the margin line***

*1*. The Surveyor General 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 main subdivision 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.

*2*. The bulkhead deck or a deck above it shall be weathertight. 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*. In passenger ships constructed on or after 1 July 1997, 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 paragraph are without prejudice to the provisions of the International Convention on Load Lines in force.

*4*. Sidescuttles, gangway, cargo and coaling ports and other means for closing openings in the shell plating above the margin line 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.

**Regulation 20-1 - *Closure of cargo loading doors***

*1*. This regulation applies to all passenger ships.

*2*. The following doors, located above the margin line, 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:

.*1*. cargo loading doors in the shell or the boundaries of enclosed superstructures;

.*2*. bow visors fitted in positions, as indicated in paragraph 2.1;

.*3*. cargo loading doors in the collision bulkhead;

.*4*. weathertight ramps forming an alternative closure to those defined in paragraphs 2.1 to 2.3 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.

*3*. Notwithstanding the requirements of paragraph 2.1 and 2.4, the Surveyor 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.

*4*. The master shall ensure that an effective system of supervision and reporting of the closing and opening of the doors referred to in paragraph 2 is implemented.

*5*. The master shall ensure, before the ship proceeds on any voyage, that an entry in the log -book, as required in regulation 25, is made of the time of the last closing of the doors specified in paragraph 2 and the time of any opening of particular doors in accordance with paragraph 3.

**Regulation 20-2 - *Watertight integrity from the ro-ro deck (bulkhead deck) to spaces below***

*1*. In ro-ro passenger ships constructed on or after 1 July 1997:

*.1*. subject to the provisions of subparagraphs .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 Surveyor 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 subparagraphs .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 subparagraphs .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 regulation 25, is made of the time of the last closing of the accesses referred to in subparagraphs .2 and .3.

*2*. In ro-ro passenger ships constructed before 1 July 1997:

*.1*. all accesses from the ro-ro deck that lead to spaces below the bulkhead deck shall be made weathertight and means shall be provided on the navigation bridge, indicating whether the access is open or closed;

*.2*. all such accesses shall be closed before the ship leaves the berth on any voyage and shall remain closed until the ship is at its next berth;

*.3*. notwithstanding the requirements of subparagraph .2, the Surveyor General may permit some accesses to be opened during the voyage but only for a period sufficient to permit through passage and, if required, for the essential working of the ship; and

*.4*. the requirements of subparagraph .1 shall apply not later than the date of the first periodical survey after 1 July 1997.

**Regulation 20-3 - *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.

**Regulation 20-4 - *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 paragraph 1, the Surveyor 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.

**Regulation 21 - *Bilge pumping arrangements***

*(Paragraphs 1.6 and 2.9 of this regulation apply to ships constructed on or after 1 February 1992)*

**1 Passenger ships and cargo ships**

*1.1*. An efficient bilge pumping system shall be provided, capable of pumping from and draining any watertight compartment other than a space permanently appropriated for the carriage of fresh water, water ballast, oil fuel or liquid cargo and for which other efficient means of pumping are provided, under all practical conditions. Efficient means shall be provided for draining water from insulated holds.

*1.2*. Sanitary, ballast and general service pumps may be accepted as independent power bilge pumps if fitted with the necessary connections to the bilge pumping system.

*1.3*. 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 suitable material.

*1.4*. The arrangement of the bilge and ballast pumping system shall be such as to prevent the possibility of water passing from the sea and from water ballast spaces into the cargo and machinery spaces, or from one compartment to another. Provision shall be made to prevent any deep tank having bilge and ballast connections being inadvertently flooded from the sea when containing cargo, or being discharged through a bilge pump when containing water ballast.

*1.5*. All distribution boxes and manually operated valves in connection with the bilge pumping arrangements shall be in positions which are accessible under ordinary circumstances.

*1.6*. Provision shall be made for the drainage of enclosed cargo spaces situated on the bulkhead deck of a passenger ship and on the freeboard deck of a cargo ship, provided that the Surveyor General may permit the means of drainage to be dispensed with in any particular compartment of any ship or class of ship if it is satisfied that by reason of size or internal subdivision of those spaces the safety of the ship is not thereby impaired.

*1.6.1*. 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 regulation 17 in the case of a

passenger ship and the requirements for scuppers, inlets and discharges of the International Convention on Load Lines in force in the case of a cargo ship.

*1.6.2*. Where the freeboard is such that the edge of the bulkhead deck or the edge of the freeboard deck, respectively, is immersed when the ship heels 5° or less, the drainage of the enclosed cargo spaces on the bulkhead deck or on the freeboard deck, respectively, 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:

*.1*. the number, size and disposition of the scuppers are such as to prevent unreasonable accumulation of free water;

*.2*. the pumping arrangements required by this regulation for passenger ships or cargo ships, as applicable, take account of the requirements for any fixed pressure water-spraying fire-extinguishing system;

*.3*. 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

*.4*. 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.

**2 Passenger ships**

*2.1*. The bilge pumping system required by paragraph 1.1 shall be capable of operation under all practicable conditions after a casualty whether the ship is upright or listed. For this purpose wing suctions shall generally be fitted except in narrow compartments at the end of the ship where one suction may be sufficient. In compartments of unusual form, additional suctions may be required. Arrangements shall be made whereby water in the compartment may find its way to the suction pipes. Where, for particular compartments, the Surveyor General is satisfied that the provision of drainage may be undesirable, it may allow such provision to be dispensed with if calculations made in accordance with the conditions laid down in regulations 8.2.1 to 8.2.3 show that the survival capability of the ship will not be impaired.

*2.2*. At least three power pumps shall be fitted connected to the bilge main, one of which may be driven by the propulsion machinery. Where the criterion numeral is 30 or more, one additional independent power pump shall be provided.

*2.3*. Where practicable, the power bilge pumps shall be placed in separate watertight compartments and so arranged or situated that these compartments will not be flooded by the same damage. If the main propulsion machinery, auxiliary machinery and boilers are in two or more watertight compartments, the pumps available for bilge service shall be distributed as far as is possible throughout these compartments.

*2.4*. On a ship of 91.5 m in length and upwards or having a criterion numeral of 30 or more, the arrangements shall be such that at least one power bilge pump shall be available for use in all flooding conditions which the ship is required to withstand, as follows:

*.1*. one of the required bilge pumps shall be an emergency pump of a reliable submersible type having a source of power situated above the bulkhead deck; or

.2 the bilge pumps and their sources of power shall be so distributed throughout the length of the ship that at least one pump in an undamaged compartment will be available.

*2.5*. With the exception of additional pumps which may be provided for peak compartments only, each required bilge pump shall be so arranged as to draw water from any space required to be drained by paragraph 1.1.

*2.6*. Each power bilge pump shall be capable of pumping water through the required main bilge pipe at a speed of not less than 2 m/s. Independent power bilge pumps situated in machinery spaces shall have direct suctions from these spaces, except that not more than two such suctions shall be required in any one space. Where two or more such suctions are provided, there shall be at least one on each side of the ship. The Surveyor General may require independent power bilge pumps situated in other spaces to have separate direct suctions. Direct suctions shall be suitably arranged and those in a machinery space shall be of a diameter not less than that required for the bilge main.

*2.7.1*. In addition to the direct bilge suction or suctions required by paragraph 2.6 a direct suction from the main circulating pump leading to the drainage level of the machinery space and fitted with a non-return valve shall be provided in the machinery space. The diameter of this direct suction pipe shall be at least two thirds of the diameter of the pump inlet in the case of steamships, and of the same diameter as the pump inlet in the case of motorships.

*2.7.2*. Where in the opinion of the Surveyor General the main circulating pump is not suitable for this purpose, a direct emergency bilge suction shall be led from the largest available independent power driven pump to the drainage level of the machinery space; the suction shall be of the same diameter as the main inlet of the pump used. The capacity of the pump so connected shall exceed that of a required bilge pump by an amount deemed satisfactory by the Surveyor General.

*2.7.3*. The spindles of the sea inlet and direct suction valves shall extend well above the engine - room platform.

*2.8*. All bilge suction piping up to the connection to the pumps shall be independent of other piping.

*2.9*. The diameter *d* of the bilge main shall be calculated according to the following formula. However, the actual internal diameter of the bilge main may be rounded off to the nearest standard size acceptable to the Surveyor General:

$$d = 25 + 1.68\sqrt{L(B + D)}$$

where:

*d* is the internal diameter of the bilge main (millimetres);
*L* and *B* are the length and the breadth of the ship (metres) as defined in regulation 2; and
*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 1.6.2 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).

The diameter of the bilge branch pipes shall meet the requirements of the Surveyor General.

*2.10*. Provision shall be made to prevent the compartment served by any bilge suction pipe being flooded in the event of the pipe being severed or otherwise damaged by collision or grounding in

any other compartment. For this purpose, where the pipe is at any part situated nearer the side of the ship than one fifth of the breadth of the ship (as defined in regulation 2 and measured at right angles to the centreline at the level of the deepest subdivision load line), or is in a duct keel, a non-return valve shall be fitted to the pipe in the compartment containing the open end.

*2.11*. Distribution boxes, cocks and valves in connection with the bilge pumping system shall be so arranged that, in the event of flooding, one of the bilge pumps may be operative on any compartment; in addition, damage to a pump or its pipe connecting to the bilge main outboard of a line drawn at one fifth of the breadth of the ship shall not put the bilge system out of action. If there is only one system of pipes common to all the pumps, the necessary valves for controlling the bilge suctions must 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 provided, it shall be independent of the main system and so arranged that a pump is capable of operating on any compartment under flooding condition as specified in paragraph 2.1; in that case only the valves necessary for the operation of the emergency system need be capable of being operated from above the bulkhead deck.

*2.12*. All cocks and valves referred to in paragraph 2.11 which can be operated from above the bulkhead deck shall have their controls at their place of operation clearly marked and shall be provided with means to indicate whether they are open or closed.

**3 Cargo ships**

At least two power pumps connected to the main bilge system shall be provided, one of which may be driven by the propulsion machinery. If the Surveyor General is satisfied that the safety of the ship is not impaired, bilge pumping arrangements may be dispensed with in particular compartments.

**Regulation 22 - *Stability information for passenger ships and cargo ships***

*1*. Every passenger ship regardless of size and every cargo ship having a length, as defined in the International Convention on Load Lines in force, of 24 m and upwards, shall be inclined upon its completion and the elements of its stability determined. The master shall be supplied with such information satisfactory to the Surveyor 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 Surveyor 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*. The Surveyor General may allow the inclining test of an individual ship to be dispensed with provided basic stability data are available from the inclining test of a sister ship and it is shown to the satisfaction of the Surveyor General that reliable stability information for the exempted ship can be obtained from such basic data, as required by paragraph 1.

*5*. The Surveyor General may also allow the inclining test of an individual ship or class of ships especially designed for the carriage of liquids or ore in bulk to be dispensed with when reference to

existing data for similar ships clearly indicates that due to the ship's proportions and arrangements more than sufficient metacentric height will be available in all probable loading conditions.

**Regulation 23 - *Damage control plans in passenger ships***

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.

**Regulation 23-1 - *Damage control in dry cargo ships***

*(This regulation applies to ships constructed on or after 1 February 1992)*

*1*. There shall be permanently exhibited or readily available on the navigation bridge, for the guidance of the officer in charge of the ship, a plan 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.

*2*. Indicators shall be provided for all sliding doors and for hinged doors in watertight bulkheads. Indication showing whether the doors are open or closed shall be given on the navigation bridge. In addition, shell doors and other openings which, in the opinion of the Surveyor General, could lead to major flooding if left open or not properly secured, shall be provided with such indicators.

*3.1*. General precautions shall consist of a listing of equipment, conditions and operational procedures, considered by the Surveyor General to be necessary to maintain watertight integrity under normal ship operations.

*3.2*. Specific precautions shall consist of a listing of elements (i.e. closures, security of cargo, sounding of alarms, etc.) considered by the Surveyor General to be vital to the survival of the ship and its crew.

**Regulation 23-2 - *Integrity of the hull and superstructure, damage prevention and control***

*(This regulation applies to all ro-ro passenger ships, except that for ships constructed before 1 July 1997, paragraph 2 shall apply not later than the date of the first periodical survey after 1 July 1997)*

*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 Surveyor 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. The indicator systems, approved by the Surveyor General or Recognized Organizations, which were installed on ships constructed before 1 July 1997 need not be changed.

*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 flo oding 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 under way.

*4*. Documented operating procedures for closing and securing all shell doors, loading doors and other closing appliances which, if left open or not prop erly secured, could, in the opinion of the Surveyor 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.

**Regulation 23-3 -** ***Water level detectors on single hold cargo ships o ther than bulk carriers***

*1*. Single hold cargo ships other than bulk carriers constructed before 1 January 2007 shall comply with the requirements of this regulation not later than the date of the first intermediate or renewal survey of the ship to be carrie d out after 1 January 2007, whichever comes first.

*2*. For the purpose of this regulation, *freeboard deck* has the meaning defined in the International Convention on Load Lines in force.

*3*. Ships having a length (L) of less than 80 m, or 100 m if construct ed before 1 July 1998, and a single cargo hold below the freeboard deck or cargo holds below the freeboard deck which are not separated by at least one bulkhead made watertight up to that deck, shall be fitted in such space or spaces with water level detec tors.

*4*. The water level detectors required by paragraph 3 shall:

*.1*. give an audible and visual alarm at the navigation bridge when the water level above the inner bottom in the cargo hold reaches a height of not less than 0.3 m, and another when such level reaches not more than 15% of the mean depth of the cargo hold; and

*.2*. be fitted at the aft end of the hold, or above its lowest part where the inner bottom is not parallel to the designed waterline. Where webs or partial watertight bulkheads are fit ted above the inner bottom, Surveyor General may require the fitting of additional detectors.

*5*. The water level detectors required by paragraph 3 need not be fitted in ships complying with regulation XII/12, or in ships having watertight side compartments each side of the cargo hold length extending vertically at least from inner bottom to freeboard deck.

**Regulation 24 -** ***Marking, periodical operation and inspection of watertight doors, etc., in passenger ships***

*1*. This regulation applies to all ships.

*2.1*. 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.

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

*3.1*. 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.

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

**Regulation 25 - *Entries in log of passenger ships***

*1*. This regulation applies to all ships.

*2*. Hinged doors, portable plates, sidescuttles, gangway, cargo and coaling ports and other openings, which are required by these regulations 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 regulations) shall be recorded in such log-book as may be prescribed by the Surveyor General.

*3*. A record of all drills and inspections required by regulation 24 shall be entered in the log-book with an explicit record of any defects which may be disclosed.

**Part B-1 - *Subdivision and damage stability of cargo ships***

(This part applies to cargo ships constructed on or after 1 February 1992)

**Regulation 25-1 - *Application***

*1*. The requirements in this part shall apply to cargo ships over 100 m in length ( $L_s$) but shall exclude those ships which are shown to comply with subdivision and damage stability regulations in other instruments developed by the International Maritime Organization. The requirements in this part shall also apply to cargo ships of 80 m in length $L_s$ and upwards but not exceeding 100 m in $L_s$ constructed on or after 1 July 1998.

*2*. Any reference hereinafter to regulations refers to the set of regulations contained in this part.

*3*. The Surveyor General may for a particular ship or group of ships accept alternative arrangements, if it is satisfied that at least the same degree of safety as represented by these regulations is achieved. Any Administration which allows such alternative arrangements shall communicate to the International Maritime Organization particulars thereof.

**Regulation 25-2 - *Definitions***

For the purpose of these regulations, unless expressly provided otherwise:

*1.1*. *Subdivision load line* is a waterline used in determining the subdivision of the ship.

*1.2*. *Deepest subdivision load line* is the subdivision load line which corresponds to the summer draught to be assigned to the ship.

*1.3*. *Partial load line* is the light ship draught plus 60% of the difference between the light ship draught and deepest subdivision load line.

*2.1*. *Subdivision length of the ship ($L_s$)* 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 load line.

*2.2*. *Mid-length* is the mid-point of the subdivision length of the ship.

*2.3*. *Aft terminal* is the aft limit of the subdivision length.

*2.4*. *Forward terminal* is the forward limit of the subdivision length.

*3*. *Breadth (B)* is the greatest moulded breadth of the ship at or below the deepest subdivision load line.

*4*. *Draught (d)* is the vertical distance from the moulded baseline at mid-length to the waterline in question.

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

**Regulation 25-3 - *Required subdivision index R***

*1*. These regulations are intended to provide ships with a minimum standard of subdivision.

*2*. The degree of subdivision to be provided shall be determined by the required subdivision index *R*, as follows:

*.1*. for ships over 100 m in $L_s$:

$$R = (0.002 + 0.0009Ls)^{1/3}$$

where $L_s$ is in metres; and

*.2*. for ships of 80 m in $L_s$ and upwards but not exceeding 100 m in length $L_s$:

$$R = 1-[1/(1 + \frac{Ls}{100} \times \frac{Ro}{Ro})]$$

where $R_o$ is the value *R* as calculated in accordance with the formula in subparagraph .1.

**Regulation 25-4 - *Attained subdivision index A***

*1*. The attained subdivision index *A*, calculated in accordance with this regulation, shall not be less than the required subdivision index *R*, calculated in accordance with paragraph 2 of regulation 25-3.

*2*. The attained subdivision index *A* shall be calculated for the ship by the following formula:

$$A = \sum p_i s_i$$

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,

$s_i$ accounts for the probability of survival after flooding the compartment or group of compartments under consideration, including the effects of any horizontal subdivision.

*3*. In calculating *A*, level trim shall be used.

*4*. This summation covers only those cases of flooding which contribute to the value of the attained subdivision index *A*.

*5*. The summation indicated by the above formula shall be taken over the ship's length for all cases of flooding in which a single compartment or two or more adjacent compartments are involved.

*6*. 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; and additionally, for all cases of simultaneous flooding of a wing compartment or compartments and the adjacent inboard compartment or compartments, assuming a rectangular penetration which extends to the ship's centreline, but excludes damage to any centreline bulkhead.

*7*. 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 will give a more severe result, such extent is to be assumed.

*8*. If pipes, ducts or tunnels are situated within assumed flooded compartments, arrangements are to be made to ensure that progressive flooding cannot thereby extend to compartments other than those assumed flooded. However, the Surveyor General 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.

*9*. In the flooding calculations carried out according to the regulations, only one brea ch of the hull need be assumed.

**Regulation 25-5 - *Calculation of the factor $p_i$***

*1*. The factor $p_i$ shall be calculated according to paragraph 1.1 as appropriate, using the following notations:

$x_1$ = the distance from the aft terminal of $L_s$ to the foremost portion of the aft end of the compartment being considered;

$x_2$ = the distance from the aft terminal of $L_s$ to the aftermost portion of the forward end of the compartment being considered;

$$E_1 = \frac{x_1}{L_s}$$

$$E_2 = \frac{x_2}{L_s}$$

$$E = E_1 + E_2 - 1$$

$$J = E_2 - E_1$$

$$J' = J - E, \text{ if } E \geq 0$$

$$J' = J + E, \text{ if } E < 0$$

The maximum nondimensional damage length

$$J_{max} = \frac{48}{L_s}$$ , but not more than 0.24

The assumed distribution density of damage location along the ship's length

$a$ = 1.2 + 0.8$E$, but not more than 1.2

The assumed distribution function of damage location along the ship's length

$F = 0.4 + 0.25E(1.2 + a)$

$y = \frac{J}{Jmax}$

$p = F_1\ Jmax$

$q = 0.4F_2(Jmax)^2$

$F_1 = y^2 - \frac{y^3}{3}$ if $y < 1$

$F_1 = y - \frac{1}{3}$ otherwise

$F_2 = \frac{y^3}{3} - \frac{y^4}{12}$ if y<1,

$F_2 = \frac{y^2}{2} - \frac{y}{3} + \frac{1}{12}$ otherwise

*1.1*. The factor $p_i$ is determined for each single compartment:

*1.1.1*. Where the compartment considered extends over the entire ship length $L_S$:

$p_i = 1$

*1.1.2*. Where the aft limit of the compartment considered coincides with the aft terminal:

$p_i = F + 0.5ap + q$

*1.1.3*. Where the forward limit of the compartment considered coincides with the forward terminal:

$p_i = 1 - F + 0.5ap$

*1.1.4*. When both ends of the compartment considered are inside the aft and forward terminals of the ship length $L_S$:

$p_i = ap$

*1.1.5*. In applying the formulae of paragraphs 1.1.2, 1.1.3 and 1.1.4, where the compartment considered extends over the "mid-length", these formulae values shall be reduced by an amount determined according to the formula for $q$, in which $F_2$ is calculated taking $y$ to be $J'/J_{max}$.

*2*. Wherever wing compartments are fitted, the $p_i$- value for a wing compartment shall be obtained by multiplying the value, as determined in paragraph 3, by the reduction factor $r$ according to paragraph 2.2, which represents the probability that the inboard spaces will not be flooded.

*2.1*. The $p_i$- value for the case of simultaneous flooding of a wing and adjacent inboard compartment shall be obtained by using the formulae of paragraph 3, multiplied by the factor (1 - $r$).

*2.2*. The reduction factor *r* shall be determined by the following formulae: For J $\geq 0.2\frac{b}{B}$

$$r = \frac{b}{B}(2.3 + \frac{0.08}{J+0.02}) + 0.1 , \quad \text{if } \frac{b}{B} \leq 0.2$$

$$r = (\frac{0.016}{J+0.02} + \frac{b}{B} + 0.36) , \quad \text{if } \frac{b}{B} > 0.2$$

For J < $0.2\frac{b}{B}$ the reduction factor *r* shall be determined by linear interpolation between:

$r = 1$ , for $J = 0$

and

*r* = as for the case where $J \geq 0.2\frac{b}{B}$, for $J = 0.2\frac{b}{B}$

where:

*b* = the mean transverse distance in metres measured at right angles to the centreline at the deepest subdivision load line between the shell and a plane through the outermost portion of and parallel to that part of the longitudinal bulkhead which extends between the longitudinal limits used in calculating the factor $p_i$.

*3*. To evaluate $p_i$ for compartments taken singly the formulae in paragraphs 1 and 2 shall be applied directly.

*3.1*. To evaluate the $p_i$- values attributable to groups of compartments the following applies:

for compartments taken by pairs:

$p_i = p_{12} - p_1 - p_2$

$p_i = p_{23} - p_2 - p_3$, etc

for compartments taken by groups of three:

$p_i = p_{123} - p_{12} - p_{23} + p_2$

$p_i = p_{234} - p_{23} - p_{34} + p_3$, etc

for compartments taken by groups of four:

$pi = p_{1234} - p_{123} - p_{234} + p_{23}$

$pi = p_{2345} - p_{234} - p_{345} + p_{34}$, etc

where:

$p_{12}$, $p_{23}$, $p_{34}$, etc

$p_{123}$, $p_{234}$, $p_{345}$, etc, and

$p_{1234}$, $p_{2345}$, $p_{3456}$, etc.

shall be calculated according to the formulae in paragraphs 1 and 2 for a single compartment whose nondimensional length *J* corresponds to that of a group consisting of the compartments indicated by the indices assigned to *p*.

*3.2*. The factor $p_i$ for a group of three or more adjacent compartments equals zero if the nondimensional length of such a group minus the nondimensional length of the aftermost and foremost compartments in the group is greater than $J_{max}$.

**Regulation 25-6 - *Calculation of the factor $s_i$***

*1*. The factor $s_i$ shall be determined for each compartment or group of compartments according to the following:

*1.1*. In general for any condition of flooding from any initial loading condition *s* shall be:

$$s = C\sqrt{0.5(CZmax)(range)}$$

with:

*C* = 1, if $\theta e \leq 25°$

*C* = 0, if $\theta e \geq 25°$

$$C = \sqrt{\frac{30-\theta e}{5}}$$

$GZ_{max}$ = maximum positive righting lever (metres) within the range as given below but not more than 0.1 m;

range = range of positive righting levers beyond the angle of equilibrium (degr ees) but not more than 20°; however, the range shall be terminated at the angle where openings not capable of being closed weathertight are immersed;

θe = final equilibrium angle of heel (degrees).

*1.2*. *s* = 0 where the final waterline taking into account sinkage, heel and trim, immerses the lower edge of openings through which progressive flooding may take place. Such opening shall include air-pipes, ventilators and openings which are closed by means of weathertight doors or hatch covers, and may exclude those openings closed by means of watertight manhole covers and flush scuttles, small watertight hatch covers which maintain the high integrity of the d eck, remotely operated sliding watertight doors, access doors and access hatch covers, of watertight integrity, normally closed at sea and sidescuttles of the non -opening type. However, if the compartments so flooded are taken into account in the calculati ons the requirements of this regulation shall be applied.

*1.3*. For each compartment or group of compartments $s_i$ shall be weighted according to draught considerations as follows:

$$S_i = 0.5s_l + 0.5\ s_p$$

where:

. $s_l$ is the *s*- factor at the deepest subdivision load line

. $s_p$ is the *s*- factor at the partial load line.

*2*. For all compartments forward of the collision bulkhead, the *s*-value, calculated assuming the ship to be at its deepest subdivision load line and with assumed unlimited vertical extent of damage, is to be equal to 1.

*3*. Wherever a horizontal subdivision is fitted above the waterline in question the following applies.

*3.1*. The *s*- value 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* according to paragraph 3.3, which represents the probability that the spaces above the horizontal subdivision will not be flooded.

*3.2*. In cases of positive contribution to index *A* due to simultaneous flooding of the spaces above the horizontal subdivision, the resulting *s*- value for such a compartment or group of compartments shall be obtained by an increase of the value as determined by paragraph 3.1 by the *s*-value for simultaneous flooding according to paragraph 1.1, multiplied by the factor (1 - *v*).

*3.3*. The probability factor $v_i$ shall be calculated according to:

$$v_i = \frac{H - d}{Hmax - d}$$

for the assumed flooding up to the horizontal subdivision above the subdivision load line, where *H* is to be restricted to a height of $H_{max}$,

$v_i$ = 1, if the uppermost horizontal subdivision in way of the assumed damaged region is below $H_{max}$,

where:

*H* is the height of the horizontal subdivision above the baseline (metres) which is assumed to limit the vertical extent of damage,

$H_{max}$ is the maximum possible vertical extent of damage above the baseline (metres), or

$H_{max} = d + 0.056 L_s (1 - \frac{L_s}{500})$ , if $L_s \leq 250$m

$H_{max} = d + 7$, if $L_s > 250$m

whichever is less.

**Regulation 25-7 - *Permeability***

For the purpose of the subdivision and damage stability calculations of the regulations, the permeability of each space or part of a space 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 |

| | |
|---|---|
| Dry cargo spaces | 0.70 |
| Intended for liquid | 0 or 0.95 |

**Regulation 25-8 - *Stability information***

*1*. The master of the ship shall be supplied with such reliable information as is necessary to enable him by rapid and simple means to obtain accurate guidance as to the stability of the ship under varying conditions of service. The information shall include:

*.1*. a curve of minimum operational metacentric height (GM) versus draught which assures compliance with the relevant intact stability requirements and the requirements of regulations 25-1 to 25-6, alternatively a corresponding curve of the maximum allowable vertical centre of gravity (KG) versus draught, or with the equivalents of either of these curves;

*.2*. instructions concerning the operation of cross-flooding arrangements; and

*.3*. all other data and aids which might be necessary to maintain stability after damage.

*2*. There shall be permanently exhibited, or readily available on the navigation bridge, 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.

*3*. In order to provide the information referred to in paragraph 1.1, the limiting GM (or KG) values to be used, if they have been determined from considerations related to the subdivision index, the limiting GM shall be varied linearly between the deepest subdivision load line and the partial load line. In such cases, for draughts below the partial load line if the minimum GM requirement at this draught results from the calculation of the subdivision index, then this GM value shall be assumed for lesser draughts, unless the intact stability requirements apply.

**Regulation 25-9 - *Openings in watertight bulkheads and internal decks in cargo ships***

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

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

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

*4*. Watertight doors or ramps of satisfactory construction may be fitted to internally subdivide large cargo spaces, provided that the Surveyor General is satisfied that such doors or ramps are essential. These doors or ramps may be hinged, rolling or sliding doors or ramps, but shall not be remotely controlled. Such doors or ramps shall be closed before the voyage commences and shall be kept closed during navigation; the time of opening such doors or ramps in port and of closing them before the ship leaves port shall be entered in the log-book. Should any of the doors or ramps be accessible during the voyage, they shall be fitted with a device which prevents unauthorized opening.

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

**Regulation 25-10 - *External openings in cargo ships***

*1*. All external openings leading to compartments assumed intact in the damage analysis, which are below the final damage waterline, are required to be watertight.

*2*. External openings required to be watertight in accordance with paragraph 1 shall be of sufficient strength and, except for cargo hatch covers, shall be fitted with indicators on the bridge.

*3*. Openings in the shell plating below the deck limiting the vertical extent of damage shall be kept permanently closed while at sea. Should any of these openings be accessible during the voyage, they shall be fitted with a device which prevents unauthorized opening.

*4*. Notwithstanding the requirements of paragraph 3, the Surveyor General may authorize that particular doors may be opened at the discretion of the master, if necessary for the operation of the ship and provided that the safety of the ship is not impaired.

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

**Part C - *Machinery installations***

(Except where expressly provided otherwise part C applies to passenger ships and cargo ships)

**Regulation 26 - *General***

*1*. 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 materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

*2*. The Surveyor General shall give special consideration to the reliability of single essential propulsion components and may require a separate source of propulsion power sufficient to give the ship a navigable speed, especially in the case of unconventional arrangements.

*3*. Means shall be provided whereby normal operation of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative. Special consideration shall be given to the malfunctioning of:

.*1*. a generating set which serves as a main source of electrical power;

.*2*. the sources of steam supply;

.*3*. the boiler feedwater systems;

.*4*. the fuel oil supply systems for boilers or engines;

.*5*. the sources of lubricating oil pressure;

.*6*. the sources of water pressure;

.*7*. a condensate pump and the arrangements to maintain vacuum in condensers;

.*8*. the mechanical air supply for boilers;

.*9*. an air compressor and receiver for starting or control purposes;

.*10*. the hydraulic, pneumatic or electrical means for control in main propulsion machinery including controllable pitch propellers.

However, the Surveyor General, having regard to overall safety considerations, may accept a partial reduction in propulsion capability from normal operation.

*4*. Means shall be provided to ensure that the machinery can be brought into operation from the dead ship condition without external aid.

*5*. All boilers, all parts of machinery, all steam, hydraulic, pneumatic and other systems and their associated fittings which are under internal pressure shall be subjected to appropriate tests including a pressure test before being put into service for the first time.

*6*. Main propulsion machinery and all auxiliary machinery essential to the propulsion and the safety of the ship shall, as fitted in the ship, be designed to operate when the ship is upright and when inclined at any angle of list up to and including 15° either way under static conditions and 22.5° under dynamic conditions (rolling) either way and simultaneously inclined dynamically (pitching) 7.5° by bow or stern. The Surveyor General may permit deviation from these angles, taking into consideration the type, size and service conditions of the ship.

*7*. Provision shall be made to facilitate cleaning, inspection and maintenance of main propulsion and auxiliary machinery including boilers and pressure vessels.

*8*. Special consideration shall be given to the design, construction and installation of propulsion machinery systems so that any mode of their vibrations shall not cause undue stresses in this machinery in the normal operating ranges.

*9*. 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 prescribed in regulation I/10(a) and replaced as necessary, or at an interval recommended by the manufacture r.

*10*. 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 unders tand such information in the performance of their duties.

*11*. 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. This paragraph applies only to ships constructed on or after 1 July 1998.

**Regulation 27 - *Machinery***

*1*. Where risk from overspeeding of machinery exists, mea ns shall be provided to ensure that the safe speed is not exceeded.

*2*. Where main or auxiliary machinery including pressure vessels or any parts of such machinery are subject to internal pressure and may be subject to dangerous overpressure, means shall b e provided where practicable to protect against such excessive pressure.

*3*. All gearing and every shaft and coupling used for transmission of power to machinery essential for the propulsion and safety of the ship or for the safety of persons on board shal l be so designed and constructed that they will withstand the maximum working stresses to which they may be subjected in all service conditions, and due consideration shall be given to the type of engines by which they are driven or of which they form part .

*4*. Internal combustion engines of a cylinder diameter of 200 mm or a crankcase volume of 0.6 $m^3$ and above shall be provided with crankcase explosion relief valves of a suitable type with sufficient relief area. The relief valves shall be arranged or pro vided with means to ensure that discharge from them is so directed as to minimize the possibility of injury to personnel.

*5*. Main turbine propulsion machinery and, where applicable, main internal combustion propulsion machinery and auxiliary machinery sha ll 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 Surveyor General may permit provisions for overriding automatic shutoff devices.

**Regulation 28 - *Means of going astern***

*1*. Sufficient power for going astern shall be provided to secure proper control of the ship in all normal circumstances.

*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 resu lts of trials to determine the ability of ships having multiple propellers to navigate and manoeuvre with

one or more propellers inoperative, 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 paragraphs 2 and 3.

**Regulation 29 - *Steering gear***

*1*. Unless expressly provided otherwise, every ship shall be provided with a main steering gear and an auxiliary steering gear in accordance with the rules and regulations of the respective Recognized Organization. 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.

*2.1*. All the steering gear components and the rudder stock shall be of sound and reliable construction in accordance with the rules and regulations of the respective Recognized Organization. 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.

*2.2*. 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 paragraph 3.2, taking into account any pressure which may exist in the low-pressure side of the system. At the discretion of the Surveyor General, fatigue criteria shall be applied for the design of piping and components, taking into account pulsating pressures due to dynamic loads.

*2.3*. 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*. The main steering gear and rudder stock shall be:

*.1*. of adequate strength and capable of steering the ship at maximum ahead service speed which shall be demonstrated;

*.2*. capable of putting the rudder over from 35° on one side to 35° 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 35° on either side to 30° on the other side in not more than 28 s;

*.3*. operated by power where necessary to meet the requirements of paragraph 3.2 and in any case when the Surveyor General requires a rudder stock of over 120 mm diameter in way of the tiller, excluding strengthening for navigation in ice; and

*.4*. so designed that they will not be damaged at maximum astern speed; however, this design requirement need not be proved by trials at maximum astern speed and maximum rudder angle.

*4*. The auxiliary steering gear shall be:

*.1*. of adequate strength and capable of steering the ship at navigable speed and of being brought speedily into action in an emergency;

*.2*. capable of putting the rudder over from 15° on one side to 15° on the other side in not more than 60 s 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; and

*.3*. operated by power where necessary to meet the requirements of paragraph 4.2 and in any case when the Surveyor General requires a rudder stock of over 230 mm diameter in way of the tiller, excluding strengthening for navigation in ice.

*5*. Main and auxiliary steering gear power units shall be:

*.1*. arranged to restart automatically when power is restored after a power failure; and

*.2*. capable of being brought into operation from a position on the navigation bridge. In the event of a power failure to any one of the steering gear power units, an audible and visual alarm shall be given on the navigation bridge.

*6.1*. Where the main steering gear comprises two or more identical power units, an auxiliary steering gear need not be fitted, provided that:

*.1*. in a passenger ship, the main steering gear is capable of operating the rudder as required by paragraph 3.2 while any one of the power units is out of operation;

*.2*. in a cargo ship, the main steering gear is capable of operating the rudder as required by paragraph 3.2 while operating with all power units;

*.3*. 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.

*6.2*. The Surveyor General may, until 1 September 1986, accept the fitting of a steering gear which has a proven record of reliability but does not comply with the requirements of paragraph 6.1.3 for a hydraulic system.

*6.3*. Steering gears, other than of the hydraulic type, shall achieve standards equivalent to the requirements of this paragraph in accordance with the Rules and Regulations of the respective Recognized Organization.

*7*. Steering gear control shall be provided:

*.1*. for the main steering gear, both on the navigation bridge and in the steering gear compartment;

*.2*. where the main steering gear is arranged in accordance with paragraph 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, except in a tanker, chemical tanker or gas carrier of 10,000 tons gross tonnage and upward s;

*.3*. 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.

*8*. Any main and auxiliary steering gear control system operable from the navigation bridge shall comply with the following:

*.1*. 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;

*.2*. 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;

*.3*. the system shall be capable of being brought into operation from a position on the navigation bridge;

*.4*. 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

*.5*. short circuit protection only shall be provided for steering gear control supply circuits.

*9*. The electrical power circuits and the steering gear control systems with their associated components, cables and pipes required by this regulation and by regulation 30 shall be separated as far as is practicable throughout their length.

*10*. A means of communication shall be provided between the navigation bridge and the steering gear compartment.

*11*. The angular position of the rudder shall:

*.1*. 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;

*.2*. be recognizable in the steering gear compartment.

*12*. Hydraulic power-operated steering gear shall be provided with the following:

*.1*. arrangements to maintain the cleanliness of the hydraulic fluid taking into consideration the type and design of the hydraulic system;

*.2*. 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

*.3*. 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.

*13*. The steering gear compartments shall be:

*.1*. readily accessible and, as far as practicable, separated from machinery spaces; and

*.2*. 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.

*14*. Where the rudder stock is required to be over 230 mm diameter in way of the tiller, excluding strengthening for navigation in ice, an alternative power supply, sufficient at least to supply the steering gear power unit which complies with the requirements of paragraph 4.2 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 tons 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.

*15*. In every tanker, chemical tanker or gas carrier of 10,000 tons gross tonnage and upwards and in every other ship of 70,000 tons gross tonnage and upwards, the main steering gear shall comprise two or more identical power units complying with the provisions of paragraph 6.

*16*. Every tanker, chemical tanker or gas carrier of 10,000 tons gross tonnage and upwards shall, subject to paragraph 17, comply with the following:

*.1*. the main steering gear shall be so arranged that in the event of loss of steering capability due to a single failure in any part of one of the power actuating systems of the main steering gear, excluding the tiller, quadrant or components serving the same purpose, or seizure of the rudder actuators, steering capability shall be regained in not more than 45 s after the loss of one power actuating system;

*.2*. the main steering gear shall comprise either:

*.2.1*. two independent and separate power actuating systems, each capable of meeting the requirements of paragraph 3.2; or

*.2.2*. at least two identical power actuating systems which, acting simultaneously in normal operation, shall be capable of meeting the requirements of paragraph 3.2. Where necessary to comply with this requirement, interconnection of hydraulic power actuating systems shall be provided. Loss of hydraulic fluid from one system shall be capable of being detected and the defective system automatically isolated so that the other actuating system or systems shall remain fully operational;

*.3*. steering gears other than of the hydraulic type shall achieve equivalent standards.

*17*. For tankers, chemical tankers or gas carriers of 10,000 tons gross tonnage and upwards, but of less than 100,000 tonnes deadweight, solutions other than those set out in paragraph 16, which need not apply the single failure criterion to the rudder actuator or actuators, may be permitted provided that an equivalent safety standard is achieved and that:

*.1*. following loss of steering capability due to a single failure of any part of the piping system or in one of the power units, steering capability shall be regained within 45 s; and

*.2*. where the steering gear includes only a single rudder actuator, special consideration is given to stress analysis for the design including fatigue analysis and fracture mechanics analysis, as appropriate, to the material used, to the installation of sealing arrangements and to testing and inspection and to the provision of effective maintenance. In consideration of the foregoing, the Surveyor General shall adopt regulations which include the provisions of the Guidelines for acceptance of non-duplicated rudder actuators for tankers, chemical tankers and gas carriers of 10,000 gross tonnage and above but less than 100,000 tonnes deadweight, adopted by the International Maritime Organization.

*18*. For a tanker, chemical tanker or gas carrier of 10,000 gross tonnage and upwards, but less than 70,000 tonnes deadweight, the Surveyor General may, until 1 September 1986, accept a steering gear system with a proven record of reliability which does not compl y with the single failure criterion required for a hydraulic system in paragraph 16.

*19*. Every tanker, chemical tanker or gas carrier of 10,000 gross tonnage and upwards, constructed before 1 September 1984, shall comply, not later than 1 September 1986, with the following:

*.1*. the requirements of paragraphs 7.1, 8.2, 8.4, 10, 11, 12.2, 12.3 and 13.2;

*.2*. two independent steering gear control systems shall be provided each of which can be operated from the navigation bridge. This does not require duplica tion of the steering wheel or steering lever;

*.3*. if the steering gear control system in operation fails, the second system shall be capable of being brought into immediate operation from the navigation bridge; and

*.4*. each steering gear control system, if electric, shall be served by its own separate circuit supplied from the steering gear power circuit 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.

*20*. In addition to the requirements of paragraph 19, in every tanker, chemical tanker or gas carrier of 40,000 gross tonnage and upwards, constructed before 1 September 1984, the steering gear shall, not later than 1 September 1988, be so arranged that, in the event of a single failure of the piping or of one of the power units, steering capability can be maintained or the rudder movement can be limited so that steering capability can be speedily regained. This shall be achieved by:

*.1*. an independent means of restraining the rudder; or

*.2*. fast-acting valves which may be manually operated to isolate the actuator or actuators from the external hydraulic piping together with a means of directly refilling the actuators by a fixed independent power-operated pump and piping system; or

*.3*. an arrangement such that, where hydraulic power systems are interconnected, loss of hydraulic fluid from one system shall be detected and the defective system isolated either automatically or from the navigat ion bridge so that the other system remains fully operational.

**Regulation 30 -** ***Additional requirements for electric and electrohydraulic steering gear***

*1*. Means for indicating that the motors of electric and electrohydraulic steering gear are running shall be installed on the navigation bridge and at a suitable main machinery control position.

*2*. 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 s witchboard; 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 su pplying 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.

*3*. 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 paragraph 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 and as may be required by regulation 51.

*4*. When in a ship of less than 1,600 gross tonnage an auxiliary steering gear which is required by regulation 29.4.3 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 paragraph 3 may be waived by the Surveyor General if satisfied with the protection arrangement together with the requirements of regulation 29.5.1 and .2 and 29.7.3 applicable to auxiliary steering gear.

**Regulation 31 - *Machinery controls***

*1*. Main and auxiliary machinery essential for the propulsion and safety of the ship shall be provided with effective means for its operation and control.

*2*. Where remote control of propulsion machinery from the navigation bridge is provided and the machinery spaces are intended to be manned, the following shall apply:

*.1*. the speed, direction of thrust and, if applicable, the pitch of the propeller shall be fully controllable from the navigation bridge under all sailing conditions, including manoeuvring;

*.2*. the remote control shall be performed, for each independent propeller, by a control device so designed and constructed that its operation does not require particular attention to the operational details of the machinery. Where multiple propellers are designed to operate simultaneously, they may be controlled by one control device;

*.3*. 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;

*.4*. propulsion machinery orders from the navigation bridge shall be indicated in the main machinery control room or at the manoeuvring platform as appropriate;

*.5*. 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;

*.6*. it shall be possible to control the propulsion machinery locally, even in the case of failure in any part of the remote control system;

*.7*. the design of the remote control system shall be such that in case of its failure an alarm will be given. Unless the Surveyor General considers it impracticable the preset speed and direction of thrust of the propellers shall be maintained until local control is in operation;

*.8*. indicators shall be fitted on the navigation bridge for:

*.8.1*. propeller speed and direction of rotation in the case of fixed pitch propellers;

*.8.2*. propeller speed and pitch position in the case of controllable pitch propellers;

*.9*. 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.

*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; for this purpose regulations 46 to 50 shall apply as appropriate. 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.

*5*. Ships constructed on or after 1 July 1998 shall comply with the requirements of paragraphs 1 to 4, as amended, as follows:

*.1*. paragraph 1 is replaced by the following:

*"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*. in the second and third lines of paragraph 2, the words "and the machinery spaces are intended to be manned" are deleted;

*.3*. the first sentence of paragraph 2.2 is replaced by the following:

*".2*. 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.";

*.4*. paragraph 2.4 is replaced by the following:

*".4*. be indicated in the main machinery control room and at the manoeuvring platform;";

*.5*. a new sentence is added at the end of paragraph 2.6 to read as follows:

"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;" and

*.6*. paragraphs 2.8, 2.8.1 and 2.8.2 are replaced by the following:

*".8*. indicators shall be fitted on the navigation bridge, the main machinery control room and at the manoeuvring platform, for:

*.8.1*. propeller speed and direction of rotation in the case of fixed pitch propellers; and

.*8.2*. propeller speed and pitch position in the case of controllable pitch propellers;"

*6*. Ships constructed on or after 1 July 2004 shall comply with the requirements of paragraphs 1 to 5, as amended, as follows:

.*1*. a new subparagraph .10 is added to paragraph 2 to read as follows:

*".10*. 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."

**Regulation 32 - *Steam boilers and boiler feed systems***

*1*. Every steam boiler and every unfired steam generator shall be provided with not less than two safety valves of adequate capacity. However, having regard to the output or any other features of any boiler or unfired steam generator, the Surveyor General may permit only one safety valve to be fitted if it is satisfied that adequate protection against overpressure is thereby provided.

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

*3*. Water tube boilers serving turbine propulsion machinery shall be fitted with a high -water-level alarm.

*4*. Every steam generating system which provides services essential for the safety of the ship, or which could be rendered dangerous by the failure of its feedwater supply, shall be provided with not less than two separate feedwater systems from and including the feed pumps, noting that a single penetration of the steam drum is acceptable. Unless overpressure is prevented by the pump characteristics, means shall be provided which will prevent over -pressure in any part of the systems.

*5*. Boilers shall be provided with means to supervise and control the quality of the feedwater. Suitable arrangements shall be provided to preclude, as far as practicable, the entry of oil or other contaminants which may adversely affect the boiler.

*6*. Every boiler essential for the safety of the ship and designed to contain water at a specified level shall be provided with at least two means for indicating its water level, at least one of which shall be a direct reading gauge glass.

**Regulation 33 - *Steam pipe systems***

*1*. Every steam pipe and every fitting connected thereto through which steam may pass shall be so designed, constructed and installed as to withstand the maximum working stresses to which it may be subjected.

*2*. Means shall be provided for draining every steam pipe in which dangerous water hammer action might otherwise occur.

*3*. If a steam pipe or fitting may receive steam from any source at a higher pressure than that for which it is designed a suitable reducing valve, relief valve and pressure gauge shall be fitted.

**Regulation 34 - *Air pressure systems***

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

*2*. The main starting air arrangements for main propulsion internal combustion engines shall be adequately protected against the effects of backfiring and internal explosion in the starting air pipes.

*3*. All discharge pipes from starting air compressors shall lead directly to the starting air receivers, and all starting pipes from the air receivers to main or auxiliary engines shall be entirely separate from the compressor discharge pipe system.

*4*. Provision shall be made to reduce to a minimum the entry of oil into the air pressure systems and to drain these systems.

**Regulation 35 - *Ventilating systems in machinery spaces***

Machinery spaces of category A shall be adequately ventilated so as to ensure that when machinery or boilers therein are operating at full power in all weather conditions including heavy weather, an adequate supply of air is maintained to the spaces for the safety and comfort of personnel and the operation of the machinery. Any other machinery space shall be adequately ventilated appropriate for the purpose of that machinery space.

**Regulation 36 - *Protection against noise***

Measures shall be taken to reduce machinery noise in machinery spaces to acceptable levels as determined by the Surveyor General. If this noise cannot be sufficiently reduced the source of excessive noise shall be suitably insulated or isolated or a refuge from noise shall be provided if the space is required to be manned. Ear protectors shall be provided for personnel required to enter such spaces, if necessary.

**Regulation 37 - *Communication between navigation bridge and machinery space***

*1*. At least two independent means shall be provided for communicating orders from the navigation bridge to the position in the machinery space or in the control room from which the engines are normally controlled: one of these shall be an engine-room telegraph which provides visual indication of the orders and responses both in the machinery space and on the navigation bridge. Appropriate means of communication shall be provided to any other positions from which the engines may be controlled.

*2*. For ships constructed on or after 1 October 1994 the following requirements apply in lieu of the provisions of paragraph 1:

At least two independent means shall be provided for communicating orders from the navigation bridge to the position in the machinery space or in the control room from which the speed and direction of thrust of the propellers are normally controlled; one of these shall be an engine-room telegraph which provides visual indication of the orders and responses both in the machinery

spaces and on the navigation bridge. Appropriate means of communication shall be provided from the navigation bridge and the engine-room to any other position from which the speed or direction of thrust of the propellers may be controlled.

**Regulation 38 - *Engineers' alarm***

An engineers' alarm shall be provided to be operated from the engine control room or at the manoeuvring platform as appropriate, and shall be clearly audible in the engineers' accommodation.

**Regulation 39 - *Location of emergency installations in passenger ships***

Emergency sources of electrical power, fire pumps, bilge pumps except those specifically servin g the spaces forward of the collision bulkhead, any fixed fire-extinguishing system required by chapter II-2 and other emergency installations which are essential for the safety of the ship, except anchor windlasses, shall not be installed forward of the collision bulkhead.

**Part D - *Electrical installations***

(Except where expressly provided otherwise part D applies to passenger sh ips and cargo ships)

**Regulation 40 - *General***

*1*. 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 e mergency 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.

*2*. The Surveyor General shall take appropriate steps to ensure uniformity in the implementation and application of the provisions of this part in respect of electrical installations.

**Regulation 41 - *Main source of electrical power and lighting systems***

*1.1*. A main source of electrical power of sufficient capacity to supply all those services mentioned in regulation 40.1.1 shall be provided. This main sourc e of electrical power shall consist of at least two generating sets.

*1.2*. 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.

*1.3*. The arrangements of the ship's main source of electrical power shall be such that the services referred to in regulation 40.1.1 can be maintained regardless of the speed and direction of rotation of the propulsion machinery or shafting.

*1.4*. 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 regulations 42.2.1 to 42.2.3 or 43.2.1 to 43.2.4.

*1.5*. Where transformers constitute an essential part of the electrical supply system required by this paragraph, the system shall be so arranged as to ensure the same continuity of the supply as is stated in this paragraph.

*2.1*. 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.

*2.2*. 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 regulations 42.2.1 and 42.2.2 or 43.2.1, 43.2.2 and 43.2.3 inoperative.

*2.3*. 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*. The main switchboard shall be so placed relative to one main generating station that, as far as is practicable, the integrity of the normal electrical supply may be affected only by a fire or other casualty in one space. 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*. Where the total installed electrical power of the main generating sets is in excess of 3 MW, the main busbars shall be subdivided into at least two parts which shall normally be connected by removable links or other approved means; so far as is practicable, the connection of generating sets and any other duplicated equipment shall be equally divided between the parts. Equivalent arrangements may be permitted to the satisfaction of the Surveyor General.

*5*. Ships constructed on or after 1 July 1998:

*.1*. in addition to paragraphs 1,2 and 3, shall comply with the following:

*.1.1*. 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;

*.1.2*. load shedding or other equivalent arrangements shall be provided to protect the generators required by this regulation against sustained overload;

*.1.3*. 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; and

*.2*. need not comply with paragraph 4.

**Regulation 42 - *Emergency source of electrical power in passenger ships***

*(Paragraphs 2.6.1 and 4.2 of this regulation apply to ships constructed on or after 1 February 1992)*

*1.1*. A self-contained emergency source of electrical power shall be provided.

*1.2*. 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.

*1.3*. 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 complying with the rules and regulations of the respective Recognized Organization 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.

*1.4*. 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:

*2.1*. For a period of 36 h, emergency lighting:

*.1*. at every muster and embarkation station and over the sides as required by regulations III/11.4 and III/16.7;

*.2*. in alleyways, stairways and exits giving access to the muster and embarkation stations, as required by regulation III/11.5;

*.3*. in all service and accommodation alleyways, stairways and exits, personnel lift cars;

*.4*. in the machinery spaces and main generating stations including their control positions;

.5. in all control stations, machinery control rooms, and at each main and emergency switchboard;

.6. at all stowage positions for firemen's outfits;

.7. at the steering gear; and

.8. at the fire pump, the sprinkler pump and the emergency bilge pump referred to in paragraph 2.4 and at the starting position of their motors.

*2.2*. For a period of 36 h:

.1. the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force; and

.2. on ships constructed on or after 1 February 1995, the VHF radio installation required by regulation IV/7.1.1 and IV/7.1.2; and, if applicable:

*.2.1*. the MF radio installation required by regulations IV/9.1.1, IV/9.1.2,IV/10.1.2 and IV/10.1.3;

*.2.2*. the ship earth station required by regulation IV/10.1.1; and

*.2.3*. the MF/HF radio installation required by regulations IV/10.2.1, IV/10.2.2 and IV/11.1.

*2.3*. For a period of 36 h:

.1. all internal communication equipment required in an emergency;

.2. the shipborne navigational equipment as required by regulation V/12; where such provision is unreasonable or impracticable the Surveyor General may waive this requirement for ships of less than 5,000 gross tonnage;

.3. the fire detection and fire alarm system, and the fire door holding and release system; and

.4. for intermittent operation of the daylight signalling 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.

*2.4*. For a period of 36 h:

.1. one of the fire pumps required by regulation II-2/4.3.1 and 4.3.3;

.2. the automatic sprinkler pump, if any; and

.3. the emergency bilge pump and all the equipment es sential for the operation of electrically powered remote controlled bilge valves.

*2.5*. For the period of time required by regulation 29.14 the steering gear if required to be so supplied by that regulation.

*2.6*. For a period of half an hour:

*.1*. any watertight doors required by regulation 15 to be power-operated together with their indicators and warning signals;

*.2*. the emergency arrangements to bring the lift cars to deck level for the escape of persons. The passenger lift cars may be broug ht to deck level sequentially in an emergency.

*2.7*. In a ship engaged regularly on voyages of short duration, the Surveyor General if satisfied that an adequate standard of safety would be attained may accept a lesser period than the 36 h period specified in paragraphs 2.1 to 2.5 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:

*3.1*. Where the emergency source of electrical power is a generator, it shall be:

*.1*. driven by a suitable prime mover with an independent supply of fuel having a flashpoint (closed cup test) of not less than 43°C;

*.2*. 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 paragraph 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; unless a second independent means of starting the emergency generating set is provided, the single source of stored energy shall be protected to preclude its complete depletion by the automatic starting system; and

*.3*. provided with a transitional source of emergency electrical power according to paragraph 4.

*3.2*. Where the emergency source of electrical power is an accumulator battery, it shall be capable of:

*.1*. carrying the emergency electrical load without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage;

*.2*. automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power; and

*.3*. immediately supplying at least those services specified in paragraph 4.

*3.3*. The following provisions in paragraph 3.1.2 shall not apply to ship s constructed on or after 1 October 1994:

Unless a second independent means of starting the emergency generating set is provided, the single source of stored energy shall be protected to preclude its complete depletion by the automatic starting system.

*3.4*. For ships constructed on or after 1 July 1998, 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 paragraph 3.1.3 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:

*4.1*. For half an hour:

*.1*. the lighting required by paragraphs 2.1 and 2.2;

*.2*. all services required by paragraphs 2.3.1, 2.3.3 and 2.3.4 unless such services have an independent supply for the period specified from an accumulator battery suitably located for use in an emergency.

*4.2*. Power to operate the watertight doors, as required by regulation 15.7.3.3, 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 regulation 15.7.2 for half an hour.

*5.1*. The emergency switchboard shall be installed as near as is practicable to the emergency source of electrical power.

*5.2*. 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.

*5.3*. No accumulator battery fitted in accordance with this regulation shall be installed in the same space as the emergency switchboard. 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 paragraph 3.1.3 or 3.1.4 are being discharged.

*5.4*. 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.

*5.5*. 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.

*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.

**Regulation 42-1 - *Supplementary emergency lighting for ro-ro passenger ships***

*(This regulation applies to all passenger ships with ro-ro cargo spaces or special category spaces as defined in regulation II-2/3, except that for ships constructed before 22 October 1989, this regulation shall apply not later than 22 October 1990)*

*1*. In addition to the emergency lighting required by regulation 42.2, on every passenger ship with ro-ro cargo spaces or special category spaces as defined in regulation II-2/3:

*.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 Surveyor General. The supplementary lighting shall 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 subparagraph .1, is provided.

**Regulation 43 - *Emergency source of electrical power in cargo ships***

*1.1*. A self-contained emergency source of electrical power shall be provided.

*1.2*. 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, except where permitted by the Surveyor General in exceptional circumstances.

*1.3*. The location of the emergency source of electrical power, associated transforming equipment, if any, the transitional source of emergency power, the emergency switchboard and the emergency lighting switchboard in relation to the main source of electrical power, associated transforming equipment, if any, and the main switchboard shall be such as to ensure complying with the rules and regulations of the respective Recognized Organization that a fire or other casualty in the space 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, and the main switchboard.

*1.4*. 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:

*2.1*. For a period of 3 h, emergency lighting at every muster and embarkation station and over the sides as required by regulations III/11.4 and III/16.7.

*2.2*. For a period of 18 h, emergency lighting:

.*1*. in all service and accommodation alleyways, stairways and exits, personnel lift cars and personnel lift trunks;

.*2*. in the machinery spaces and main generating stations including their control positions;

.*3*. in all control stations, machinery control rooms, and at each main and emergency switchboard;

.*4*. at all stowage positions for firemen's outfits;

.*5*. at the steering gear;

.*6*. at the fire pump referred to in paragraph 2.5, at the sprinkler pump, if any, and at the emergency bilge pump, if any, and at the starting positions of their motors; and

.*7*. in all cargo pump-rooms of tankers constructed on or after 1 July 2002

*2.3*. For a period of 18 h:

.*1*. the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force;

.*2*. on ships constructed on or after 1 February 1995 the VHF radio installation required by regulation IV/7.1.1 and IV/7.1.2 ; and, if applicable:

.*2.1*. the MF radio installation required by regulations IV/9.1.1, IV/9.1.2, IV/10.1.2 and IV/10.1.3;

.*2.2*. the ship earth station required by regulation IV/10.1.1; and

.*2.3*. the MF/HF radio installation required by regulations IV/10.2.1, IV/10.2.2 and IV/11.1.

*2.4*. For a period of 18 h:

.*1*. all internal communication equipment as required in an emergency;

.*2*. the shipborne navigational equipment as required by regulation V/12; where such provision is unreasonable or impracticable the Surveyor General may waive this requirement for ships of less than 5,000 gross tonnage;

.*3*. the fire detection and fire alarm system; and

*.4*. intermittent operation of the daylight signalling lamp, the ship's whistle, the manually operated call points and all internal signals that are re quired in an emergency;

unless such services have an independent supply for the period of 18 h from an accumulator battery suitably located for use in an emergency.

*2.5*. For a period of 18 h one of the fire pumps required by regulation II-2/4.3.1 and 4.3.3 if dependent upon the emergency generator for its source of power.

*2.6.1*. For the period of time required by regulation 29.14 the steering gear where it is required to be so supplied by that regulation.

*2.6.2*. In a ship engaged regularly in voyages of short duration, the Surveyor General if satisfied that an adequate standard of safety would be attained may accept a lesser period than the 18 h period specified in paragraphs 2.2 to 2.5 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:

*3.1*. Where the emergency source of electrical power is a generator, it shall be:

*.1*. driven by a suitable prime mover with an independent supply of fuel, having a flashpoint (closed cup test) of not less than 43°C;

*.2*. started automatically upon failure of the main so urce of electrical power supply unless a transitional source of emergency electrical power in accordance with paragraph 3.1.3 is provided; where the emergency generator is automatically started, it shall be automatically connected to the emergency switchbo ard; those services referred to in paragraph 4 shall then be connected automatically to the emergency generator; and unless a second independent means of starting the emergency generator is provided the single source of stored energy shall be protected to preclude its complete depletion by the automatic starting system; and

*.3*. provided with a transitional source of emergency electrical power as specified in paragraph 4 unless an emergency generator is provided capable both of supplying the services mentioned in that paragraph and of being automatically started and supplying the required load as quickly as is safe and practicable subject to a maximum of 45 s.

*3.2*. Where the emergency source of electrical power is an accumulator battery it shall be capable of:

*.1*. carrying the emergency electrical load without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage;

*.2*. automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power; and

*.3*. immediately supplying at least those services specified in paragraph 4.

*3.3*. The following provision in paragraph 3.1.2 shall not apply to ships constructed on or after 1 October 1994:

Unless a second independent means of starting the emergency generating set is provided, the single source of stored energy shall be protected to preclude its complete depletion by the automatic starting system.

*3.4*. For ships constructed on or after 1 July 1998, 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 where required by paragraph 3.1.3 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 shall be so arranged as to supply automatically in the event of failure of either the main or the emergency source of electrical power for half an hour at least the following services if they depend upon an electrical source for their operation:

*.1*. the lighting required by paragraphs 2.1, 2.2 and 2.3.1. For this transitional phase, the required emergency electric lighting, in respect of the machinery space and accommodation and service spaces may be provided by permanently fixed, individual, automatically charged, relay operated accumulator lamps; and

*.2*. all services required by paragraphs 2.4.1, 2.4.3 and 2.4.4 unless such services have an independent supply for the period specified from an accumulator battery suitably located for use in an emergency.

*5.1*. The emergency switchboard shall be installed as near as is practicable to the emergency source of electrical power.

*5.2*. 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.

*5.3*. No accumulator battery fitted in accordance with this regulation shall be installed in the same space as the emergency switchboard. 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 electrical power referred to in paragraph 3.2 or 4 are being discharged.

*5.4*. 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.

*5.5*. 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 electrical power shall be available automatically to the emergency circuits.

*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.

**Regulation 44 - *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 Surveyor 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 in accordance with the Rules and Regulations of the respective Recognized Organizations and shall be approved by them, with a stored energy capability of at least three consecutive starts. 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.

*2.1*. Ships constructed on or after 1 October 1994, in lieu of the provision of the second sentence of paragraph 2, shall comply with the following requirements:

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:

*.1*. electrical and hydraulic starting systems shall be maintained from the emergency switchboard;

*.2*. 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;

*.3*. 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.

*4.1*. 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.

*4.2*. When manual starting is not practicable, the requirements of paragraphs 2 and 3 shall be complied with except that starting may be manually initiated.

**Regulation 45 - *Precautions against shock, fire and other hazards of electrical origin (Paragraphs 10 and 11 of this regulation apply to ships constructed on or after 1 January 2007)***

*1.1*. Exposed metal parts of electrical machines or equipment which are not intended to be live but which are liable under fault conditions to become live shall be earthed unless the machines or equipment are:

*.1*. supplied at a voltage not exceeding 50 V direct current or 50 V root mean square between conductors; auto-transformers shall not be used for the purpose of achieving this voltage; or

*.2*. supplied at a voltage not exceeding 250 V by safety isolating transformers supplying only one consuming device; or

*.3*. constructed in accordance with the principle of double insulation.

*1.2*. The Surveyor General may require additional precautions for portable electrical equipment for use in confined or exceptionally damp spaces where particular risks due to conductivity may exist.

*1.3*. All electrical apparatus shall be so constructed and so installed as not to cause injury when handled or touched in the normal manner.

*2*. Main and emergency switchboards shall be so arranged as to give easy access as may be needed to apparatus and equipment, without danger to personnel. The sides and the rear and, where necessary, the front of switchboards shall be suitably guarded. Exposed live parts having voltages to earth exceeding a voltage to be specified by the Surveyor General shall not be installed on the front of such switchboards. Where necessary, nonconducting mats or gratings shall be provided at the front and rear of the switchboard.

*3.1*. The hull return system of distribution shall not be used for any purpose in a tanker, or for power, heating, or lighting in any other ship of 1,600 gross tonnage and upwards.

*3.2*. The requirement of paragraph 3.1 does not preclude under conditions approved by the Surveyor General or Recognized Organizations the use of:

*.1*. impressed current cathodic protective systems;

*.2*. limited and locally earthed systems; or

*.3*. insulation level monitoring devices provided the circulation current does not exceed 30 mA under the most unfavourable conditions.

*3.2-1*. For ships constructed on or after 1 October 1994, the requirement of paragraph 3.1 does not preclude the use of limited and locally earthed systems, provided that any possible resulting current does not flow directly through any dangerous spaces.

*3.3*. Where the hull return system is used, all final subcircuits, i.e. all circuits fitted after the last protective device, shall be two-wire and special precautions shall be taken in accordance with the Rules and Regulations of the respective Recognized Organization.

*4.1*. Earthed distribution systems shall not be used in a tanker. The Surveyor General may exceptionally permit in a tanker the earthing of the neutral for alternating current power networks of 3,000 V (line to line) and over, provided that any possible resulting current does not flow directly through any of the dangerous spaces.

*4.2*. When a distribution system, whether primary or secondary, for power, heating or lighting, with no connection to earth is used, a device capable of continuously monitoring the insulation level to earth and of giving an audible or visual indication of abnormally low insulation values shall be provided.

*4.3*. Ships constructed on or after 1 October 1994, in lieu of the provisions of paragraph 4.1, shall comply with the following requirements:

*.1*. Except as permitted by paragraph 4.3.2 earthed distribution systems shall not be used in a tanker.

*.2*. The requirement of paragraph 4.3.1 does not preclude the use of earthed intrinsically safe circuits and in addition, under conditions approved by the Surveyor General or Recognized Organizations, the use of the following earthed systems:

*.2.1*. power-supplied control circuits and instrumentation circuits where technical or safety reasons preclude the use of a system with no connection to earth, provided the current in the hull is limited to not more than 5 A in both normal and fault conditions; or

*.2.2*. limited and locally earthed systems, provided that any possible resulting current does not flow directly through any of the dangerous spaces; or

*.2.3*. alternating current power networks of 1,000 V root mean square (line to line) and over, provided that any possible resulting current does not flow directly through any of the dangerous spaces.

*5.1*. Except as permitted by the Surveyor General in exceptional circumstances, all metal sheaths and armour of cables shall be electrically continuous and shall be earthed.

*5.2*. All electric cables and wiring external to equipment shall be at least of a flame-retardant type and shall be so installed as not to impair their original flame-retarding properties. Where necessary for particular applications the Surveyor General may permit the use of special types of cables such as radio frequency cables, which do not comply with the foregoing.

*5.3*. Cables and wiring serving essential or emergency power, lighting, internal communications or signals shall so far as practicable be routed clear of galleys, laundries, machinery spaces of category A and their casings and other high fire risk areas. In ro-ro passenger ships, cabling for emergency alarms and public address systems installed on or after 1 July 1998 shall be approved by the Recognized Organization having regard to the MSC/Circ.808, Recommendation on performance standards for public address systems on passenger ships, including cabling developed by the International Maritime Organization. Cables connecting fire pumps to the emergency switchboard shall be of a fire-resistant type where they pass through high fire risk areas. Where practicable all such cables should be run in such a manner as to preclude their being rendered unserviceable by heating of the bulkheads that may be caused by a fire in an adjacent space.

*5.4*. Where cables which are installed in hazardous areas introduce the risk of fire or explosion in the event of an electrical fault in such areas, special precautions against such risks shall be taken in accordance with Rules and Regulations of the respective Recognized Organization.

*5.5*. Cables and wiring shall be installed and supported in such a manner as to avoid chafing or other damage.

*5.6*. Terminations and joints in all conductors shall be so made as to retai n the original electrical, mechanical, flame-retarding and, where necessary, fire-resisting properties of the cable.

*6.1*. Each separate circuit shall be protected against short circuit and against overload, except as permitted in regulations 29 and 30 or where the Surveyor General may exceptionally otherwise permit.

*6.2*. The rating or appropriate setting of the overload protective device for each circuit shall be permanently indicated at the location of the protective device.

*7*. Lighting fittings shall be so arranged as to prevent temperature rises which could damage the cables and wiring, and to prevent surrounding material from becoming excessively hot.

*8*. All lighting and power circuits terminating in a bunker or cargo space shall be provide d with a multiple-pole switch outside the space for disconnecting such circuits.

*9.1*. Accumulator batteries shall be suitably housed, and compartments used primarily for their accommodation shall be properly constructed and efficiently ventilated.

*9.2*. Electrical or other equipment which may constitute a source of ignition of flammable vapours shall not be permitted in these compartments except as permitted in paragraph 10.

*9.3*. Accumulator batteries shall not be located in sleeping quarters except where hermetically sealed in accordance with the Rules and Regulations of the respective Recognized Organization.

*10*. No electrical equipment shall be installed in any space where flammable mixtures are liable to collect, e.g. in compartments assigned principa lly to accumulator batteries, in paint lockers, acetylene stores or similar spaces, unless the Surveyor General is satisfied that such equipment is:

*.1*. essential for operational purposes;

*.2*. of a type which will not ignite the mixture concerned;

*.3*. appropriate to the space concerned; and

*.4*. appropriately certified for safe usage in the dusts, vapours or gases likely to be encountered.

*11*. In tankers, electrical equipment, cables and wiring shall not be installed in hazardous locations unless it conforms with standards not inferior to those acceptable to the International Maritime Organization. However, for locations not covered by such standards, electrical equipment, cables and wiring which do not conform to the standards may be installed in hazard ous locations based on a risk assessment in accordance with the Rules and Regulations of the respective Recognized Organization, to ensure that an equivalent level of safety is assured.

*12*. In a passenger ship, distribution systems shall be so arranged th at fire in any main vertical zone as is defined in regulation II-2/3.9 will not interfere with services essential for safet y in any other such zone. This requirement will be met if main and emergency feeders passing through any such zone are separated both vertically and horizontally as widely as is practicable.

**Part E -** ***Additional requirements for periodically unattended mac hinery spaces***

(Part E applies to cargo ships except that regulation 54 refers to passenger ships)

**Regulation 46 -** ***General***

*1*. The arrangements provided shall be such as to ensure that the safety of the ship in all sailing conditions, including manoeuvring, is equivalent to that of a ship having the machinery spaces manned.

*2*. Measures shall be taken of complying to the requirements of Recognized Organization to ensure that the equipment is functioning in a reliable manner and that satisfactory arrangements are made for regular inspections and routine tests to ensure continuous reliable operation.

*3*. Every ship shall be provided with documentary evidence, complying with the requirements of Recognized Organization, of its fitness to operate with periodically unattended machinery spaces.

**Regulation 47 - *Fire precautions***

*1*. Means shall be provided to detect and give alarms at an early stage in case of fires:

*.1*. in boiler air supply casings and exhausts (uptakes); and

*.2*. in scavenging air belts of propulsion machinery,

unless the Surveyor General considers this to be unnecessary in a particular case.

*2*. Internal combustion engines of 2,250 kW and above or having cylinders of more than 300 mm bore shall be provided with crankcase oil mist detectors or engine bearing temperature monitors or equivalent devices.

**Regulation 48 - *Protection against flooding***

*1*. Bilge wells in periodically unattended machinery spaces shall be located and monitored in such a way that the accumulation of liquids is detected at normal angles of trim and heel, and shall be large enough to accommodate easily the normal drainage during the unattended period.

*2*. Where the bilge pumps are capable of being started automatically, means shall be provided to indicate when the influx of liquid is greater than the pump capacity or when the pump is operating more frequently than would normally be expected. In these cases, smaller bilge wells to cover a reasonable period of time may be permitted. Where automatically controlled bilge pumps are provided, special attention shall be given to oil pollution prevention requirements.

*3*. The location of the controls of any valve serving a sea inlet, a discharge below the waterline or a bilge injection system shall be so sited as to allow adequate time for operation in case of influx of water to the space, having regard to the time likely to be required in order to reach and operate such controls. If the level to which the space could become flooded with the ship in the fully loaded condition so requires, arrangements shall be made to operate the controls from a position above such level.

**Regulation 49 - *Control of propulsion machinery from the navigation bridge***

*1*. Under all sailing conditions, including manoeuvring, the speed, direction of thrust and, if applicable, the pitch of the propeller shall be fully controllable from the navigation bridge.

*1.1*. Such remote 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.

*1.2*. 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 sy stem.

*2*. Propulsion machinery orders from the navigation bridge shall be indicated in the main machinery control room or at the propulsion machinery control position as appropriate.

*3*. Remote control of the propulsion machinery shall be possible only fro m 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 in the main machinery control room. The system shall include means to prevent the propelling thrust from altering significantly when transferring control from one location to anoth er.

*4*. It shall be possible for all machinery essential for the safe operation of the ship to be controlled from a local position, even in the case of failure in any part of the automatic or remote control systems.

*5*. The design of the remote automatic c ontrol system shall be such that in case of its failure an alarm will be given. Unless the Surveyor General considers it impracticable, the preset speed and direction of thrust of the propeller shall be maintained until local control is in operation.

*6*. Indicators shall be fitted on the navigation bridge for:

*.1*. propeller speed and direction of rotation in the case of fixed pitch propellers; or

*.2*. propeller speed and pitch position in the case of controllable pitch propellers.

*7*. The number of consecu tive automatic attempts which fail to produce a start shall be limited to safeguard sufficient starting air pressure. An alarm shall be provided to indicate low starting air pressure set at a level which still permits starting operations of the propulsion machinery.

**Regulation 50 - *Communication***

A reliable means of vocal communication shall be provided between the main machinery control room or the propulsion machinery control position as appropriate, the navigation bridge and the engineer officers' accomm odation.

**Regulation 51 - *Alarm system***

*1*. An alarm system shall be provided indicating any fault requiring attention and shall:

*.1*. be capable of sounding an audible alarm in the main machinery control room or at the propulsion machinery control position, and indicate visually each separate alarm function at a suitable position;

*.2*. have a connection to the engineers' public rooms and to each of the engineers' cabins through a selector switch, to ensure connection to at least one of those cabins. Surveyor General may permit equivalent arrangements;

*.3*. activate an audible and visual alarm on the navigation bridge for any situation which requires action by or attention of the officer on watch;

*.4*. as far as is practicable be designed on the fail -to-safety principle; and

.5. activate the engineers' alarm required by regulation 38 if an alarm function has not received attention locally within a limited time.

*2.1*. The alarm system shall be continuously powered and shall have an automatic change -over to a stand-by power supply in case of loss of normal power supply.

*2.2*. Failure of the normal power supply of the alarm system s hall be indicated by an alarm.

*3.1*. The alarm system shall be able to indicate at the same time more than one fault and the acceptance of any alarm shall not inhibit another alarm.

*3.2*. Acceptance at the position referred to in paragraph 1 of any alarm c ondition shall be indicated at the positions where it was shown. Alarms shall be maintained until they are accepted and the visual indications of individual alarms shall remain until the fault has been corrected, when the alarm system shall automatically r eset to the normal operating condition.

**Regulation 52 - *Safety systems***

A safety system shall be provided to ensure that serious malfunction in machinery or boiler operations, which presents an immediate danger, shall initiate the automatic shutdown of tha t part of the plant and that an alarm shall be given. Shutdown of the propulsion system shall not be automatically activated except in cases which could lead to serious damage, complete breakdown, or explosion. Where arrangements for overriding the shutdow n of the main propelling machinery are fitted, these shall be such as to preclude inadvertent operation. Visual means shall be provided to indicate when the override has been activated.

**Regulation 53 - *Special requirements for machinery, boiler and electrical installations***

*1*. The special requirements for the machinery, boiler and electrical installations shall be in accordance with the rules and regulations of the respective Recognized Organization and s hall include at least the requirements of this regulation.

*2*. The main source of electrical power shall comply with the following:

*2.1*. Where the electrical power can normally be supplied by one generator, suitable load -shedding arrangements shall be provided to ensure the integrity of supplies to services required for propulsion and steering as well as the safety of the ship. In the case of loss of the generator in operation, adequate provision shall be made for automatic starting and connecting to the m ain switchboard of a stand-by generator of sufficient capacity to permit propulsion and steering and to ensure the safety of the ship with automatic restarting of the essential auxiliaries including, where necessary, sequential operations. The Surveyor Gen eral may dispense with this requirement for a ship of less than 1,600 gross tonnage, if it is considered impracticable.

*2.2*. If the electrical power is normally supplied by more than one generator simultaneously in parallel operation, provision shall be m ade, for instance by load shedding, to ensure that, in case of loss of one of these generating sets, the remaining ones are kept in operation without overload to permit propulsion and steering, and to ensure the safety of the ship.

*3*. Where stand-by machines are required for other auxiliary machinery essential to propulsion, automatic change-over devices shall be provided.

**4 Automatic control and alarm system**

*4.1*. The control system shall be such that the services needed for the operation of the main propulsion machinery and its auxiliaries are ensured through the necessary automatic arrangements.

*4.2*. An alarm shall be given on the automatic change-over.

*4.3*. An alarm system complying with regulation 51 shall be provided for all important pressures, temperatures and fluid levels and other essential parameters.

*4.4*. A centralized control position shall be arranged with the necessary alarm panels and instrumentation indicating any alarm.

*5*. Means shall be provided to keep the starting air pressure at the required level where internal combustion engines are used for main propulsion.

**Regulation 54 - *Special consideration in respect of passenger ships***

Passenger ships shall be specially considered by the Surveyor General as to whether or not their machinery spaces may be periodically unattended and if so whether additional requirements to those stipulated in these regulations are necessary to achieve equivalent safety to that of normally attended machinery spaces.